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Can Universities Encourage Students' Continued Motivation For Knowledge Sharing And How Can This Help Organizations?

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ABSTRACT

Both practitioners and researchers recognize the increasing importance of knowledge sharing in organizations (Bock, Zmud, Kim, & Lee, 2005; Vera-Muñoz, Ho, & Chow, 2006). Knowledge sharing influences a firm's knowledge creation, organizational learning, performance achievement, growth, and competitive advantage (Bartol & Srivastava, 2002; Bock & Kim, 2002; Vera-Muñoz et al., 2006). However, an individual's natural tendency is to hoard knowledge rather than to share knowledge (Davenport, 1997; Ruggles, 1998). So, how can knowledge sharing be encouraged?

Extrinsic rewards are believed to effectively motivate desired behaviors (Bartol & Locke, 2000). Under certain environmental conditions, extrinsic rewards are also believed to develop a more sustained motivation, called "self-determined motivation," for these behaviors (Deci & Ryan, 1991). These ideas raise the following questions: (a) Do extrinsic rewards motivate students to share knowledge? and (b) How can universities encourage individuals to develop the self-determined motivation to take part in desired behaviors such as knowledge sharing?

This study investigates the effect of extrinsic rewards on knowledge sharing in a team setting. It also examines whether universities can facilitate individuals' continued or self-determined motivation to share knowledge using certain environmental conditions. To examine these questions, I perform an experiment with 113 undergraduate students from accounting and management classes who are working on team projects. Results suggest that specifically rewarding knowledge sharing can increase individuals' knowledge-sharing behaviors and, in the right environment, their internalization of the motivation to share knowledge.

Keywords: Knowledge Sharing; Self-Determined Motivation; Extrinsic Rewards

1. INTRODUCTION

This study examines two questions related to knowledge sharing in an educational context.¹ The first question is whether extrinsic rewards for knowledge sharing increase knowledge sharing among team members. The second is whether certain conditions can motivate students' continued knowledge-sharing behavior.

Both practitioners and researchers recognize the increasing importance of knowledge sharing in organizations (Bock et al., 2005; Vera-Muñoz et al., 2006). Knowledge sharing is believed to increase firms' ability to solve problems and avoid repeating mistakes by bringing together a wide range of employee knowledge, skills,

¹ Knowledge sharing is "a set of individual behaviors involving sharing one's work-related knowledge and expertise with other members within one's organization, which can contribute to the ultimate effectiveness of the organization" (Yi, 2009, p. 68).

and experience (Chow, Ho, & Vera-Muñoz, 2008; Collins & Smith, 2006; Robinson, Anumba, Carrillo, & Al-Ghassani, 2006; Weick, 2005). Consequently, knowledge sharing influences a firm's knowledge creation, organizational learning, performance achievement, growth, and competitive advantage (Bartol & Srivastava, 2002; Bock & Kim, 2002; Vera-Muñoz et al., 2006).

Davenport (1997) argued that knowledge sharing is unnatural because unique knowledge is considered valuable. Consequently, knowledge hoarding (rather than sharing) often occurs. Because it is difficult to deter individuals' natural tendency to hoard knowledge, it is particularly challenging for organizations to encourage knowledge sharing successfully (Ruggles, 1998).

To overcome this challenge, universities can begin to develop their students' ongoing motivation to share knowledge. Extrinsic rewards, such as bonus points or monetary compensation, are believed to effectively motivate desired behaviors (Bartol & Locke, 2000). Under certain environmental conditions, extrinsic rewards are also believed to develop a more sustained motivation, called "self-determined motivation," for these behaviors (Deci & Ryan, 1991). These ideas raise the following questions: (a) Do extrinsic rewards motivate students to share knowledge? and (b) How can universities encourage individuals to develop the self-determined motivation to take part in desired behaviors such as knowledge sharing?

In this study, extrinsic rewards are defined as tangible rewards given to individuals contingent upon their knowledge-sharing behaviors. Extrinsic motivation to share knowledge refers to an individual's being stimulated by something outside themselves to engage in knowledge sharing. Motivation is the stimulus that encourages individuals to perform a certain behavior (i.e., knowledge sharing).

To address these research questions, I perform a between-subjects experiment using 113 undergraduate accounting and management students working on team projects. I manipulate the absence or presence of an extrinsic reward using bonus points on a team project and measure individuals' knowledge sharing using peer evaluation of their knowledge sharing behavior. Self-determined motivation is measured using a self-report questionnaire.

The experiment used in this study provides a controlled environment in which to examine the influence of extrinsic rewards on knowledge-sharing behavior. As discussed later, prior studies investigating this topic rarely used experiments and none provided actual rewards to participants for knowledge sharing. These studies also used self-report measures rather than external measures of knowledge-sharing behavior. In contrast, this study gives participants a specific tangible reward for knowledge sharing (i.e., bonus points). In addition, my study uses an external measure of knowledge-sharing behavior rather than a self-report measure of knowledge-sharing behavior or knowledge-sharing intentions. Consequently, this methodology provides a better understanding of the relationship between extrinsic rewards and knowledge-sharing behavior. This study is also one of the first to explore the extent to which environmental conditions lead individuals to internalize extrinsic rewards and develop self-determined motivation.²

The remainder of the paper is organized as follows. Section 2 discusses the background of the paper. Section 3 develops the hypotheses. Section 4 describes the study's methodology. Section 5 explains the results and Section 6 concludes.

2. BACKGROUND

As discussed above, knowledge sharing within an organization can generate growth and provide a competitive advantage (Bartol & Srivastava, 2002; Bock & Kim, 2002; Vera-Muñoz et al., 2006). By uniting individuals' knowledge, skills, and experience, knowledge sharing increases a firm's ability to solve problems, create knowledge, and avoid repeating mistakes (Chow et al., 2008; Collins & Smith, 2006; Robinson et al., 2006; Weick, 2005). Extrinsic rewards are believed to affect individuals' knowledge-sharing behavior through their influence on the individuals' motivation to share knowledge (Bartol & Locke, 2000; Bartol & Srivastava, 2002).

² Internalization of extrinsic rewards for knowledge sharing involves individuals' accepting the behavior as valuable and doing it for personal reasons (i.e., because they want to) as opposed to external reasons (i.e., because they receive a reward).

Deci and Ryan (1991) also hypothesized that certain environmental conditions (discussed later) can cause extrinsic rewards to yield a more sustained type of motivation called “self-determined” motivation.

Figure 1 illustrates the relationships between extrinsic rewards, motivation, and knowledge sharing investigated in this study.

2.1 Extrinsic Rewards and Knowledge Sharing

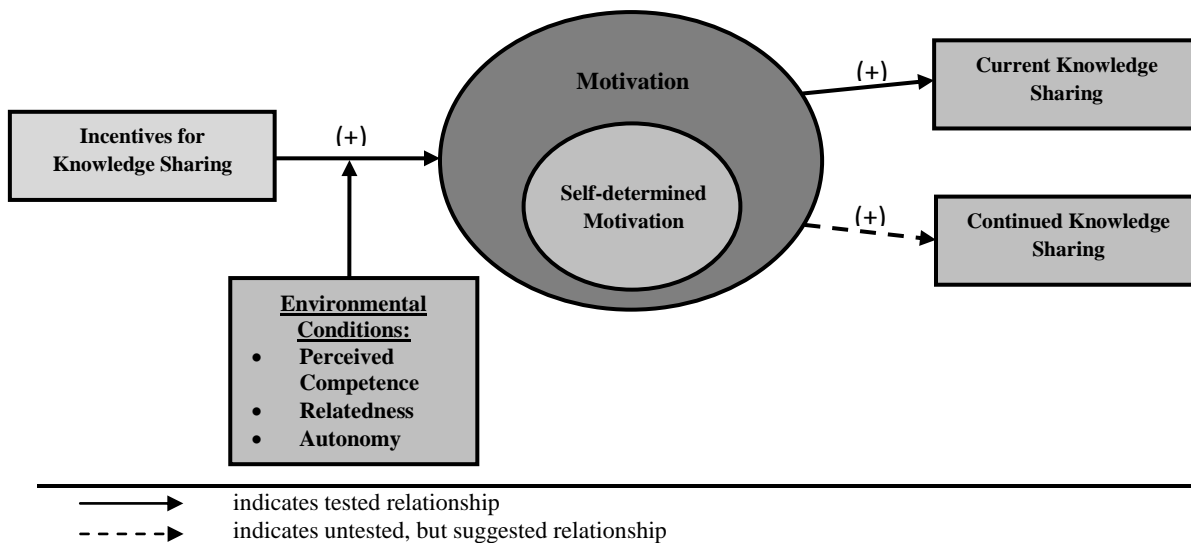


Figure 1: Relationships between Extrinsic Rewards, Motivation, and Knowledge Sharing

Several theories suggest that individuals are more likely to share knowledge when extrinsic rewards for knowledge sharing are provided. For example, social exchange theory suggests that individuals will engage in a behavior when its rewards exceed its costs (Emerson, 1976; Homans, 1974; Thibaut & Kelley, 1959). Emerson (1976) stated “that a resource will continue to flow only if there is a valued return contingent upon it” (p. 359). Applying social exchange theory, Bartol and Srivastava (2002) hypothesized that pay plans that include specific rewards for knowledge sharing will positively influence personal knowledge-sharing behavior within and across teams.

The motivation literature also suggests that organizational rewards motivate organizationally-desired behaviors (Bartol & Locke, 2000; Lin, 2007).³ Prior studies typically discuss two types of motivation: intrinsic motivation and extrinsic motivation. Intrinsic motivation refers to an individual being stimulated to engage in a behavior because it is considered enjoyable or interesting; extrinsic motivation refers to an individual being stimulated to engage in a behavior in order to obtain a desired outcome, such as an extraneous reward (Ryan & Deci, 2000a, b).

Existing research testing the relationship between extrinsic rewards and knowledge sharing has reported mixed results (Bock et al., 2005; Bock & Kim, 2002; Lin, 2007; Wolfe & Loraas, 2008). For example, Bock and Kim (2002) and Bock et al. (2005) found that extrinsic rewards are negatively related to knowledge-sharing intentions, while Lin (2007) found no significant relationship between extrinsic rewards and knowledge-sharing intentions.

Each of these studies used a survey methodology that measured extrinsic rewards as participants’ beliefs that they will receive extrinsic incentives for sharing their knowledge. In these studies, extrinsic incentives included

³ Ryan and Deci (2000b) stated that “to be motivated is to be moved to do something” (p. 54).

both nonmonetary incentives (i.e., recognition) and monetary incentives (i.e., cash or bonus points).⁴ These studies used self-report measures of attitudes toward knowledge sharing, knowledge-sharing intentions, and knowledge-sharing behavior as their dependent variables. As discussed later in more detail, these characteristics may not provide the best test of the relationship between extrinsic rewards and knowledge-sharing behavior because of (a) the potential for social desirability bias in the self-report measures and (b) the differential effects of nonmonetary and monetary incentives on knowledge-sharing behavior.⁵

In contrast to the studies discussed above, Wolfe and Loraas (2008) found that sufficient monetary extrinsic rewards increase knowledge-sharing intentions.⁶ They also found that a nonmonetary incentive (i.e., recognition) is not considered sufficient to motivate knowledge sharing. Wolfe and Loraas's (2008) results plausibly explain why earlier studies gave contrasting results. Bock and Kim (2002), Bock et al. (2005), and Lin (2007) included both monetary and non-monetary rewards in their measure of extrinsic rewards. Wolfe and Loraas's (2008) findings suggest that the different types of extrinsic rewards (monetary vs. nonmonetary) used in these earlier studies have different effects on knowledge-sharing behaviors. If this is true, these different types of extrinsic rewards should not be combined into a single measure of extrinsic reward because of their different effects on knowledge-sharing behaviors.

My study addresses this limitation by including only a monetary-type extrinsic reward (i.e., bonus points on a project grade) in my experimental manipulation. In addition, my study uses an external measure of knowledge-sharing behavior instead of the self-report measures used in prior studies. This external measure of knowledge-sharing behavior should reduce some of the social desirability bias that can exist in self-report measures and provide a more accurate measure of knowledge-sharing behavior. For these reasons, I believe that my study provides a more precise test of the relationship between extrinsic rewards and knowledge-sharing behavior.

2.2 Extrinsic Rewards and Self-Determined Motivation

Humans act because they are motivated to do so. Motivation determines the energy, direction, and persistence of our behaviors (Ryan & Deci, 2000a). The most researched forms of motivation are intrinsic and extrinsic. Intrinsic motivation, the most self-determined (or self-regulated) form of motivation, exists when individuals find an activity inherently interesting or satisfying (Ryan & Deci, 2000a, b). Because many school- and work-related activities are not inherently interesting or satisfying, organizations often use extrinsic motivators (i.e., financial rewards, gifts, promotions, etc.) to motivate employees. Deci and Ryan (1991) used self-determination theory to suggest that individuals can internalize these extrinsic motivators to varying degrees, producing many forms of motivation.⁷ Based on this suggestion, recent research has begun to describe motivation in terms of a continuum ranging from externally regulated motivation to internal (or self-determined) motivation.

Self-determination theory (SDT) emphasizes humans' inherent psychological need to control their own behavior (Ryan & Deci, 2000a). SDT suggests that people are naturally motivated "to internalize the regulation of uninteresting though important activities" (Deci, Eghrari, Patrick, & Leone, 1994, p. 119). Organismic integration theory, a branch of SDT, suggests that extrinsically motivated behaviors can vary in the degree to which they are self-determined (Deci & Ryan, 1991). Organismic integration theory then describes the various forms of extrinsic motivation that are used to represent different levels of internalization. Finally, it discusses the situations that assist or hinder the internalization of externally regulated behaviors (Deci et al., 1994; Deci & Ryan, 1985; Ryan & Deci,

⁴ I consider bonus points on a project grade to be a monetary-type incentive because receiving extra points on a grade in a course is similar to receiving extra money on a job. Nonmonetary incentives include such things as social and formal recognition. Ideally, a student's grades are only released to the student and do not provide any widespread social or formal recognition. Consequently, bonus points cannot be considered a nonmonetary incentive.

⁵ Social desirability bias occurs when individuals respond to a questionnaire in a manner that they believe will be viewed favorably by others, regardless of their actual actions/opinions.

⁶ Wolfe and Loraas (2008) described sufficient incentives as incentives where the benefits received from knowledge sharing outweigh the costs of knowledge sharing.

⁷ Internalization of extrinsic rewards involves individuals' considering the behavior as valuable and engaging in it for personal reasons (i.e., because they want to), as opposed to external reasons (i.e., because they receive an extraneous reward). Internalization involves individuals fully understanding the value of the encouraged behavior and incorporating that behavior with their other personal goals and values (Ryan & Deci, 2000a).

2000a, b).⁸ Internalization can occur through two different processes: introjection or integration (Deci et al., 1994; Ryan & Deci, 2000a, b). Introjection is an individual’s taking in of an encouraged behavior but not identifying it as one’s own (Ryan & Deci, 2000a, b); integration is the taking in of an encouraged behavior when an individual recognizes its value and accepts the responsibility for engaging in it (Ryan & Deci, 2000a, b).

Self-determination theory and organismic integration theory identify six distinct types of motivation ranging along a continuum from “amotivation” (the extreme form of non-self-determined motivation) to intrinsic motivation (the extreme form of self-determined motivation) (Ryan & Deci, 2000a).⁹ The four intermediate types of motivation are forms of extrinsic motivation that are influenced by extrinsic rewards. Figure 2 illustrates the entire motivation continuum.

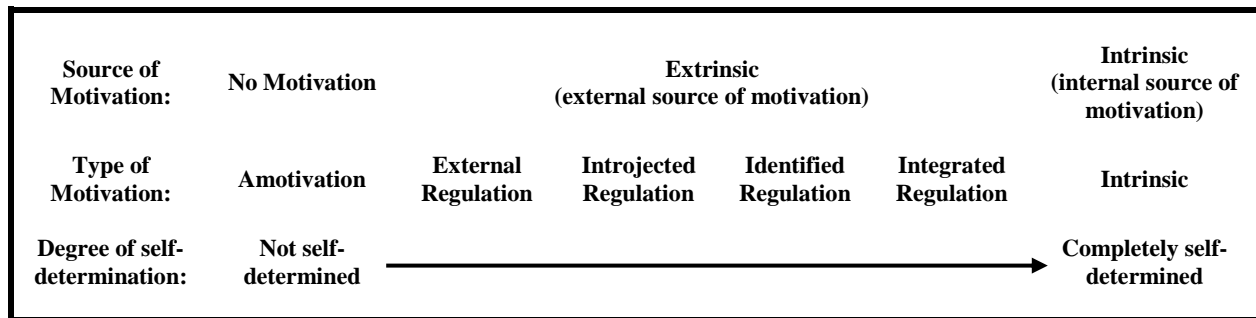


Figure 2: Continuum of Motivation

In the first form of extrinsic motivation, *external regulation*, behaviors occur solely to receive a reward or fulfill an external demand. Consequently, there is no internalization of the extrinsic reward. The next level, *introjected regulation*, describes behaviors done to avoid feelings of guilt or anxiety or to improve feelings of self-worth. Here, individuals take in (internalize) the regulation but do not identify it as personally important.

The third level, *identified regulation*, occurs when an individual consciously values a behavior as personally important.¹⁰ The fourth level of extrinsic motivation, *integrated regulation*, occurs when the encouraged behavior is assimilated into the individual’s other values and needs.

Self-determined motivation leads to self-determined behaviors in which individuals act in response to personal values and internal regulatory processes rather than external pressures or incentives to act (Deci & Ryan, 1991; Ryan & Deci, 2000a, b). Self-determined behavior is desirable because it leads to better and more persistent behavior, job satisfaction, organizational commitment, and positive work attitudes (Deci & Ryan, 1991, Gagné & Deci, 2005; Ryan & Deci, 2000a, b; Sheldon, Ryan, Rawsthorne, & Ilardi, 1997). Therefore, it is important to understand the degree to which individuals internalize extrinsic rewards, leading to self-determined motivation and self-determined behaviors.

2.3 Environmental Factors that Facilitate Self-Determined Motivation

Because it is difficult to motivate individuals to share knowledge, Bock and Kim (2002) suggested that individuals’ self-determined motivation to share knowledge needs to be developed. This raises the question: How can universities begin to develop their students’ ongoing motivation to share knowledge?

Self-determination theory identifies three factors related to basic psychological needs of individuals that encourage the internalization of extrinsic motivators (Ryan & Deci, 2000a, b). The first, *relatedness*, refers to an

⁸ Internalization of externally regulated behaviors leads individuals to have self-determined motivation to engage in those behaviors.

⁹ Amotivation is defined as “the state of lacking the intention to act” where one has no motivation to engage in a behavior (Ryan & Deci, 2000a, p. 72). Alternatively, intrinsic motivation occurs when people engage in a certain behavior because they find it inherently satisfying. Here an individual’s choice to engage in a certain behavior is motivated by purely personal reasons (i.e., their enjoyment of the activity).

¹⁰ For example, after being offered an extrinsic reward to share knowledge, an individual recognizes the importance of knowledge sharing and personally classifies this behavior as valuable.

individual's need to feel connected with others (Ryan & Deci, 2000a, b). Relatedness occurs when individuals feel connected to and cared for by their teacher or workgroup (Ryan & Deci, 2000a). Feelings of relatedness can be fostered when the teacher or workgroup devotes time and energy to their relationships with the individual and provides support for the individual (Deci & Ryan, 1991).

Ryan and Deci (2000a, b) hypothesized that when individuals satisfy their need for relatedness, they are more likely to internalize the behavior encouraged by the teachers' external rewards. For example, individuals who have supportive working relationships with classmates are more likely to internalize external rewards for knowledge sharing and share knowledge because they perceive it as worthwhile rather than because they feel pressured to do so.

The second factor is *perceived competence*. Perceived competence is an individual's belief that he or she can perform an activity with sufficient ability to produce a desired outcome. Thus, perceived competence encompasses both perceived efficacy and perceived control over outcomes (Deci & Ryan, 1991). Ryan and Deci (2000a, b) suggested that individuals who feel competent to do a behavior and produce a desired outcome are more likely to have a self-determined motivation for that behavior.¹¹ Thus, environments that provide individuals with clear expectations and feedback about each individual's competence will encourage self-determined behaviors. Alternatively, environments where expectations are not clearly explained or in which people cannot determine their competence will not encourage self-determined motivation and action.

The final of these three factors is *autonomy* (Ryan & Deci, 2000a, b). In self-determination theory (SDT), autonomy exists when an individual believes that there is a choice to perform or not perform an act. Thus, autonomy-supportive environments (as opposed to controlling environments) provide individuals with choice, reduce pressure on individuals to perform their tasks in specific ways, and encourage individuals to initiate their own actions. Autonomy supportive environments respect each individual's perceptions and needs and use non-pressuring styles of communication. SDT suggests that greater internalization of a regulation occurs in more autonomous environments where individuals feel that their need for autonomy is met. Thus, individuals who believe they have a choice whether to share knowledge are more likely to internalize extrinsic rewards for knowledge sharing and share knowledge because they perceive it as valuable.

In summary, SDT suggests that each of the three factors -- relatedness, perceived competence, and autonomy-- leads to greater internalization of extrinsic rewards and more self-determined motivation.

2.4 Discussion

My study investigates the influence of extrinsic rewards on motivation and knowledge-sharing behavior. The experimental approach used here differs from prior studies by providing a tangible reward to participants for sharing knowledge and measuring knowledge-sharing behavior with an external rather than a self-report measure. This approach allows for a better understanding of the affect of extrinsic rewards on knowledge sharing within teams because it reduces the likelihood of bias in the dependent variable's measurement and expressly examines how tangible rewards influence knowledge sharing.

This study also examines whether environments that promote feelings of relatedness, competence, and autonomy facilitate the development of individuals' self-determined motivation to share knowledge in a work setting. While prior studies have explored the effects of these factors on attitudes and motivation, none have explicitly considered how an individual's feelings of relatedness, competence, and autonomy encourage the internalization of an extrinsic motivator.

3. HYPOTHESES

I use an experimental approach to test my research questions. Based on the theories and prior research discussed above, I hypothesize the following relationships among extrinsic rewards, motivation, and knowledge sharing.

¹¹ Typically, the word competent refers to an ability, whereas, confidence refers to a feeling. I chose to use the word competent because that is the language used by Ryan and Deci (2000a, b).

- H1:** Extrinsic rewards increase knowledge sharing.
H2: The positive association between extrinsic rewards and knowledge sharing is mediated by individuals' motivation to share knowledge.

As discussed in detail in the next section, the presence or absence of extrinsic rewards was manipulated using bonus points on a team project. Knowledge sharing was measured using the peer evaluations of knowledge-sharing behavior. Motivation was measured using a self-report questionnaire that assesses individual differences in motivation for a specific task.

Using predictions based on self-determination theory, I hypothesize that environments that promote feelings of relatedness, competence, and autonomy will influence an individual's self-determined motivation in the following ways:

- H3:** When relatedness is high, extrinsic rewards will lead to more self-determined motivation than when relatedness is not high.
H4: When perceived competence is high, extrinsic rewards will lead to more self-determined motivation than when perceived competence is not high.
H5: When autonomy is high, extrinsic rewards will lead to more self-determined motivation than when autonomy is not high.

For these hypotheses, self-determined motivation was measured using a self-report measure of why an individual is motivated to perform a certain activity. Answers from this questionnaire can be used to calculate an individual's overall level of self-determined motivation. The constructs *relatedness*, *perceived competence*, and *autonomy* were also measured using self-report questionnaires that assessed the extent to which an individual felt as though s/he experienced relatedness, competence, and autonomy in the working environment.

4. METHODOLOGY

To test my hypotheses, I performed a classroom experiment in which I manipulated the existence (presence or absence) of an extrinsic reward for knowledge-sharing behavior. I recruited 113 undergraduate students from one accounting class and two management classes that had team projects. In each class, students were required to work in teams to complete a project. Due to individual team members' different backgrounds, experience levels, and abilities, it is likely that these team members had unique project-relevant knowledge and ideas about how to complete the project. For these reasons, knowledge sharing among team members was important to the success of the team.

4.1 Experiment

I used a between-subjects experimental design. I manipulated the existence (presence or absence) of an extrinsic reward across classes such that an extrinsic reward for knowledge-sharing behavior was provided to the teams in one class, but not in the others. Bonus points were the extrinsic reward for knowledge sharing. Each team was given a number of bonus points, predetermined by the instructor, to allocate to individual team members as extra credit towards their individual project grade. At the end of the project, team members were required to evaluate the knowledge-sharing behavior of each of the other team members and allocate the total number of bonus points to the other team members on the basis of this knowledge-sharing evaluation.¹² The average number of bonus points allocated to each team member by their peers was added to the team project grade to determine the individual's grade for the team project.

For example, suppose that a team has three members and four bonus points for each team member to allocate to the other two team members at the end of the project based on how well they shared knowledge during the project. A sample illustration of how this allocation could be done is as follows:

¹² The instrument used for this evaluation will be discussed further when the measurement of the dependent variables in the study is explained.

Team Member Allocating:	Results of Allocation for Each Team Member			
	Bob	Sarah	Jane	Total
Bob	.	2	2	4
Sarah	1	.	3	4
Jane	0	4	.	4
Average (received as bonus points)	0.5	3	2.5	= 6

Figure 3: Sample Illustration of Bonus Point Allocation

As shown in Figure 3, Bob would receive 0.5 bonus points, Sarah would receive 3.0 points, and Jane would receive 2.5 bonus points.

Participants in classes where extrinsic rewards were absent conducted without extrinsic rewards did not have the opportunity to allocate and receive bonus points for knowledge sharing. Consequently, each individual on the team received the same grade for the team project.

4.2 Measured Variables

Knowledge sharing was measured using peer evaluations of knowledge sharing. At the end of the team project, the knowledge-sharing performance of each individual was evaluated by their team members using applicable items from a knowledge-sharing behavior scale previously developed and validated by Yi (2009).¹³ The questions included on this scale are found in Appendix A. Responses were collected using a 7-point Likert scale. The knowledge-sharing behavior scale had a Cronbach alpha of 0.96. Each individual's knowledge-sharing behavior was measured as the average of the scores received from their peer evaluations.

Measures for both external and self-determined motivation to share knowledge were measured using the Self-Regulation Questionnaire introduced by Ryan and Connell (1989).¹⁴ The Self-Regulation Questionnaire (SRQ) assesses individual differences in motivation for a specific task. Thus, the questionnaire identifies the regulatory mechanism that motivates individuals to engage in that behavior by asking respondents to provide a reason why they do a certain behavior (University of Rochester, 2011).¹⁵

The questions used for this measure originally measured individuals' motivation to exercise. I modified these questions to assess individuals' motivation to share knowledge. The questionnaire has a subscale for each of four different types of motivation identified by Deci and Ryan (1985): external, introjected, identified, and intrinsic. The specific questions used are found in Appendix B along with an explanation of which questions form each subscale. Responses were collected using a 7-point Likert scale. Scores were calculated for each of the four subscales by averaging the responses for each item on that subscale.

Scores on the external motivation subscale were used to measure participants' external motivation because these subscale items assess the degree to which individuals share knowledge solely to receive the extrinsic reward. The external motivation subscale had a Cronbach alpha of 0.74. Questions five, seven, and twelve of the Self-Regulation Questionnaire are used to form this subscale.

Participants' self-determined motivation was measured using the Relative Autonomy Index (RAI), which measures the overall level of autonomous motivation (Ryan & Connell, 1989; Williams & Deci, 1996). The RAI is obtained by combining the four subscales of the Self-Regulation Questionnaire, found in Appendix B, in the following way: $2 \times \text{Intrinsic} + \text{Identified} - \text{Introjected} - 2 \times \text{External}$. This weighting gives the more autonomous, or self-determined, forms of motivation a higher positive weight and the more controlled, or non-self-determined, forms of motivation a higher negative weight. Higher scores represent more self-determined or internally-driven motivation; lower scores represent less self-determined (i.e., more externally controlled) motivation.

¹³ This external measure of knowledge sharing behavior differs from the self-reports of knowledge sharing behavior or intentions to share knowledge used in prior studies.

¹⁴ This questionnaire is made available for research use by the University of Rochester (2011).

¹⁵ For example, the questionnaire identifies whether individuals are motivated to share knowledge for external reasons, such as for a reward, or for more internal reasons, such as valuing or enjoying the activity.

The interaction variables *autonomy* and *relatedness* were measured at the end of the project using a modified version of the Basic Psychological Needs Scale introduced by Kasser, Davey, and Ryan (1992).¹⁶ The portion of the Basic Psychological Needs Scale used measures whether individuals’ needs for autonomy and relatedness are satisfied (University of Rochester, 2011). Using responses from a 7-point Likert scale, the individual subscale scores were calculated by averaging individuals’ responses for each subscale. The autonomy subscale had a Cronbach alpha of 0.62, while the relatedness subscale had a Cronbach alpha of 0.82. Individuals who feel that they have autonomy and relatedness in the team project environment will have higher scores on the autonomy and relatedness subscales. The specific questions included on this scale are found in Appendix A, Parts 2 and 3.

Perceived competence for knowledge sharing, the final interaction variable, was measured using the Perceived Competence Scale adapted for knowledge sharing. This scale was originally introduced by Williams and Deci (1996), and here measures individuals’ feelings of competence regarding sharing knowledge.¹⁷ Scores are calculated by averaging the responses to the four questions. Perceived competence for knowledge sharing was measured at the end of the project and had a Cronbach alpha of 0.91. The specific questions included on this scale are found in Appendix A, Part 5.

5. DATA ANALYSIS AND RESULTS

Table 1 presents demographic information on the participants. As shown, participants were approximately half male and half female. The majority were seniors (93.2%) of age 20 – 25 (76.7%). Approximately 46.6% had no work experience, but 37.9% had one to ten years of work experience.

Table 1: Demographics

<i>Classification</i>			<i>Gender</i>		
	<u>Number</u>	<u>Percent</u>		<u>Number</u>	<u>Percent</u>
Senior	96	93.2	Male	54	52.4
Graduate	7	6.8	Female	49	47.6
	84	100.0		103	100.0
<i>Age</i>			<i>Work Experience (in years)</i>		
	<u>Number</u>	<u>Percent</u>		<u>Number</u>	<u>Percent</u>
20-25	79	76.7	None	48	46.6
26-30	10	9.6	< 1	4	3.9
31-40	8	7.8	1 – 10	39	37.9
40 or older	6	5.9	11 – 20	8	7.7
	84	100.0	>20	4	3.9
				103	100.0

Hypothesis 1 predicts that extrinsic rewards increase knowledge sharing. Mean knowledge sharing for the incentive (no incentive) condition was 49.08 (46.97). A t-test was performed to determine whether this difference was significant. As indicated in Table 2, knowledge sharing is significantly higher among participants in the incentive condition (t-statistic = -1.734, p = 0.043), consistent with Hypothesis 1. As shown in Table 3, this relationship remains significant after controlling for class (p = 0.038).

Table 2: Results of t-Test of Knowledge Sharing Differences

	Incentive	No Incentive	t-Statistic	p-value
Condition	49.08	46.97	-1.734	0.043

¹⁶ This questionnaire is made available for research use by the University of Rochester (2011).

¹⁷ See footnote 16.

Table 3: Results of ANCOVA for Incentive-Knowledge Sharing Relationship (H1)

Source of Variance	Type III SS	df	F-value	p-value (one-sided)
Model	1072.47	2	7.559	0.001
<i>Independent Variable:</i>				
Condition	314.70	1	4.436	0.038
<i>Covariate:</i>				
Class	836.31	1	11.79	0.001
Error	7094.18	100		

Hypothesis 2 predicts that external motivation will mediate the relationship between extrinsic rewards and knowledge sharing. Baron and Kenny's (1986) procedures were used to test for mediation. The first step examines whether extrinsic rewards have a direct effect on knowledge sharing. As reported in Table 4, the ANOVA results indicate that extrinsic rewards are significantly related to knowledge sharing ($p = 0.043$). The second step tests whether extrinsic rewards have a direct effect on the mediator, external motivation. Results indicate that extrinsic rewards have a significant, positive effect on external motivation ($p = 0.008$). The final step examines whether the effect of extrinsic rewards is reduced when external motivation is included in the model. ANOVA results indicate that the significance of extrinsic rewards is 0.007, while the significance of external motivation is 0.065. Since external motivation does not remain significant in step three, Hypothesis 2 is not supported.

Table 4: Results for Mediation of Incentive-Knowledge Sharing Relationship (H2)

Step 1: Dependent Variable: Knowledge Sharing				
Source of Variance	Type III SS	df	F-value	p-value (one-sided)
Model	236.15	1	3.008	0.043
<i>Independent Variable:</i>				
Condition	236.15	1	3.008	0.043
Error	7930.49	101		
Step 2: Dependent Variable: External Motivation				
Source of Variance	Type III SS	df	F-value	p-value (one-sided)
Model	7.649	1	5.959	0.008
<i>Independent Variable:</i>				
Condition	7.649	1	5.959	0.008
Error	129.648	101		
Step 3: Dependent Variable: Knowledge Sharing				
Source of Variance	Type III SS	df	F-value	p-value (one-sided)
Model	2046.28	18	1.560	0.045
<i>Independent Variables:</i>				
Condition	468.93	1	6.436	0.007
External Motivation	1810.12	17	1.461	0.065
Error	6120.37	84		

Hypotheses 3, 4, and 5 focus on whether the environmental conditions of autonomy, perceived competence, and relatedness facilitate the internalization of extrinsic rewards and lead to self-determined motivation. Since the presence of an extrinsic reward was necessary for internalization to occur, only data collected from those in the incentive condition was used to test these hypotheses.

Hypothesis 3 predicts that high (low) feelings of relatedness lead to more (less) self-determined motivation. Participants were split into high/low relatedness groups using a mean split. As shown in Table 5, the mean self-determined motivation for the high (low) group was 3.86 (3.21). T-test results indicate that there is no significant difference in self-determined motivation between the high/low relatedness groups ($p = 0.242$). Thus, Hypothesis 3 is not supported.

Table 5: Results of t-Tests of Self-Determined Motivation Differences (H3, H4, H5)

Environmental Condition	High Group	Low Group	t-Statistic	p-value (one-sided)
Relatedness	3.86	3.21	0.707	0.242
Perceived Competence	4.42	1.81	3.051	0.002
Autonomy	4.38	2.24	2.529	0.008

Hypothesis 4 suggests that high (low) feelings of competence lead to more (less) self-determined motivation. Similar to relatedness, individuals were split into high and low competence groups. Results, shown in Table 4, show that individuals with higher perceived competence have more self-determined motivation (4.42 vs. 1.81, $p = 0.002$). These results support Hypothesis 4.

Hypothesis 5 suggests that high (low) feelings of autonomy lead to more (less) self-determined motivation. Using the same split procedure as above, t-test results indicate that there was significantly more self-determined motivation in the high autonomy group versus the low autonomy group (4.38 vs. 2.24, $p = 0.008$). Thus, Hypothesis 5 is supported.

6. CONCLUSION

This study examines the influence of extrinsic rewards on motivation and knowledge-sharing behavior and investigates the environmental factors that affect the internalization of these external motivators. It draws upon theory and prior research to hypothesize that extrinsic rewards increase knowledge sharing and that motivation will mediate this relationship. It also hypothesizes that autonomy, perceived competence, and relatedness moderate the relationship between extrinsic rewards and motivation such that when these factors are high, extrinsic rewards will lead to more self-determined motivation and when these factors are low, extrinsic rewards will lead to less self-determined motivation.

This study has several implications for research and practice. First, it contributes to the literature on extrinsic rewards and knowledge sharing. The results suggest that specifically rewarding knowledge sharing can increase individuals' knowledge-sharing behaviors and, in the right environment, their internalization of the motivation to share knowledge. These findings indicate that universities can begin to develop individuals' ongoing motivation to share knowledge under the right conditions.

Second, this study improves our understanding of the relationship between extrinsic rewards and knowledge sharing. This study, along with Wolfe and Loraas (2008), suggests that extrinsic rewards can positively influence knowledge-sharing behaviors. However, Bock and Kim (2002), Bock et al. (2005), and Lin (2007) found that extrinsic rewards negatively influence knowledge-sharing behavior. These studies measure participants' perceptions of the overall rewards for sharing knowledge. Consequently, they do not differentiate between monetary and nonmonetary rewards.

The results of Wolfe and Loraas (2008) suggested that this distinction may specifically affect knowledge-sharing behavior. Thus, the failure of Bock and Kim (2002), Bock et al. (2005), and Lin (2007) to differentiate between monetary and nonmonetary rewards may explain why their results differ from those of Wolfe and Loraas (2008). Results from this study support this conjecture, finding that monetary-type extrinsic rewards can effectively increase knowledge sharing within teams.

Finally, this study is one of the first to empirically examine the extent to which extrinsic motivation is internalized by individuals to become self-determined motivation (Gagné & Deci, 2005). Self-determined motivation leads to greater volitional persistence and is important for the persistence of knowledge-sharing behavior in both educational and work-related environments (Deci & Ryan, 1991; Gagné & Deci, 2005; Ryan & Deci, 2000; Sheldon et al., 1997). Results indicate that environments that satisfy individuals' needs for autonomy and competence support the internalization of extrinsic rewards for knowledge sharing, leading individuals to possess a self-determined motivation to engage in knowledge sharing.

This study has limitations. First, team members in a school setting may not have the same barriers to knowledge sharing as employees in an organization. Davenport (1997) argued that many organizations view knowledge as a valuable resource. Therefore, employees who share their knowledge with others risk losing their value to the organization. Davenport (1997) then stated that knowledge hoarding often occurs because of the risk and effort involved in sharing it. In school, the risks associated with knowledge sharing are minimized because students typically are evaluated on how much knowledge they have rather than how much knowledge they have compared to their peers. Thus, students may be more willing to share knowledge than employees in an audit or organizational setting. Students may also be more willing to share knowledge in a team-based project because it results in a higher project grade for all team members. Future research should investigate the generalizability of these findings to a corporate setting.

Second, although this study suggests that increased self-determined motivation leads to the persistence of knowledge-sharing behavior after the extrinsic reward is removed, the testing of this hypothesis was beyond the scope of this study. Future research should determine whether the internalization of extrinsic rewards that lead to higher self-determined motivation result in continued knowledge-sharing behavior, even in the absence of a reward.

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APPENDIX A

Knowledge Sharing Questionnaire

1. This group member shares personal work related to the team project.
2. This group member expresses ideas and thoughts in team meetings.
3. This group member proposes problem-solving suggestions in team meetings.
4. This group member answers the questions of others in team meetings.
5. This group member supports other team members with time from personal schedule.
6. This group member spends time in personal conversation (e.g., discussion in the hallway or on the telephone) with others to help them with their team-related problems.
7. This group member keeps other updated about important project information through personal conversation.
8. This group member spends time in e-mail communication with others to help them with their work-related problems.

APPENDIX B

Self-Regulation Questionnaire

There are a variety of reasons why people share knowledge. Please indicate how true each of these reasons is for why you share knowledge.

1. I simply enjoy sharing knowledge.
2. Sharing knowledge is important and beneficial to me.
3. I would feel bad about myself if I didn't share knowledge.
4. It is fun and interesting to share knowledge.
5. Others like me better when I share knowledge.
6. I'd be afraid of not sharing knowledge.
7. Sharing knowledge helps my image.
8. It is personally important to me to share knowledge.
9. I feel pressured to share knowledge.
10. I have a strong value for sharing knowledge.
11. For the pleasure of discovering and mastering new knowledge sharing techniques.
12. I want others to see that I share knowledge.

The individual subscales for external, introjected, identified, and intrinsic motivation are formed as follows:

- External motivation – questions 5, 7, and 12.
- Introjected motivation – questions 3, 6, and 9.
- Identified motivation – questions 2, 8, and 10.
- Intrinsic motivation – questions 1, 4, and 11.

APPENDIX C

Basic Psychological Needs Scale

Autonomy Subscale

1. I felt like I could make a lot of inputs to deciding how this project got done.
2. I felt pressured when working on this project. (R)
3. I felt free to express my ideas and opinions while working on this project.
4. When working on this project, I had to do what I was told. (R)
5. My feelings were taken into consideration while working on this project.
6. I felt like I could pretty much be myself while working on this project.
7. There was not much opportunity for me to decide for myself how to go about my work on this project. (R)

Relatedness Subscale

1. I really liked the people I worked with on this project.
2. I got along with my team members.
3. I pretty much kept to myself when working on this project. (R)
4. I consider the people I worked with on this project to be my friends.
5. My team members care about me.
6. There are not many team members that I am close to. (R)
7. My team members do not seem to like me much. (R)
8. My team members were pretty friendly towards me while working on this project.

APPENDIX D

Perceived Competence Scale

1. I felt confident in my ability to share knowledge on this project.
2. I was capable of sharing knowledge on this project.
3. I was able to share knowledge for this project.
4. I felt able to meet the challenge of sharing knowledge on this project.

NOTES