

Endogenous and Exogenous Instrumentality
on Student Motivation and Achievement

by

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ABSTRACT

Instrumentality is an important motivational construct that empathizes the connection between a present task and a future goal. Instrumentality is conceptualized as a task-specific variable. Reflecting context-dependent characteristics, two different types of instrumentality are distinguished: endogenous and exogenous instrumentality. Endogenous instrumentality is the perception that learning in a present task is useful to achieving valued future goals and exogenous instrumentality is the perception that outcome in a present task is instrumental to achieving valued future goals. This study investigated the differential relationships among each instrumentality type, academic achievements, and motivational variables. Three studies were conducted to investigate the relationship between each type of instrumentality and students' achievement and motivational variables such as achievement goals, situational interests, and pressure and the moderating role of self-efficacy on the relationship. Study 1 investigated how endogenous and exogenous instrumentality was related to students' achievement respectively. In addition, it was examined whether self-efficacy moderated in the relationship between each instrumentality and achievement. Study 2 was conducted to find that how each instrumentality was related to three different types of achievement goals, which were mastery, performance-approach, and performance-avoidance goals. Interaction between each type of instrumentality and self-efficacy was examined to find a moderating effect by self-efficacy on accounting for the relationship between instrumentality and achievement goals. Study 3 examined the role of each instrumentality on situational interest, pressure and achievement. The results showed that endogenous instrumentality predicted grade positively regardless students' self-efficacy level,

whereas exogenous instrumentality positively predicted grade of students with high self-efficacy and negatively predicted grade of students with low-self-efficacy. In addition, endogenous instrumentality predicted mastery goals positively and performance-avoidance goals negatively, whereas exogenous instrumentality predicted both performance-approach and performance avoidance goals positively. Moreover, students with high self-efficacy were less likely to adopt performance-avoidance goals when they perceived more endogenous instrumentality. It was also found that endogenous instrumentality was a positive predictor of situational interest and a negative predictor of pressure, whereas exogenous instrumentality was a negative predictor of situational interest and as a positive predictor of pressure. There was a mediating effect of pressure on the relationship between each instrumentality and grade.

This dissertation is dedicated to my parents,
my wife Soyong,
and my children, Yongbin, and Sowon.

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CHAPTER 1

Overview

Students show a wide range of achievement, even when they are taught by the same teacher, during the same class time, and in the same classroom. For example, why does one student get 100 percent on a final math exam whereas another student gets 30 percent? This has been an important question for teachers, parents, and educational researchers for a long time. One possible answer is that students have different levels of motivation for their education.

Motivation predicts students' persistence, engagement, task choice, and achievement in academic settings (Wigfield & Eccles, 2000). Students are motivated by various reasons. Deci and Ryan (1985) made the distinction between intrinsic and extrinsic motivation. Intrinsic motivation is performing activity for the inherent satisfaction or enjoyment experienced from the activity itself, whereas extrinsic motivation is performing an activity to obtain a desirable outcome, which is separate from the activity itself (e.g., wealth). Perception of instrumental value is a key construct in understanding extrinsic motivation (Ryan & Deci, 2000).

When students are intrinsically motivated, they actively engage in learning or performing school activities because they experience interest or enjoyment inherently related to those activities themselves. In comparison, when students are extrinsically motivated, they engage in school activities because these activities have instrumental value or give students external rewards based on future consequences (Eccles & Wigfield, 2002; Lens, Paixão, & Herrera, 2009; Ryan & Deci, 2000). It is well known that intrinsic motivation is ideal because it is correlated with deeper learning, longer task

engagement, and better performance than extrinsic motivation is (Deci & Ryan, 1985). However, it is not possible for teachers or parents to provide contexts where students are entirely intrinsically motivated by interest or enjoyment from the activity itself (Kauffman & Husman, 2004). In addition, students are required to engage in tasks that are not interesting, but useful and necessary for their future. Therefore, many educational researchers have recently considered various ways to support students' motivation, including factors that are not purely intrinsic to students.

One way to support students' motivation is enhancing the value perception of the task students are engaging in (Brophy, 1999; Hidi & Harackiewicz, 2000; Wigfield & Eccles, 2002). For example, students invested more effort and achieved at higher levels when they perceived a task as instrumental for achieving a future goal (Malka & Covington, 2005). In addition, Hulleman and Harackiewicz (2009) also suggested that value perception could trigger situational interest, which also enhanced students' motivation. In classrooms, it is necessary for students to perceive such instrumental value in present tasks for attaining their valued future goals in order to enhance their achievement motivation. Instrumentality is defined as a personal perception of future consequence of present behaviors (Husman, 1998; Husman, & Lens, 1999). Therefore, it is very important to help students realize how present activities are connected to their future goals in order to enhance achievement motivation.

Perception of instrumentality is characterized as a task-specific construct (Husman & Lens, 1999). For example, a student studies math often because he/she wants to be a math teacher. In this case, the student focuses more on learning to achieve a future goal. On the contrary, another student studies math often because he/she requires a good

math grade to gain admission to a top-tier university. In this case, the student is not interested in learning; however, he/she is interested in performing well to achieve a future goal. Even though both students perceive math as instrumental for future goal attainment, their orientations for the present task are very different depending on the context.

Husman (1998) distinguishes between two types of instrumentality reflecting these context-dependent characteristics: endogenous and exogenous instrumentality. Endogenous instrumentality means the present task is inherently related to the individual's future goal, while exogenous instrumentality means the present task is not inherently related to individual's future goal; however, it is necessary for attaining the future goal (Husman & Lens, 1999). When students engage in a task because of its instrumentality for future success, it means they are extrinsically motivated. However, motivational researchers have argued that extrinsic motivation decreases intrinsic motivation and has a negative effect on achievement-related behavior (Cameron, Banko, & Pierce, 2001; Deci, 1971; Deci, Koestner, & Ryan, 2001). One question generated from this argument is whether instrumentality undermines intrinsic motivation.

Deci and Ryan (1985) suggest that some types of extrinsic motivation can increase intrinsic motivation if the extrinsic motivator supports autonomy. They emphasized that the quality of motivation explains the positive effects of extrinsic motivation. According to Ryan and Deci (2000), extrinsic motivation can be differentiated into different types based on the individual's perception in the behavioral-regulation process. They suggested that extrinsic motivation, which can support internal regulation, could increase achievement-related behavior as much as intrinsic motivation.

Therefore, it is important to determine the effect of instrumentality type on students' achievement in educational settings.

In a situation where students perceive high endogenous instrumentality, they are more likely to focus on learning. In another situation where students perceive high exogenous instrumentality, they are more likely to emphasize graded performance. In this study, I examined the relative benefits and pitfalls of endogenous and exogenous instrumentality for students' achievement motivation.

Instrumentality has been examined in accordance with the Future Time Perspective (FTP) theory (Lens, 1988; Nuttin & Lens, 1985). FTP theory has suggested that the personal conception of the future can have a positive effect on achievement in learning contexts (Kauffman & Husman, 2004). Especially, FTP theory emphasizes the connected relationship between a present task and future goal attainment in order to enhance students' motivation (Husman & Lens, 1999). Based on the research conducted within FTP theory, I expected that two types of instrumentality would have different relationships with students' achievement and motivation. Specifically, I hypothesized that students' performance and intrinsic motivation would have a positive relationship with endogenous instrumentality and a negative relationship with exogenous instrumentality.

Three studies were conducted to test these hypotheses. In Study 1, I examined the relationship between students' instrumentality and achievement (i.e., course grade). In Study 2, I investigated how endogenous and exogenous instrumentality predicted students' achievement goals. In Study 3, I examined the psychological mechanism linking endogenous and exogenous instrumentality to situational interest, pressure, and achievement.

CHAPTER 2

Theoretical Framework

Overview of Future Time Perspective Theory

School is a place for students to prepare for their future lives. Some students believe their present learning or outcomes from their current course activities are related to attainment of their valued future goals, whereas other students fail to see this connection (De Bilde, Vansteenkiste, & Lens., 2011). FTP researchers have established a convincing body of evidence to explain the common characteristics and dimensions of how people consider their personal future (Andriessen, Phalet, & Lens, 2006; Husman & Shell, 2008; Lang & Carstensen, 2002; Miller, DeBacker, & Greene, 1999; Simons, Vansteenkiste, Lens, & Lacante, 2004; Tabachnick, Miller, & Relyes, 2008).

Lens, Paixão, Herrera, and Grobler (2012) claimed that future goals create a FTP. Future goals can affect an individual's present behavior. The degree that students perceive the value for future goals affects their achievement-related behaviors such as learning strategies, task persistence, and task choice (Carvalho, 2015; Husman & Lens, 1999; Lens et al., 2012; Simons et al., 2004). Therefore, understanding the value perception of future goals has very important educational implications in achievement motivation. FTP theory has typically focused on the effect of future goals on student learning and achievement (Miller et al., 1999; Simons, Dewitte, & Lens, 2003).

Most of the goals that students are striving for in academic settings are future oriented by nature, even though those goals can be relatively proximal or distal (Husman & Lens, 1999). In FTP theory, generating future goals and elaborating related sub-goals to reach these future goals enable students to develop an extended FTP (Lens et al.,

2012). From a goal-setting perspective, Lens et al. (2012) defined FTP as “the present anticipation of goals in the near and/or distant future” (p. 322). Miller and Brickman (2004) emphasized the importance of distal future goals and related proximal sub-goals because individuals can perceive the incentive value for completion of each sub-goal when they realize that successful attainment of each sub-goal is a necessary condition for achieving their distal-valued future goals. Lewin (1942) mentioned that FTP is an individual reflection of anticipated future consequences at the present time.

Nuttin and Lens (1985) characterized FTP as a cognitive-motivational construct. In FTP, human motivation can be enhanced by the connected relationship between the present and the future (Husman & Lens, 1999). A study conducted by De Volder and Lens (1982) reported that FTP has a positive effect on male high school students’ grade point averages and persistence. Zimbardo and Boyd (1999) suggested that a “future” orientation could better predict achievement-related behaviors than a “present” orientation. Carvalho (2015) also showed the positive effect of FTP on students’ adaptation in school situations.

In FTP theory, time refers to the individual’s subjective and psychological perception, not just actual physical time (Husman, 1998; Husman & Shell, 2008). Therefore, each individual’s temporal distance to future goals can vary from very short to very long depending on the individual’s perception about the span of time. Carvalho (2015) suggested that individual difference in time perspective would cause different behavioral patterns among individuals. Individual differences toward time perspective can have different effects on achievement motivation (De Volder & Lens, 1982).

Distinctive Characteristics of Future Time Perspective Theory

Psychological distance to future goals can vary from short to very long, depending on an individual's subjective time perception (Simons et al., 2004). This individual difference in the length of FTP, called 'extension,' has meaningful implications for understanding achievement-related behaviors and human motivation (De Volder & Lens, 1982). The reason why each individual has a different level of extension in time perception is related to the fact that each individual develops his/her own "habitual time space" (Husman & Lens, 1999). Habitual time space means a range of actual future time that an individual considers for devising future goals (Nuttin & Lens, 1985). According to Nuttin and Lens (1985), habitual time space is very short for people with a short FTP; therefore, they have trouble when considering goals beyond their habitual time space. In contrast, people with long FTP can formulate distant long-term future goals and can be motivated by these long-term future goals because those future goals can be located in their extended habitual time space.

Husman (1998) used the concept of extension to explain individual differences in time perception. Extension, in particular, is one of the distinguished characteristics in FTP theory. Wallace (1956) defined extension as "the length of the future time span which is conceptualized" (p. 240). Students are likely to situate their goals in the near future if they have a shorter FTP, whereas students with a longer FTP are likely to extend their goals toward a distal future (Lens et al., 2012). Especially, one of the problems for students with a short FTP is that their time perspective is very present-oriented and they cannot envision the future consequences of present activities (Creten, Lens, & Simons, 2001).

According to Zaleski (1987; 1994), people with a long FTP were more motivated and satisfied with present tasks than people with a short FTP. Each individual has developed its own psychological time perspective based on the personal experiences about past, present, and future. Lens et al. (2012) argued that temporal distances to the future could have various ranges because each individual has a different level of extension (Lens et al., 2012). If rewards for achieving goals are not given immediately, motivation for students with short FTP is decreased because they fail to find the instrumental value in present tasks, whereas students with a long FTP maintain their motivation to engage in present tasks because they believe they are important and useful for future goal attainment. Therefore, it is necessary to understand the role of extension to investigate the relationship between FTP and motivation.

De Volder and Lens (1982) suggested two distinctive aspects to explain the effect of FTP on achievement motivation: dynamic and cognitive. The dynamic aspect in FTP means a personal characteristic to value future goals (De Bilde et al., 2011). Individuals generally perceive less value for distal future goals than for proximal future goals (Husman & Lens, 1999). However, Husman and Shell (2008) posited that individual with a long FTP can maintain more perception of value for distal future goals than individuals with a shorter FTP can. The cognitive aspect of FTP refers to the disposition to anticipate future consequences of present activities (De Volder & Lens, 1982). The cognitive aspect emphasizes the instrumental value of present activities for attaining valued future goals (Husman & Lens, 1999; Shell & Husman, 2001). Individuals with a short FTP perceived present activities as less instrumental than individuals with a long FTP did because the former do not find the connection between present activities and distal future goals

(Husman & Shell, 2008; Simons et al, 2004). The cognitive aspect of FTP is directly related to instrumentality (Husman & Lens, 1999). Recently many researchers focused on the role of instrumentality perception in achievement motivation to better understand how to enhance students' motivation in educational contexts (Creten et al., 2001; De Volder & Lens, 1982; Van Calster, Lens, & Nuttin, 1987).

Instrumentality and Expectancy-Value Theory

Expectancy-value theory is another theory that emphasizes the role of value perception in present tasks to enhance student motivation (Eccles & Wigfield, 2002). In classical expectancy-value theory, Atkinson (1964) suggested probabilities for success and incentive value of success are two important constructs that predicted achievement-related behaviors. According to Atkinson (1957), probability for success means expectancy and incentive value means an individual's value perception of success. It is well known that these beliefs that an individual holds about his/her expectancy and task value directly predicts their task choice, engagement, and achievement (Schunk & Pajares, 2005). In his model, Atkinson (1964) emphasized an inverse relationship between expectancy and value belief.

However, modern expectancy-value theory assumes an independent, positive relationship between expectancy and value (Eccles & Wigfield, 2002). According to Wigfield (1994), success expectancy and value perception are positively correlated. Eccles et al. (1983) proposed that students' achievement-related behaviors are influenced by the connection between their expectancy for success and subjective perception of task value. Therefore, students are more likely to value tasks that they do well at (Wigfield, 1994). Feather (1982) also assumed that if a student had a low expectation for success,

high value beliefs could not help the student enhance his/her motivation. For example, if students show poor performance in a specific subject, such as math or science, and attribute this result to a lack of ability that is perceived as stable, then they may lower their perceptions of the subject's value to protect their overall self-worth (Wigfield & Eccles, 1992).

According to Eccles et al (1983), expectancy can be defined as an individual's belief about competence when he/she will perform a task in the future and value was defined as the relative attractiveness of succeeding or failing at a task (Trautwein, March, Nagengast, Lüdtke, Nagy, & Jonkmann, 2012). In addition, task value can be defined as "how a task meets different needs of individuals" (Wigfield, 1994, p. 52) and expectancies for success can be defined as "individuals' beliefs about how well they will do on an upcoming task" (Wigfield, 1994, p. 52). Wigfield and Eccles (1992) proposed that expectancy beliefs are directly related to performance and value perceptions are more related to task choice and further engagement in a task. Wigfield (1994) reported that expectancies for success in mathematics most strongly predicted students' subsequent mathematics grade, while students' valuing of mathematics most strongly predicted their intentions to continue taking mathematics courses and their actual decisions regarding the enrollment in advanced mathematics courses.

Expectancy-value theory (Wigfield, 1994; Wigfield & Eccles, 1992) explains that students are more likely to invest more effort and achieve at higher levels when they perceive the tasks as having great personal importance or relevance, even when the tasks may not be intrinsically interesting. Researchers have reported that value perceptions are positively related with various motivational outcomes such as interest, task choice, and

future course enrollment (Bong, 2001; Eccels & Harold, 1991; Hulleman & Harackiewicz, 2009; Wigfield, 1994).

Eccels and Wigfield (1995) distinguished four different types of task values: attainment value, intrinsic value, costs, and utility value. Attainment value refers to how important doing well on a given task is for one's self. Intrinsic value refers to the enjoyment or fun individuals feel during a task. Cost refers to the anticipated effort for completing a task and relative loss of engaging in the task. Utility value refers to how a task is helpful for attaining individuals' future goals (Eccles & Wigfield, 2002). Specifically, Shecheter, Durik, Miyamoto, and Harackiewicz (2011) described utility value as students' perception that a task is helpful for accomplishing valued goals in the proximal or distal future. This characteristic of utility value is very similar to FTP's instrumentality construct (Husman & Lens, 1999).

Husman and Lens (1999) operationalized instrumentality as a context dependent construct. Therefore, each individual might have developed different types of instrumentality in each learning situation depending on his or her future goals. Further, Malka and Covington (2005) suggested that it is necessary to make distinctions in instrumentality because each student has a different point of view in perception of instrumentality. They exemplified two students taking a specific course to become a successful lawyer in the future. One student believes that learning the course material will be useful for becoming a good lawyer. In this case, the student develops more learning-oriented instrumentality. On the contrary, the other student thinks that getting an "A" grade from the course will be necessary for gaining admission to a top-tier law school, which is critical to becoming a successful lawyer. In this case, the student develops more

grade-oriented instrumentality. In this example, both students perceive the course as instrumental for achieving their future goals; however, each student perceives different types of instrumentality. Therefore, it is necessary to investigate how different types of instrumentality can be developed and how this difference in perception of instrumentality can affect achievement motivation.

Role of Instrumentality in Achievement Motivation

Ryan and Deci (2000) suggested that a person's value perception in a task has important implication on achievement motivation because the person can engage in specific tasks that he/she is not interested in. Both FTP theory and expectancy-value theory stress the important role of value perception in present tasks to enhance motivation and learning (Hulleman, Godes, Hendricks, & Harackiewicz, 2010; Husman & Lens, 1999; Markus & Nurius, 1986).

Focusing on personally relevant future consequences helps students demonstrate positive motivation and adopt an adaptive approach in academic settings (Simons, Dewitte, & Lens, 2003). A number of studies have reported that students who believe that their present learning is an instrumental means for achieving their valued future goals are more likely to be motivated than students who lack these beliefs (Husman & Lens, 1999; Shell & Husman, 2001; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005; Wigfield & Eccles, 2000). These findings have important implications for teachers who try to help unmotivated students. Teachers can promote students' motivation by enhancing the usefulness or instrumentality of current activities while students are performing important, yet potentially uninteresting tasks (Jang, 2008).

Instrumentality is a perception that completion of present tasks or activities will directly increase the probability of achieving valued future goals. (Lens, 1988; Nuttin & Lens, 1985; Simons, Dewitte, & Lens, 2000). Raynor (1981) defined instrumentality as a perception of the relationship between present task and future goals. In real learning situations, most students are not only intrinsically motivated by the task itself, but also extrinsically motivated by the possible immediate and more remote intrinsic and extrinsic consequences (Husman & Lens, 1999). Lens et al. (2009) described instrumentality as an extrinsic motivation because learning from the current task is not a goal in itself, but a useful means for attaining valued future goals. Therefore, positive consequence can be expected in the future when students perceive instrumental value in present tasks.

For example, Van Calster, Lens, and Nuttin (1987) found, in their study with grade 11 and 12 students, that students who perceived their schoolwork as important for the future were more motivated than students who perceived schoolwork as less important. In addition, Simons et al. (2000) found, in studies with adults and grade 12 students, that when an individual's future consequences of present tasks were stressed, participants were more oriented towards learning than towards performance. Therefore, an instrumental relationship between the present tasks and future goals was identified as having an important influence on students' task engagement, their competence beliefs for the task, and their valuing of the task (Carvalho, 2015; Malka & Covington, 2005; Miller et al., 1999).

Perceptions of instrumentality in present activities are not, however, always sufficient to maintain interest in school subjects (Creten, Lens, and Simons, 1998 as cited in Husman & Lens, 1999). This study examined Belgian students in a low-level

vocational school to determine whether students who recognized an instrumentality for learning French were more motivated in the French course than in their practical vocational courses. Students recognized that in Belgium, where French is one of the official languages, speaking French is important and necessary for their every life and for their future professional career development. Therefore, it is typical that they attached a high instrumentality to the French course. Despite this high perception of instrumentality for French, students showed more motivation for their practical vocational courses than for their French course or for any of the other “theoretical courses” such as mathematics. Students explained this difference by complaining that the French course content and the way that it was taught were not motivating. Therefore, it is necessary to consider the interactive relationship between instrumentality and context to support students’ achievement motivation.

Instrumentality Types and Goal Contents

Instrumentality focuses more on the connection between present tasks and future goals (Husman & Shell, 2008). Based on self-determination theory (SDT), Lens et al. (2012) posited that the quality of future goals could affect individuals’ perception of instrumentality. SDT claims that human motivation can be enhanced in a context where autonomy is supportive (Deci & Ryan, 1985). SDT explains four different types of extrinsic motivation based on an individual’s perception of behavioral regulation and the distinctive effect of the each regulation for students’ motivation: external, introjected, identified, and integrated regulation (Ryan & Deci, 2000). How an individual internalizes the external regulations is a key process to understand the type of behavioral regulation (Deci & Ryan, 1985). Lens et al. (2009) explained external regulation as the most

controlling and integrated regulation and the most autonomy-supportive form of extrinsic motivation. In addition, introjected regulation is less controlled than external regulation; however, it is more controlled than identified regulation. Furthermore, identified regulation is more autonomous than introjected regulation; however, it is less autonomous than integrated regulation (Lens et al., 2009).

Vansteenkiste, Lens, and Deci (2006) distinguished intrinsic goals such as personal development and extrinsic goal such as financial success according to SDT regulation. According to them, intrinsic goals are more related to autonomy-supportive regulation and extrinsic goals are more related to controlled regulations. Vansteenkiste, Simons, Lens, Soenens, Matos, and Lacante (2004) conducted a study with Belgian college students in a teacher training program to investigate how different goal contents affected students' achievement-related behaviors. They manipulated three different types of goal content conditions: intrinsic, extrinsic, and a combined version. For example, participants in the intrinsic goal condition were instructed that reading a text about recycling (present activity) was helpful for creating a clean, healthy environment (future consequence). Participants in the extrinsic goal condition were instructed that reading a text about recycling (present activity) was helpful for saving money (future consequence). In the dual-goal condition, participants were told about both intrinsic and extrinsic goals. Students in the intrinsic goal condition had better performance and persistence than did students in the extrinsic and dual-goal conditions.

Based on FTP and SDT theory, researchers made a distinction in instrumentality types and investigated the effect of different types of instrumentality on achievement motivation (Husman, 1998; Husman, McCann, & Crowson, 2000; Simons et al., 2000;

2003). Simons et al. (2003) divided instrumentality into three types based on the two combined dimensions. The first dimension focuses on the relationship between a present task and a future goal (Lens & Rand, 1997). Husman (1998) referred to endogenous and exogenous relationships between a present task and a future goal. In an endogenous relationship, a present task and a future goal are inherently related and they belong to the same category, whereas a present task and a future goal are not inherently related and they belong to different categories in an exogenous relationship. Based on this distinctive relationship between a present task and a future goal, Husman and Lens (1999) defined endogenous and exogenous instrumentality. According to them, endogenous instrumentality focuses more on the perception of instrumental value for learning, and exogenous instrumentality focuses more on the perception of instrumental value for outcomes such as obtaining grades.

The second dimension depends on the locus of causality in human behavior (Lens & Rand, 1997). According to SDT (Deci & Ryan, 1985), human behavior is regulated either internally or externally. A person's behavior is internally regulated when the reason for the behavior exists inside the person. In contrast, a person's behavior is externally regulated when the reason for the behavior is outside the person (Ryan & Deci, 2000). Based on these two dimensions, three types of instrumentality are defined as exogenous-externally regulated, exogenous-internally regulated, and endogenous-internally regulated (Simon et al., 2003).

Simons et al. (2003) exemplified three cases to explain each of the three types of instrumentality. In exogenous-externally regulated instrumentality, a person takes tennis lessons in order to get a reward such as a car offered by his/her parents. In this case, the

present task (taking tennis lessons) is not inherently related to the future goal (getting a reward); therefore, the behavior is regulated by the external reward. In exogenous-internally regulated instrumentality, a person takes tennis lessons because the person wants to get into shape. In this case, the present task is not inherently related to a future goal; however, the behavior is internally regulated (personal development). This type of instrumentality is very similar to how exogenous instrumentality is defined by Husman (1998). In the endogenous-internally regulated instrumentality, a person takes tennis lesson because the person wants to be a good tennis player. In this case, the present task is inherently related to the future goal and the behavior is internally regulated. This type of instrumentality is similar to how endogenous instrumentality is referred to by Husman (1998). Therefore, it is important to investigate how each type of instrumentality can predict achievement motivation. Especially, Husman and Lens (1999) posited that endogenous and exogenous instrumentalities are types of extrinsic motivation and that they may have different effects on intrinsic motivation.

Relationship of Instrumentality with Intrinsic Motivation

Instrumentality is a type of extrinsic motivation because the belief is that the present task is useful and important for an individual's future success even though it is not inherently related to the task itself (Lens et al., 2009). Deci and Ryan (1985) suggested that external events relevant to the initiation or regulation of behavior would affect a person's intrinsic motivation and they proposed that extrinsic incentives and pressures would undermine motivation to perform even inherently interesting activities based on SDT. Therefore, it is easy to see why instrumentality will provide an

opportunity to access future goals and discourage the intrinsic valuing of a task (Ryan Sheldon, Kasser, & Deci, 1996).

However, more recent research has shown that it is not possible to say that extrinsic motivation always negatively affects students' achievement motivation because extrinsic motivation can have a different effect on intrinsic motivation depending on its quality (Deci & Ryan, 2000; Simons et al., 2003; 2004; Vansteenkiste et al., 2004). For example, a study conducted by Miller et al. (1999) reported that students' perceptions of instrumentality for schoolwork increases both extrinsic and intrinsic motivation. Therefore, in order to enhance students' achievement motivation, it is important for teachers to help students realize how their present tasks are meaningfully related to their future goals and how their behavior is linked with the attainment of valued future goals (Miller et al., 1999; Simons et al., 2004).

Despite these findings, the adaptive nature of the motivation that students derive from instrumentality is still questioned in the literature. Because instrumentality sometimes concerns outcomes that are extraneous to the act of learning itself, there are researchers who predict that it encourages an extrinsic valuing of learning and eventually weakens the inherent interest and enjoyment that we would hope students find in their academic achievement (Eccles, Wigfield, & Schiefele, 1998; Kover & Worrell, 2010). This confusion regarding the role of instrumentality in achievement motivation might be due to the failure of distinguishing different types of instrumentality. In real classroom situations, students may perceive value in both their learning activities and grades; therefore, they will likely obtain a successful education. Consequently, it is necessary to investigate how students' motivation can be differentially affected by different types of

perceived instrumentality in order to form a complete understanding of student motivation.

Hulleman, Durik, Schweigert, and Harackiewicz (2008) considered task values to be situation-specific predictors of subsequent interest and performance. Interest during task engagement is one of the most important variables in explaining students' motivation (Deci & Ryan, 1985). However, students' interest in academic settings has decreased over time (Lepper, Corpus, & Iyengar, 2005). Research based on interest theory emphasized the positive role of value perception in developing interest during task engagement (Hidi & Renninger, 2006; Renninger & Hidi, 2002).

According to Hidi and Renninger (2006), interest has been developed through a four-phase model from situational interest to individual interest. Situational interest means interest that is generated by an interaction between a person and a specific condition. Individual interest means interest that is a relatively long-lasting, personal disposition (Hidi & Renninger, 2006). At the very first stage, perceived task value can trigger short-term interest in a specific situation, and this situational interest can develop into individual interest over time (Hulleman et al., 2010). Therefore, value perception may play a critical role in the beginning stages of interest development as well as in the deepening of individual interest over time (Hulleman et al., 2008). Hulleman et al. (2010) showed that relevance intervention had a positive effect on situational interest and perceived utility value. Especially, performance expectation was a significant moderator of situational interest.

Pressure is often referred as a negative predictor of intrinsic motivation (Ryan, Mims, & Koestner, 1983). Expectations for success and task values are motivational

constructs that are central in defining the self in achievement contexts (Wigfield & Eccles, 1994). Self-worth theory argues that learners' motives to establish and maintain a positive self-image, especially in situations with strong ability implications, are one of the reasons underlying various classroom behaviors (Covington, 1992). Lee and colleagues (Lee, Bong, & Kim, 2014; Lee, Lee, & Bong, 2013) have provided empirical evidence that value perception and self-efficacy interact with each other to determine the adaptive and maladaptive nature of achievement behaviors. The tendency for students to engage in maladaptive behaviors was the strongest when they held strong instrumentality beliefs that were accompanied by a weaker self-efficacy. Together, these results suggest that heightened negative emotion such as pressure caused by high instrumentality and weak self-efficacy may be a mediating mechanism between instrumentality and student motivation.

Instrumentality and achievement Goals.

Miller and Brickman (2004) argued that activities that are perceived as instrumental for attaining valued future goals are positively related to students' adoption of achievement goals. Achievement goals are an important construct in understanding human motivation because individuals' achievement-related behaviors are directed by various goals (Ames, 1992; Covington, 2000). Achievement goals posit that the reasons why students intend to engage in a specific task are an important predictor of their further behaviors and academic outcomes (Greene et al., 2004; Liem, Lau, & Nie, 2008). For example, students' achievement goals can predict their learning strategy use and achievement (Greene & Miller, 1996). Especially, competence representation is an important construct in recognizing achievement goals (Hulleman et al., 2008). Greene et

al. (2004) described students' behavioral patterns depending on their competence representation. For example, some students spend a lot of time and effort improving their competence, whereas other students only try to demonstrate competence. This difference in competence representation affects students' behavioral patterns in learning situations (Elliot, McGregor, & Gable, 1999).

Although many researchers have suggested various goals in an achievement goal framework based on competence representation (Ames, 1992; Dweck & Leggett, 1988; Elliott & Dweck, 1999), generally achievement goals have been divided in two categories: ego-involved goals and task-involved goals (Nicholls, 1984). Dweck (2000) also distinguished between performance goals and learning goals. In addition, Ames (1992) described two distinctive achievement goals: performance goals and mastery goals. Even though these researchers used different terminology to explain goal orientation, task-involved goals, learning goals, and mastery goals can all be regarded as similar achievement goals; ego-involved goals and performance goals can be categorized as another achievement goal. In this study, mastery and performance goal construct will be used to represent each achievement goal.

In a mastery goal context, students are typically interested in how they can develop competence by acquiring knowledge and skills. In comparison, students with a performance goal focus on proving their competence and performance compared with others. However, this mastery/performance framework in achievement goals has recently been extended to a trichotomous framework that represents mastery, performance-approach, and performance-avoidance goals (Elliot, 1999; Elliot & Harackiewicz, 1996). Performance-approach goals refer to the attainment of competence and performance-

avoidance goals means the avoidance of incompetence in comparison with others (Elliot et al., 1999).

Nicholls, Patashnick, and Nolen (1985) showed that students' achievement goals could be differentiated depending on their perceptions about the purposes of schooling. Greene et al. (2004) reported that students tend to adopt mastery goals when they perceive what they learn in the present task as important for attaining their valued future goals. However, students tend to adopt performance goals when they perceive that better performance in present tasks is important to achieve their valued future goals. Miller and Brickman (2004) argued that perception of instrumentality has a close relationship with mastery goals. According to them, students are less likely to adopt mastery goals if they fail to find personal value in a present task in terms of achieving their valued future goals. In addition, they also suggested that students are more likely to adopt performance-avoidance goals and show less effort and persistence when they perceive that it is not possible for them to attain desired performances or outcomes.

Miller et al. (1999) conducted a study with 180 college students to examine the relationship among perceived instrumentality, mastery, performance goals, and intrinsic and utility value. Mastery goal and perceived instrumentality were highly correlated ($r = .72$), whereas performance goal and perceived instrumentality were not significantly correlated ($r = -.04$). However, the perceived instrumentality subscale used in Miller and colleagues' study measured both instrumentality for learning and instrumentality for performance in a specific course simultaneously in one dimension. Therefore, it is necessary to distinguish these two types of perceived instrumentality to examine distinctive effects of each type of instrumentality on each type of achievement goal.

It is well known that mastery goals are more related to adaptive achievement-related behaviors and promote motivation than performance-approach and performance-avoidance goals do (Elliot & Harackiewicz, 1996). Therefore, it is important to determine the overall relationship between each type of instrumentality and achievement goals to better understand achievement motivation.

Instrumentality and Beliefs about Intelligence

Dweck and Molden (2005) explained the relationship between individuals' beliefs about their intellectual ability and achievement goals. According to them, some people believe that their intelligence can be increased by learning efforts (called incremental belief), whereas other people believe their intelligence is fixed and cannot be changed (called entity belief). They suggested that incremental belief is more related to learning goal orientation and entity belief is more related to performance goal orientation.

Students with incremental beliefs are more likely to adopt mastery goals whereas students with entity belief are more likely to adopt performance goals (Dweck & Sorich, 1999; Dweck, 2000). When students believe that they can improve their intellectual ability, they put in more effort and focus on learning course material. However, students try to prove their intellectual ability or avoid their inability when they have entity belief (Dweck & Molden, 2005).

It is very important to understand how students' beliefs about their intelligence can affect their learning, effort to learn, use of learning strategies, and achievement in educational contexts (Dweck & Sorich, 1999). Students who believe that their intelligence is changeable put more effort in to develop their intelligence, whereas

students who believe that their intelligence is fixed perceive their intelligence as a personal trait (Dweck & Leggett, 1988).

Dweck and Sorich (1999) claimed that students with incremental beliefs are more likely to adopt learning goals and students with entity beliefs are more likely to adopt performance goals. Especially, students with entity beliefs are inclined to choose easier tasks and exert less effort during task engagement (Dweck, 2000). Moreover, incremental beliefs predict more achievements than entity beliefs in educational situations (Blackwell, Trzesniewski, & Dweck, 2007; Cury, Elliot, Da Fonseca, & Moller, 2006; Grant & Dweck, 2003).

Relationship among Instrumentality, Achievement Goals, and Self-Efficacy

Elliot (1999) depicted the connection between self-efficacy and achievement goals. Self-efficacy means an individual belief about the capability to learn or perform at designated levels (Bong, 2001). Especially, self-efficacy is understood to play an important role in distinguishing between approach and avoidance motivation (Elliot, 1999). Therefore, it is necessary to determine the dynamic relationships among instrumentality, self-efficacy, and achievement goals to better understand achievement motivation in learning situations.

Students' self-efficacy beliefs are positively related with their interest development (Jacobs et al., 2002). Pintrich (2003) suggested that students are more likely to engage in tasks and are more motivated when they believe they can do well in those tasks. Value perception is recognized as a powerful predictor of interest and task choice (Xiang, Chen, Bruene, 2005). Godes, Hulleman, & Harackiewicz (2007) showed that emphasizing instrumental value in a math activity could have different effects on

students' interest depending on the level of their perceived competence. For example, a student who is not good at math or not interested in math will feel burden when he/she is told that math is important and necessary for their future goal attainment. Hulleman et al. (2008) suggested that students with high self-efficacy are less in need of situational supports for interest development because their interest is already at a higher level; however, students with low self-efficacy will have a difficult time finding interest in the task. Hulleman et al. (2010) showed that instrumentality intervention had a greater effect for students with low self-efficacy and no effect for students with high self-efficacy.

Elliot (1999) suggested that students were more likely to be mastery or performance-approach goal oriented when they have high self-efficacy, whereas students with low self-efficacy were more likely to be performance-avoidance goal oriented. Self-efficacy plays an additive or moderating role in explaining the relationships between instrumentality and achievement. Ability beliefs, which refer to children's evaluation of their current competence in different areas, have a prominent place in achievement motivation theory, including expectancy-value theory and self-worth theory (Covington, 1984). Miller and Brickman (2004) described the overall relationship among instrumentality, self-efficacy, and goal orientations. According to them, even when students perceive present activities as instrumental for obtaining their personally valued future goals in school situations, they were not likely to engage in those activities if they had low task-specific self-efficacy. Therefore, understanding how the interaction between self-efficacy and instrumentality can predict students' achievement motivation has important implications in academic settings.

CHAPTER 3

Purpose of Study

According to FTP theory (Husman & Lens, 1999), instrumentality is a powerful predictor of students' persistence, task choice, engagement, and achievement in academic settings. However, students are often asked to perform tasks that they hold a low expectancy of success for, even though they perceive high instrumentality. Further, the instrumentality can be endogenous or exogenous depending on the relationship between present tasks and future goals.

Unfortunately, little research has distinguished students' perceptions of instrumentality or examined the effect of the discrepancy between each type of instrumentality and self-efficacy on students' motivation. Some students value learning more because they believe skills and knowledge acquired from present tasks are instrumental for achieving their future goals. In contrast, other students focus more on their outcomes such as grades because they realize that the outcomes are more instrumental for achieving their future goals. In each case, the discrepancy between instrumentality and expectancies for success may cause a different effect on students' achievement motivation. Especially, students with low self-efficacy and high exogenous instrumentality are expected to devalue the tasks and show avoidance behaviors. In this case, students feel high pressure due to the "exogenous" nature of the instrumentality and, at the same time, low interest due to low self-efficacy; unfortunately, both of these undermine their motivation and further achievement in learning situations. Therefore, it is important to examine the dynamic relationship between self-efficacy and different types

of instrumentality and examine how these variables interact to affect students' motivation and achievement.

This study investigated the mediating effect of motivational variables on the relationship between two different types of instrumentality and students' achievement. In addition, this study examined the moderation of self-efficacy in accounting for the relationship between two different types of instrumentality and students' emotion, motivation, and achievement. The primary research questions and specific hypotheses were as follows:

- 1) Do incremental beliefs about intelligence relate to instrumentality?
- 2) Does each type of instrumentality predict students' academic achievement?
- 3) What unique role does self-efficacy assume in the relationship between instrumentality and students' academic achievement?

I hypothesized that endogenous instrumentality would be more likely to be related to incremental beliefs than exogenous instrumentality. It was also hypothesized that endogenous instrumentality would be positively related with students' achievement regardless of self-efficacy, whereas exogenous instrumentality would be positively related with achievement of students with high self-efficacy; however it would be negatively related with achievement of students with low self-efficacy.

- 4) What are the relationships between each type of instrumentality and achievement goals?
- 5) Does self-efficacy interact with instrumentality in predicting achievement goals?

I hypothesized that endogenous instrumentality would be more related to mastery goals and exogenous instrumentality would be more related to both performance-

approach and performance avoidance goals. It was also hypothesized that self-efficacy would interact with endogenous and exogenous instrumentality respectively in predicting achievement goals.

6) Does instrumentality predict situational interest and pressure?

7) Does situational interest and pressure mediate the relationship between instrumentality and students' academic achievement?

I hypothesized that endogenous instrumentality would positively predict situational interest and negatively predict pressure. In contrast, I hypothesized that exogenous instrumentality would negatively predict situational interest and positively predict pressure.

Research questions 1, 2, and 3 were examined in Study 1. Research questions 4 and 5 were examined in Study 2. Finally, Study 3 examined research questions 6 and 7.

CHAPTER 4

Study 1

Study 1 was conducted to investigate whether endogenous and exogenous instrumentality predicted students' achievement differently and whether the implicit theory of intelligence predicted each type of instrumentality differently. In addition, Study 1 examined the moderating effect of self-efficacy on the relationship between each type of instrumentality and students' achievement.

Individuals with endogenous instrumentality views learning the present task important because it provides a useful means for achieving a future goal (Hilpert et al., 2012). This emphasis on learning in endogenous instrumentality shares similarity with incremental beliefs about intelligence. According to Dweck and Soric (1999), students with incremental beliefs of intelligence believe that learning is important for their growth in intellectual ability. In other words, learning the present task is important for the valued future goal of one's own intellectual growth. Therefore, a strong belief in the incremental nature of ability was hypothesized to predict endogenous instrumentality. In contrast, there is no clear conceptual overlap between incremental beliefs of intelligence and exogenous instrumentality. This relationship was thus hypothesized to be nonsignificant.

Simmons et al. (2003) reported that different types of instrumentality predicted students' performance differently in a physical activity. More important, an experimental study by Hulleman and Harackiewicz (2009) demonstrated that there was a significant interaction between instrumentality and self-efficacy on students' course grades.

Specifically, students with low self-efficacy received a higher grade in the instrumentality

condition than in the control condition. The instrumentality manipulation did not produce significant difference in the students with high self-efficacy.

Taken together, I hypothesized that incremental beliefs about intelligence would be positively and more strongly related endogenous instrumentality than exogenous instrumentality. I also hypothesized that self-efficacy would moderate the relationship between each type of instrumentality and course grade (see Figure 1).

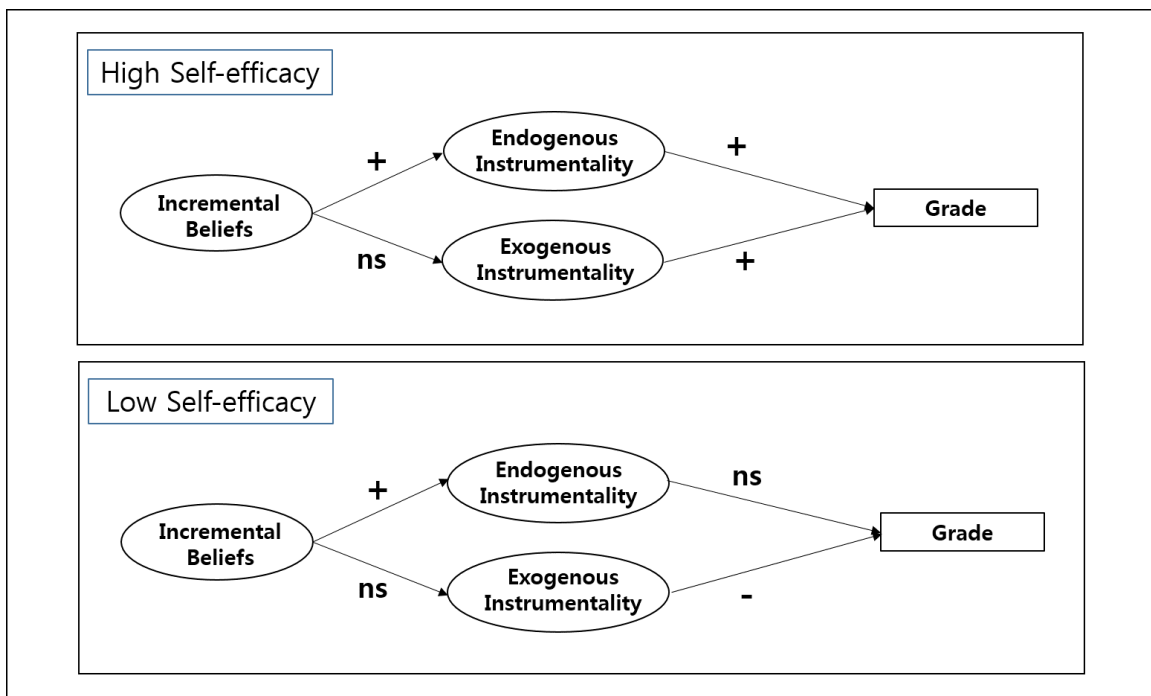


Figure 1. The hypothetical model of Study 1.

Method

Participants

Survey responses from a sample of 765 undergraduate engineering students were analyzed in Study 1. Data collection took place across three years from students taking various courses in Mechanical and Aerospace Engineering (MAE) at a large public university in the United States. Because students were taking multiple MAE courses and surveys were course specific, they had the opportunity to take multiple surveys. To reduce the number of surveys to one per participant when duplicates occurred, I retained only the survey taken from the lowest-level courses. This process resulted in 765 unique participants for data analysis.

Students taking MAE courses were considered a suitable sample to test the present hypotheses because these courses were directly related to their future career goals and, therefore, the students were believed to have high perceptions of endogenous instrumentality, exogenous instrumentality, or both. Among the participants, 14.6 % were female students and 86.4% were male students. 14% of participants were in the first year of the engineering program, 55% were in their second year, and 31% were in their third year. The sample contained 3.8% less female students than the gender breakdown of those receiving science and engineering degree across the United States in 2012 (Yoder, 2012). The participant age range was from 18 to 44 years, with a mean age of 21.7 years ($SD = 1.12$).

Procedure

Participant recruitment was conducted through in-class announcement in various Mechanical and Aerospace Engineering courses. Participation was voluntary and students

were assured that there would be no disadvantage for choosing not to participate in the survey or to respond any of the questions on the survey. The survey was administered online, using a commercial survey portal. Students could start participating in the survey after two weeks from the beginning of the semester. The survey site was open for a week and participants could complete the online survey outside of class. Participants received a small money incentive for their participation.

Measures

Incremental beliefs of intelligence. The Implicit Theories of Intelligence (Dweck, 2000) is an established scale to measure self-theories about ability. Three items in this scale assessed students' incremental beliefs which focused on the malleability of intelligence. Example items assessing incremental beliefs were "No matter how much intelligence you have, you can always change it quite a bit" and "You can always greatly change how intelligent you are." The participants responded on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Self-efficacy. Self-efficacy was measured using the Motivated Strategies for Learning Questionnaire (MSLQ). The MSLQ is an established scale to assess college students' motivational behaviors and their use of different learning strategies for a course (Pintrich, Smith, Garcia, & Mckeachie, 1993). The self-efficacy scale in MSLQ was designed to measure students' expectation for success in a course and their confidence about ability and skills to perform the tasks well (Pintrich, et al., 1993). In Study 1, the eight-item subscale related to self-efficacy for learning course material was administered (e.g., "I believe I will receive an excellent grade in this class" and "I am confident I can understand the most complex material presented by the instructor in this course"). In

previous research with college students, the alpha coefficient ranged from .92 to .93 (Pintrich, Smith, Garcia, & MeKeachie, 1991; Stump et al., 2011). The participants responded on a Likert-type scale ranging from 1 (*not at all true of me*) to 7 (*very true of me*). Participants were instructed to consider only the course that they were being surveyed about.

Perceptions of instrumentality. The perceptions of instrumentality (PI) scale (Husman, Derryberry, Crowson, & Lomax, 2004) was administered to assess participants' endogenous and exogenous instrumentality. The scale contained eight positively and negatively worded items. The endogenous instrumentality subscale consisted of four items (e.g., "I will use the information I learn in this class in other classes I will take in the future") and the exogenous instrumentality subscale consisted of four items (e.g., "The grade I get in this class will not affect my ability to continue on with my education"). Previous research using the perceptions of instrumentality scale reported that the alpha coefficient for endogenous and the exogenous instrumentality scales were .90 and .64, respectively (Hilpert et al., 2012). Participants responded on a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). They were instructed to think only about the course they were being surveyed in when responding to these items.

Course grade. Participants' final course grades were obtained from the university registrar's office and included in the data as measure of achievement. Grade were measured on a four-point plus or minus scale. The highest possible grade was an A+ (4.33) and the lowest possible grade was no credit (0.00).

Data Analysis

Missing values were less than 0.8% across all items. To deal with missing values, the expectation-maximization (EM) algorithm was applied using SPSS 16.0 software. All subscale scores for incremental beliefs of intelligence, endogenous and exogenous instrumentality, and self-efficacy were obtained by computing a mean score of all relevant survey items for each participant. Course grade were converted to a Z-score for each MAE course for SEM analyses. Descriptive statistics, including the means, standard deviations, and maximum-minimum item scores, skewness, and kurtosis were computed and checked for normality, along with coefficient alpha for reliability evidence (Cronbach, 1951). Then, bivariate correlations were conducted to examine the relationship between all variables. After that, structural equation modeling procedures (SEM) using AMOS 18 were performed to test hypothetical model. . In structural equation modeling, items were used as observed indicators for each corresponding latent factor.

The chi-square statistics, Tucker-Lewis Index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used to evaluate the goodness-of-fit of the model. Hu and Bentler (1999) suggested that values above .95 for CFI and TLI indicated an acceptable model fit. For RMSEA, values less than .05 indicated a good model fit and those between .05 and .08 indicated a reasonable model fit (Browne & Cudeck, 1993).

Significance of the mediation effect in the structural equation model was examined using the phantom model approach (Macho & Ledermann, 2011). Specific phantom representing each indirect effect was added to the main structural model and

tested for the significance. Significance of indirect effect was tested by applying the bias-corrected percentile bootstrapping with 1,000 randomly selected samples and 95% confidence intervals was applied (Kline, 2011). Indirect paths from incremental beliefs of intelligence to course grade via endogenous and exogenous instrumentality were examined when they were connected significantly to each other.

A multi-group structural equation modeling analysis was conducted to statistically compare the magnitudes of the predictive paths in the hypothetical model depending on the self-efficacy level. The self-efficacy groups were created by median splitting based on students' self-efficacy score. First, measurement invariance model with invariance constraints of factor loadings was tested to ensure that differences in the structural paths were not due to differences in the items' function. Once, the measurement model was supported as invariant across samples, structure model which imposed invariance constraints on the structural paths was analyzed to test whether the predictive paths among the latent variables were also equivalent across the samples. Finally, the equality constraints on those structural paths for which the assumption of equality was rejected in the structure model were lifted. Measurement invariance was supported when the difference between CFI (Δ CFI) of two models is smaller than 0.01 (Cheung & Rensvold, 2001).

Results

Descriptive Statistics

Table 1 presents descriptive statistics and reliabilities of all variables in Study 1. All variables followed approximate normal distributions according to the statistical criteria of skewness and kurtosis (Kline, 2011). Mean scores for endogenous and

exogenous instrumentality were 4.06 and 3.86 on the 1-5 response scale respectively. In addition, the mean score for self-efficacy was 5.41 on the 1-7 response scale. In particular, students perceived high confidence about ability in the course that they were currently taking.

Table 1
Descriptive Statistics for All Variables in Study 1

Variable	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurt	α
Incremental beliefs	3.42	.99	1.00	5.00	-.38	-.60	.93
Endogenous instrumentality	4.06	.82	1.00	5.00	-1.24	1.85	.72
Exogenous instrumentality	3.86	.75	1.00	5.00	-.55	.37	.68
Self-efficacy	5.41	1.16	1.00	7.00	-.72	.17	.95
Course grade	2.78	.96	0.00	4.33	-.89	.17	

Note. Listwise $N = 765$. Min = minimum; Max = maximum; Skew = skewness; Kurt = kurtosis.

Table 2 shows the bivariate correlational analysis among variables in Study 1. The results revealed that incremental beliefs was positively correlated only with exogenous instrumentality ($r = .09$). Endogenous and exogenous instrumentality correlated positively each other ($r = .35$). In addition, endogenous instrumentality showed positive correlation with self-efficacy ($r = .34$) and course grade ($r = .09$). However, there was no significant correlation between exogenous instrumentality and either self-efficacy and course grade. Self-efficacy demonstrated a significant correlation with course grade ($r = .40$).

Table 2

Correlations Among All Variables in Study 1

Variable	1	2	3	4
1. Incremental beliefs	-			
2. Endogenous instrumentality	.09*	-		
3. Exogenous instrumentality	-.04	.35**	-	
4. Self-efficacy	.04	.34**	.02	-
5. Course grade	.01	.09*	.00	.40**

Note. Listwise $N = 765$.

* $p < .05$. ** $p < .01$.

Structural Equation Modeling

Structural equation modeling was conducted to investigate the overall relationships among the variables in Study 1. In the measurement model and the structural model, items were used as indicators of latent variables except course grade. The measurement model demonstrated a satisfactory fit, $\chi^2(49, N = 765) = 135.36, p < .001$ TLI = .98, CFI = .98, RMSEA = .05 [90% CI = .04, .06]. All factor loadings were significant at $p < .001$ with the standardized factor loadings ranged in magnitude from .59 to .95. After the measurement model was checked, paths among the latent variables in the structural equation model were tested. Model fit statistics indicated a satisfactory fit, $\chi^2(50, N = 765) = 133.40, p < .001$ TLI = .97, CFI = .98, RMSEA = .05 [90% CI = .04, .06]. Figure 2 displays the standardized path coefficients among the latent variables. Incremental beliefs predicted endogenous instrumentality in a positive way ($\beta = .10$), but did not predict exogenous instrumentality. In addition, endogenous

instrumentality positively predicted course grade ($\beta = .11$). However, exogenous instrumentality did not predict course grade.

Next, the significance of mediation effects in the structural equation model was tested using the bootstrapping method (Macho & Ledermann, 2011). The results showed that endogenous instrumentality did not significantly mediate the path from incremental beliefs about intelligence to course grade (bootstrap 95% CI [.00, .03], $B = .01$, $p = .07$).

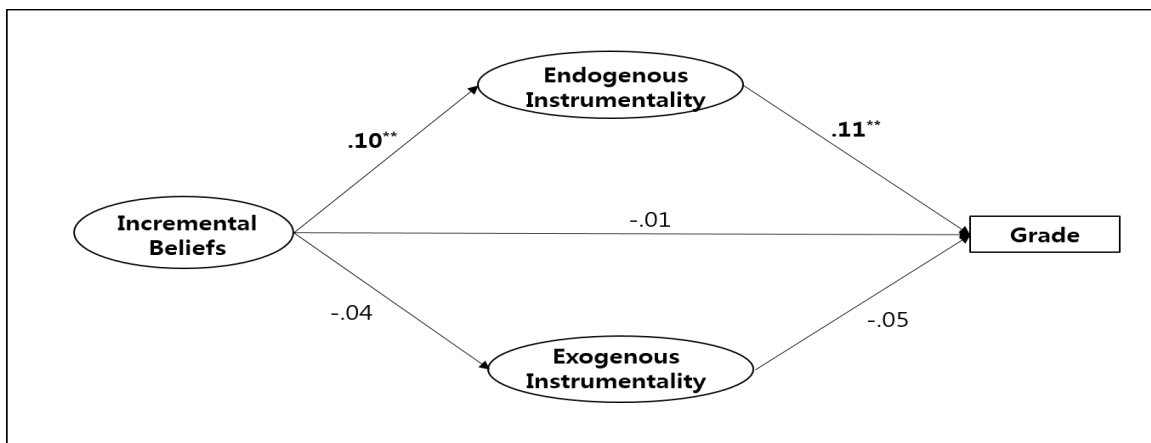


Figure 2. Standardized path coefficients from the model tested in Study 1.

** $p < .01$.

To test the potential differences depending on self-efficacy level, independent samples t -tests were conducted. The self-efficacy groups were created by median splitting based on students' self-efficacy score. The upper half of students comprise the high self-efficacy group, whereas the bottom half made up the low self-efficacy group. As shown in Table 3, students with high self-efficacy reported higher levels of endogenous instrumentality. There was no difference on the incremental beliefs and exogenous

instrumentality depending on the self-efficacy level. High self-efficacy students also obtained higher grades.

Table 3

Independent-Samples T-test on Mean Value of Variables Depending on Self-efficacy Level

Variable	Low self-efficacy (N = 381)		High self-efficacy (N = 384)		t
	M	SD	M	SD	
Incremental beliefs	3.38	.96	3.46	1.02	-1.15
Endogenous instrumentality	3.84	.88	4.27	.69	-7.59***
Exogenous instrumentality	3.84	.72	3.88	.77	-.64
Course grade	-.31	.99	.29	.84	-9.04***

*** $p < .001$.

A multi-group structural equation modeling analysis based on self-efficacy level was conducted to examine the different predictive patterns. First of all, measurement invariance was tested for the purpose of examining whether items measured the same constructs in different samples. The fit of the measurement model with equality constraints was similar to the fit of the default model with no such constraints, $\chi^2(100, N = 765) = 186.98, p < .001, TLI = .97, CFI = .98, RMSEA = .03$ [90% CI = .03, .04]. Therefore, the results constituted evidence that the items functioned similarly in the two samples (Cheung & Rensvold, 2002; Kline, 2011). The multi-group structural model showed that reasonable fits, $\chi^2(110, N = 765) = 203.67, p < .001, TLI = .97, CFI = .98, RMSEA = .03$ [90% CI = .03, .04]. Figure 3 shows the standardized path coefficients from multi-group comparison based on self-efficacy.

Incremental beliefs positively predicted endogenous instrumentality regardless of self-efficacy level ($\beta = .13$ for high self-efficacy students, $\beta = .09$ for low self-efficacy students), but did not predict exogenous instrumentality in either the low or high self-efficacy group. Specifically, exogenous instrumentality positively predicted the course grade of students with high self-efficacy ($\beta = .13$), but negatively predicted the course grade of students with low self-efficacy ($\beta = -.16$). Even though there was a statistically significant group difference in the predictive power of endogenous instrumentality on course grade, the path coefficient for each self-efficacy group was not statistically significant.

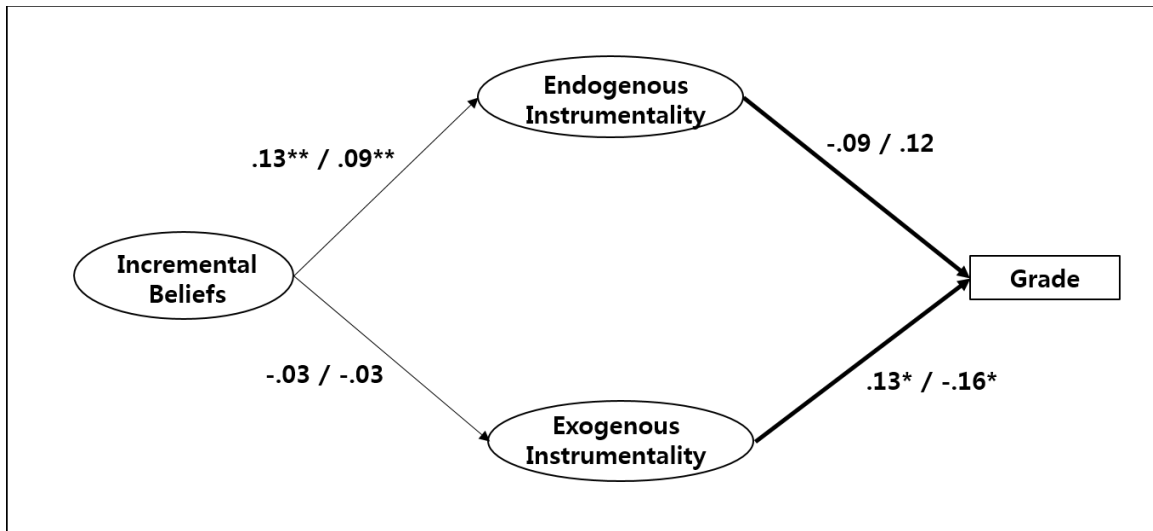


Figure 3. Standardized path coefficients from multi-group comparison based on self-efficacy level. Coefficients to the left of the slash are for the high self-efficacy group; coefficients to the right of the slash are for the low self-efficacy group. Thick lines indicate the path of statistical difference between the two groups.

* $p < .05$. ** $p < .01$.

Discussion

The results from Study 1 supported one of the hypotheses. Incremental beliefs predicted endogenous instrumentality; however, it did not predict exogenous instrumentality regardless of students' self-efficacy. According to Dweck and Sorich (1999), students with incremental beliefs tended to adopt mastery goals and focused on learning to increase new knowledge and master course material. This characteristic of incremental beliefs was more similar to endogenous instrumentality, which emphasizes the connected relationship between learning from present tasks and valued future goal attainment, than it was to exogenous instrumentality, which focuses on the relationship between outcomes of present tasks and valued future goal attainment (Husman & Lens, 1999).

In addition, the results from a whole group analysis in Study 1 showed that a possibility of a mediation effect of endogenous instrumentality on the relationship between incremental beliefs and course grade. However, the result of mediation test showed there was no mediation effect of exogenous instrumentality on the relationship between incremental beliefs and course grade. In previous research, it was well known that perceiving present tasks as an instrumental way to obtain valued future goals enhanced students' motivation and achievement (Malka & Covington, 2005; Vansteenkiste et al., 2005).

Interestingly, only endogenous instrumentality predicted course grade positively, but not exogenous instrumentality. It meant that students' perceptions of instrumentality in present tasks had a different relationship with their achievement depending on its type (Malka & Covington, 2005). In this sense, it is noteworthy that the way that students

perceive their present tasks as a meaningful tool for attaining their valued future goals is important for supporting their achievement in academic settings.

In Study 1, one of main hypotheses was to investigate the moderating effect of self-efficacy on the relationship among incremental beliefs, endogenous and exogenous instrumentality, and course grade. The results from multi-group analyses by self-efficacy level showed that incremental beliefs predicted only endogenous instrumentality, regardless of self-efficacy. However, the results showed that exogenous instrumentality positively predicted the course grade of students with high self-efficacy and negatively predicted the course grade of students with low self-efficacy. This result showed the moderating effect of self-efficacy on the relationship between exogenous instrumentality and course grade. It meant that the discrepancy between task value and self-efficacy resulted in a negative effect on students' achievement when they focused on an outcome (e.g., grade) with low expectation for success.

Even though it failed to show group difference with statistical significance, one interesting finding from multi-group comparison analyses was that endogenous instrumentality marginally predicted the course grade of students with low self-efficacy ($p = .06$). Based on this result, it is possible to assume that endogenous instrumentality may have a more positive effect on achievement of students with low self-efficacy than students with high self-efficacy.

Findings from Study 1 have important implications in terms of the relationship between each type of instrumentality and students' achievement. First, students can reach higher achievement, when they perceive the usefulness of learning in present tasks for achieving their valued future goals, which is defined as endogenous instrumentality.

Second, findings from Study 1 suggest the possibility of undermining effect of instrumentality on students' achievement if the usefulness of grade is emphasized for achieving their valued future goals, which is defined as exogenous instrumentality. Such undermining effect of exogenous instrumentality particularly emerges when students have low self-efficacy.

CHAPTER 5

Study 2

Study 2 was conducted to investigate the relationship between each type of instrumentality and achievement goals. In Study 1, incremental beliefs of intelligence, a well-established antecedent of mastery goals, predicted endogenous instrumentality but not exogenous instrumentality, regardless of students' self-efficacy. These results suggest that students with strong beliefs in the incremental nature of ability tend to perceive endogenous rather than exogenous instrumentality in the given task. Moreover, Dweck and Sorich (1999) suggested students with incremental beliefs were more likely to adopt mastery goals. Taken together, I hypothesized that endogenous instrumentality would positively predict mastery goals (see Figure 4).

Incremental beliefs of intelligence did not demonstrate a significant relationship with exogenous instrumentality in Study 1. Therefore, it is not clear what kinds of relationships exogenous instrumentality may demonstrate with achievement goals. Incremental and entity beliefs of intelligence are often negatively correlated (e.g., Dupeyrat & Mariné, 2005). When both beliefs enter the prediction equation simultaneously, it is often the case that either the incremental-mastery goal or the entity-performance goal relationship turns out to be significant, but not both (e.g., Bong, Woo, & Shin, 2013; Dupeyrat & Mariné, 2005). Considering these findings, it was deemed worthwhile to directly test the relationship between exogenous instrumentality and achievement goals. Based on the contrasting nature of endogenous and exogenous instrumentality and the shared extrinsic focus of exogenous instrumentality and performance goals, I hypothesized that exogenous instrumentality would positively

predict performance-approach and performance-avoidance goals but not mastery goals (see Figure 4).

Given that effects of instrumentality on course grade were significantly moderated by self-efficacy in Study 1, I examined whether effects of instrumentality on achievement goals were also moderated by self-efficacy in Study 2. I hypothesized that endogenous instrumentality would relate to mastery goals but not performance goals, regardless of self-efficacy levels. In contrast, I hypothesized that exogenous instrumentality would more strongly relate to performance-approach goals for students with high self-efficacy, while more strongly relate to performance-avoidance goals for students with low self-efficacy.

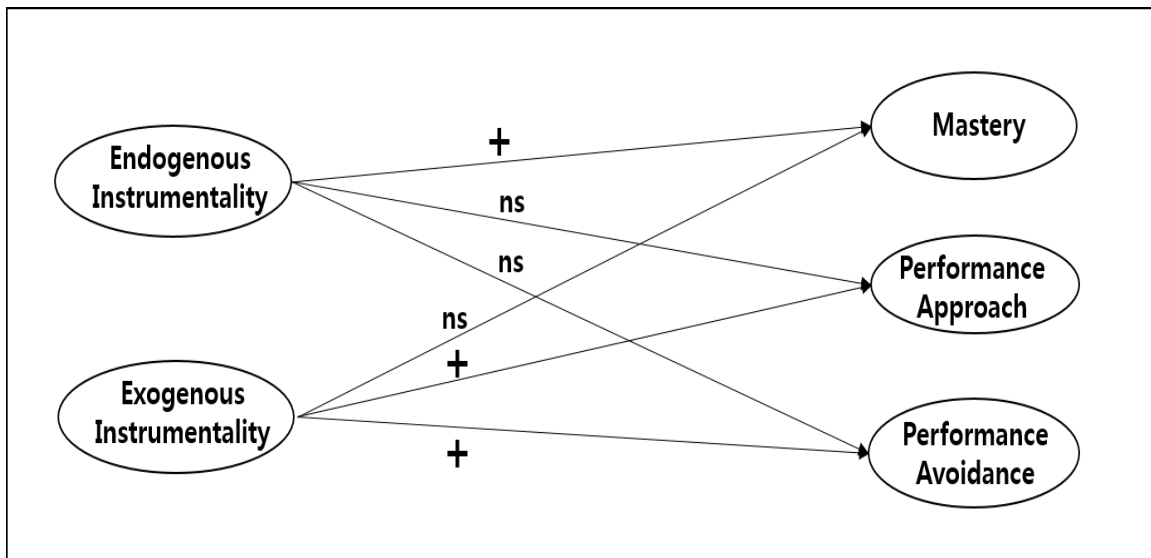


Figure 4. The hypothetical model of Study 2.

Method

Participants

Undergraduate students were recruited from several sections of an introductory educational psychology course at three private universities in South Korea in Study 2. Survey responses from 298 students were collected and analyzed. The introductory educational psychology course was a required course for students who wanted to enter the teaching profession and it was taken by students from diverse majors. The sample consisted of 97.7% females and 2.3% males, which was typical of the courses designated as teacher certificate courses in Korea. Participants' ages ranged from 19 to 55 years, with a mean age of 20.5 years ($SD = 1.76$)

Procedure

Participants were recruited through an in-class announcement in introductory educational psychology courses. The survey was presented in a hard-copy format and administrated during a regular class period. It took approximately 15 minutes for participants to complete the survey. Participation was voluntary and participants were assured that they would not be subjected to any disadvantage for choosing not to participate. Participants were awarded extra 5% of the total course points for their participation.

Measures

Self-efficacy. The same self-efficacy scale used in Study 1 was used to assess participants' self-efficacy in Study 2. Because the participants in Study 2 were Korean college students, it was necessary to translate the original version of the self-efficacy scale into Korean. For the translation, a professional English-Korean translator translated

all items into Korean. After that, separate and independent back-translation into English was conducted by two graduate students majoring in educational psychology. One of them was a native Korean who graduated from a high school and a college in the U.S.; the other was a Korean, who lived in Canada for all her life before coming back to Korea for her graduate studies. Both of them were fluent in both Korean and English. The guidelines recommended by Brislin (1986) were followed in the translation and back-translation. Items that were back-translated into English were compared with their original counterparts to see if they conveyed an identical meaning. Any discrepancies between translators were resolved through discussion, until consensus was reached. No particular problem was encountered during the translation process.

Perceptions of instrumentality. Perceptions of instrumentality were assessed with the same endogenous and exogenous instrumentality scales used in Study 1. Because the original version of the perceptions of instrumentality scale was developed in English and the participants in Study 2 were Korean, the same translation and back-translation procedures used for translating self-efficacy scale was applied to develop a Korean version of the perceptions of instrumentality scale.

Achievement goals. The achievement-goal subscale in the Student Motivation in the Learning Environment Scales (SMILES) was adopted. The scales were designed to measure students' purpose and reasons for demonstrating achievement-related behaviors in a given learning context (Bong et al., 2012). This scale was originally developed with Korean middle and high school students in Korea. The achievement-goal scales consisted of fifteen items that measured mastery goal orientations (e.g., "The reason why I study in this course is to improve my own ability" and "My goal in this course is to learn as much

as possible”), performance-approach goal orientations (e.g., “I study to get a better grade than those of other students” and “My goal in this course is to show that I’m superior than other students”), and performance-avoidance goal orientations (e.g., “I study to conceal that I lack ability” and “My goal in this course is to avoid doing worse than other students.”). Each subscale contained five items.

Participants responded to the survey with a Likert-type response scale ranging from 1 (entirely disagree) to 7 (entirely agree). A study conducted by Bong et al. (2012) with 900 Korean middle and high school students reported that the coefficient alpha reliabilities were .87, .87, and .93 for the mastery, performance-approach, and performance-avoidance goal subscales, respectively.

Data Analysis

Missing values were less than 1.0% across all items. To deal with missing values, the expectation-maximization (EM) algorithm was applied using SPSS 16.0 software. The scale scores for self-efficacy; endogenous and exogenous instrumentality; and mastery, performance-approach, and performance avoidance achievement goals were created for each student by calculating a mean score from the respective items contained in each of the scales. Descriptive statistics, including the means, standard deviations, maximum-minimum item scores, skewness, and kurtosis were computed and checked for normality, along with coefficient alpha for reliability evidence (Cronbach, 1951). Then, the bivariate correlations were conducted to examine the relationship between all variables.

To test the hypothesized interaction between each type of instrumentality and self-efficacy on students’ achievement goals, three hierarchical multiple regression

analyses with each type of achievement goals (i.e. mastery, performance-approach, and performance-avoidance goals) as a dependent variable, using SPSS 16. Prior to computation of the interaction terms, two types of instrumentality and self-efficacy were centered around their mean scores to avoid problems associated with multicollinearity (Aiken & West, 1991).

Results

Descriptive Statistics

Table 4 presents descriptive statistics of all variables in Study 2. All variables followed approximate normal distributions according to the statistical criteria of skewness and kurtosis (Kline, 2011). Mean scores for endogenous and exogenous instrumentality were 4.18 and 3.58 on the 1-5 response scale respectively. Mean scores of three achievement goal subscales ranged between 3.20 and 4.86 on the 1-7 response scale. Descriptive statistics showed that students perceived their required engineering courses as instrumental for their future goal attainment in both endogenous and exogenous aspects.

Table 4

Descriptive Statistics for All Variables in Study 2

Variable	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurt	α
Endogenous instrumentality	4.18	.64	2.50	5.00	-.47	-.55	.77
Exogenous instrumentality	3.58	.86	1.00	5.00	-.43	-.05	.73
Self-Efficacy	4.12	1.06	1.50	7.00	.29	-.07	.93
Mastery goals	4.86	1.06	1.00	7.00	-.03	-.11	.83
Performance-approach goals	3.53	1.20	1.00	7.00	.26	.12	.86
Performance-avoidance goals	3.20	1.19	1.00	6.80	.30	.24	.83

Note. Listwise $N = 298$. Min = minimum; Max = maximum; Skew = skewness; Kurt = kurtosis.

Table 5 shows the results of the bivariate correlational analysis among the variables in Study 2. As was the case in Study 1, endogenous and exogenous instrumentality correlated positively with each other ($r = .22$). Endogenous instrumentality demonstrated a significant positive correlation with self-efficacy ($r = .34$) and mastery goals ($r = .52$) and a significant negative correlation with performance-avoidance goals ($r = -.12$). There was no significant correlation between endogenous instrumentality and performance-approach goals. In comparison, exogenous instrumentality showed significant positive correlations with both performance-approach ($r = .40$) and performance-avoidance goals ($r = .33$). However, there was no significant correlation between exogenous instrumentality and either mastery goals or self-efficacy. Self-efficacy maintained a significant positive correlation with mastery goals ($r = .44$) and a significant negative correlation with performance-avoidance goals ($r = -.25$). Correlation between self-efficacy and performance-approach goals was not significant.

Table 5

Correlations Among All Variables in Study 2

Variable	1	2	3	4	5
1. Endogenous instrumentality	-				
2. Exogenous instrumentality	.22**	-			
3. Self-efficacy	.34**	-.06	-		
4. Mastery goals	.52**	.11	.44**	-	
5. Performance-approach goals	.05	.40**	.08	.21**	-
6. Performance-avoidance goals	-.12*	.33**	-.25**	-.07	.67**

Note. Listwise $N=298$.

* $p < .05$. ** $p < .01$.one

Hierarchical multiple regression

To answer the research questions regarding the interaction between each type of instrumentality and self-efficacy on three different types of achievement goals, three hierarchical multiple regression analyses were conducted. The main effects of endogenous and exogenous instrumentality, and self-efficacy on three types of achievement goals were tested in Step 1. The instrumentality \times self-efficacy interaction term was created and entered at Step 2, to investigate whether self-efficacy moderated the relationship between the two types of instrumentality and three types of achievement goals.

A first hierarchical multiple regression analysis examined the predictive role of endogenous and exogenous instrumentality, self-efficacy, and their interaction on mastery goals. Variables were centered on their means to improve interpretability of the partial regression coefficients. Table 6 shows the results. The linear combination of

endogenous and exogenous instrumentality and self-efficacy was predictive of mastery goals, $F(3, 294) = 51.85, p < .001, R^2 = .35, \text{adj. } R^2 = .34$, and significant predictors were endogenous instrumentality and self-efficacy. Endogenous instrumentality was the most powerful predictor of mastery goals, accounting for 14% of the total variance. Self-efficacy accounted for 8% of the total variance in mastery goals. However, neither the interaction between endogenous instrumentality and self-efficacy, nor the interaction between exogenous instrumentality and self-efficacy, was statistically significant.

Table 6

Hierarchical Multiple Regression Analyses Predicting Mastery Goals

Predictor	R^2	$\text{Adj. } R^2$	ΔR^2	$B (SEB)$	β	sr^2
Step 1	.35	.34				
Endogenous instrumentality				.67** (.09)	.41	.14
Exogenous instrumentality				.04 (.06)	.04	.00
Self-efficacy				.30** (.05)	.30	.08
Step 2	.35	.34	.00			
Endogenous instrumentality				.68** (.09)	.56	.14
Exogenous instrumentality				.06 (.06)	.07	.00
Self-efficacy				.30** (.05)	.40	.07
Endogenous PI \times self-efficacy				.09 (.08)	.09	.00
Exogenous PI \times self-efficacy				-.05 (.05)	-.08	.00

Note. Listwise $N = 298$. B = unstandardized coefficient; SEB = standard error of the unstandardized coefficient; β = standardized beta coefficient; sr^2 = squared semi-partial correlation; PI = Perceptions of Instrumentality.

** $p < .01$.

A second hierarchical multiple regression analysis was performed with performance-approach goals as a dependent variable. Table 7 presents the results of this analysis without (Step 1) and with the interaction (Step 2). As in the previous analysis on mastery goals, the linear combination of endogenous and exogenous instrumentality and self-efficacy was predictive of performance-approach goals, $F(3, 294) = 20.88, p < .001, R^2 = .18, \text{adj. } R^2 = .17$. However, unlike the previous analysis, significant predictors within that combination were exogenous instrumentality and self-efficacy. Exogenous instrumentality accounted for 17% of the total variance in performance-approach goals. None of the interaction terms was statistically significant.

Table 7

Hierarchical Multiple Regression Analyses Predicting Performance-Approach Goals

Predictor	R^2	$\text{Adj. } R^2$	ΔR^2	$B (SEB)$	β	sr^2
Step 1	.18	.17				
Endogenous instrumentality				-.16 (.11)	-.09	.01
Exogenous instrumentality				.59** (.08)	.43	.17
Self-efficacy				.15* (.06)	.13	.01
Step 2	.19	.18	.01			
Endogenous instrumentality				-.18 (.11)	-.15	.01
Exogenous instrumentality				.58** (.08)	.68	.15
Self-efficacy				.17* (.07)	.23	.02
Endogenous PI \times self-efficacy				-.18 (.10)	-.21	.01
Exogenous PI \times self-efficacy				.09 (.06)	.13	.01

Note. Listwise $N = 298$. B = unstandardized coefficient; SEB = standard error of the unstandardized coefficient; β = standardized beta coefficient; sr^2 = squared semi-partial correlation; PI = Perceptions of Instrumentality.

* $p < .05$. ** $p < .01$.

A third hierarchical multiple regression analysis examined whether self-efficacy moderated the relationship between instrumentality and performance-approach goals. Results show (see Table 8) that the linear combination of endogenous and exogenous instrumentality and self-efficacy was again predictive of performance-avoidance goals, $F(3, 294) = 21.08, p < .001, R^2 = .18, \text{adj. } R^2 = .17$. Exogenous instrumentality was the most powerful predictor of performance-avoidance goals, accounting for 12% of the total variance. Endogenous instrumentality and self-efficacy accounted for 2% of the total variance in mastery goals respectively.

Table 8

Hierarchical Multiple Regression Analyses Predicting Performance-Avoidance Goals

Predictor	R^2	$\text{Adj. } R^2$	ΔR^2	$B (SEB)$	β	sr^2
Step 1	.18	.17				
Endogenous instrumentality				-.24* (.11)	-.13	.01
Exogenous instrumentality				.48** (.08)	.35	.11
Self-efficacy				-.22** (.06)	-.19	.03
Step 2	.20	.18	.02*			
Endogenous instrumentality				-.28** (.11)	-.23	.02
Exogenous instrumentality				.50** (.08)	.59	.12
Self-efficacy				-.17* (.06)	-.21	.02
Endogenous PI \times self-efficacy				-.25* (.10)	-.28	.02
Exogenous PI \times self-efficacy				-.03 (.06)	-.04	.00

Note. Listwise $N = 298$. B = unstandardized coefficient; SEB = standard error of the unstandardized coefficient; β = standardized beta coefficient; sr^2 = squared semi-partial correlation; PI = Perceptions of Instrumentality.

* $p < .05$. ** $p < .01$.

All three variables were significant predictors of performance-avoidance goals: endogenous instrumentality and self-efficacy were positive predictors; exogenous instrumentality was a negative predictor. In addition, a significant interaction was observed between endogenous instrumentality and self-efficacy ($\beta = -.28, p < .05$). While endogenous instrumentality negatively predicted performance avoidance overall, high efficacious students showed less avoidance goals ($\beta_{\text{High SE}} = -.55, p < .001$) compared to low efficacious students ($\beta_{\text{Low SE}} = -.02, ns$). The difference in the two regression slopes was statistically significant, $d = .529, p < .05$. An additional 2% of the variance in performance-avoidance goals was accounted for by this interaction. Figure 5 shows that simple slopes for the regression of performance-avoidance goals on endogenous instrumentality varied depending on self-efficacy level.

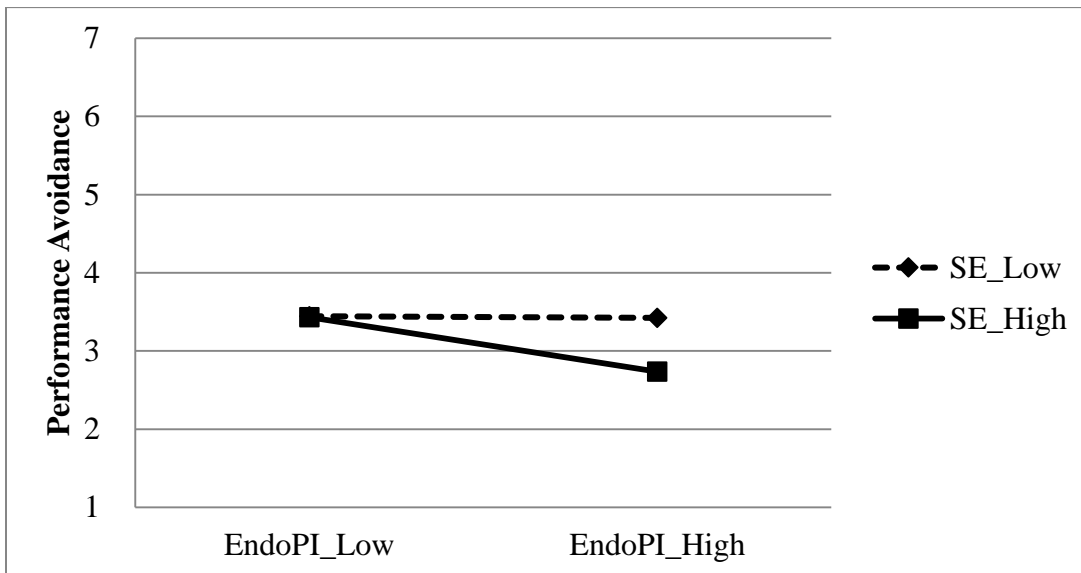


Figure 5. Simple regression line of performance-avoidance goals on endogenous instrumentality at two levels of self-efficacy. Low self-efficacy is at 1 SD below mean of self-efficacy and high self-efficacy is at 1 SD above mean of self-efficacy.

Discussion

In Study 2, endogenous instrumentality was more positively related with mastery goals than exogenous instrumentality, whereas, exogenous instrumentality was more positively related with both performance-approach and performance-avoidance goals than endogenous instrumentality. Results from Study 2 showed that Endogenous instrumentality was a positive predictor of mastery goals and a negative predictor of performance-avoidance goals. However, endogenous instrumentality did not predict performance-approach goals. In contrast, exogenous instrumentality was a strong predictor of both performance-approach and performance-avoidance goals but not of mastery goals. These findings partially supported the main hypotheses of Study 2.

Greene et al. (2004) suggested that students' achievement goal adoption could be differentiated by what they valued in present tasks between learning and performance for achieving their future goals. Learning is regarded as a valuable factor in both endogenous instrumentality and mastery goals. In addition, an important factor in both exogenous instrumentality and the two types of performance goals is the grade. Presumably because of these relationships between instrumentality and achievement goals, endogenous instrumentality was more strongly related to mastery goals, whereas exogenous instrumentality was more strongly related to both performance-approach and performance-avoidance goals.

Interestingly, endogenous instrumentality negatively predicted only performance-avoidance goals, but not performance-approach goals. Endogenous instrumentality stresses learning from present tasks for attaining valued future goals. It means that students put more value on their learning when they perceive endogenous instrumentality.

For these students, learning is believed to be an important means to develop and enhance their competence. Therefore, they are more likely to approach, rather than avoid, the given task and this approach tendency may lead to both mastery and performance-approach goals. Applying the same logic, endogenous instrumentality may weaken the avoidance tendency of striving to hide relative incompetence, that is, performance-avoidance goals.

Findings from Study 2 showed that self-efficacy emerged as a positive predictor of mastery and performance-approach goals and a negative predictor of performance-avoidance goals. These findings are consistent with the previously reported function of self-efficacy in the adoption of achievement goals, where students were oriented toward different achievement goals depending on their self-efficacy levels (Elliot, 1999). For example, students with high self-efficacy were more likely to be mastery or performance-approach goal oriented, whereas students with low self-efficacy were more likely to be performance-avoidance oriented. Therefore, self-efficacy may play a unique role in the adoption of achievement goals in academic settings.

CHAPTER 6

Study 3

In both Studies 1 and 2, each endogenous and exogenous instrumentality maintained different relationships with variables included in the model. In particular, endogenous instrumentality positively predicted students' course grade in Study 1. However, exogenous instrumentality positively predicted course grade in Study 1 but only for students with high self-efficacy, and it negatively predicted course grade for students with low self-efficacy. In addition, endogenous instrumentality positively predicted students' mastery goals, whereas exogenous instrumentality positively predicted only performance-approach and performance-avoidance goals in Study 2.

Given these results from Studies 1 and 2, Study 3 was designed to investigate the underlying psychological mechanism that accounted for the relationship between each type of instrumentality and students' achievement. Researchers have demonstrated that self-efficacy and task value are independent constructs with unique predictive effects on students' motivation and achievement (Bong, 2001; Eccles & Wigfield, 1995; Hulleman et al., 2010). Instrumentality emphasizes individuals' value perceptions, which are formed through understanding the usefulness of a present task for attaining a valued future goal (Husman et al., 2004). According to Malka and Covington (2004), instrumentality predicted students' graded performance independently of self-efficacy. Because the moderating role of self-efficacy was documented in Studies 1 and 2, only the role of instrumentality was examined in Study 3. In addition, researchers have suggested that instrumentality would affect interest and pressure as indicators of intrinsic motivation (Creten et al., 2001; Greene et al., 2004; Malka & Covington, 2005; Miller &

Brickman, 2004; Miller et al., 1999). Therefore, the relationship between instrumentality and interest was tested in Study 3.

Simons et al. (2003) manipulated instrumentality by creating three experimental conditions: endogenous-internally regulated, exogenous-internally regulated, and exogenous-externally regulated. The distinction between endogenous and exogenous instrumentality depended on whether what one learned from the present experimental task was relevant to one's future career goals (i.e., endogenous instrumentality) or how one performed on the present experimental task was relevant to one's future career goals (i.e., exogenous instrumentality). The distinction between internal and external regulation depended on whether the present experimental task was helpful for personal development (i.e., internal regulation) or for extrinsic rewards such as material gain (i.e., external regulation). The participants in the endogenous-internally regulated condition demonstrated the highest level of interest and enjoyment in the task, while those in the exogenous-externally regulated condition exhibited the lowest level. In addition, the study showed that instrumentality manipulation affected achievement goals. Mastery goals were the highest in the endogenous-internally regulated condition and the lowest in the exogenous-externally regulated condition. In contrast, performance goals were the highest in the exogenous-externally regulated condition and the lowest in the endogenous-internally regulated condition.

Consistent with these past findings and the positive association between endogenous instrumentality and mastery goals, and between exogenous instrumentality and both performance-approach and performance-avoidance goals observed in Study 2, I

expected that endogenous and exogenous instrumentality would have a relationship with situational interest in a different way.

Vansteenkiste et al. (2004) suggested that individual's perception of instrumentality was determined by the relationship between present tasks and future goals. According to Vansteenkiste et al. (2007), present tasks can be either inherently or externally related to future goals. Goals that are inherently related to present tasks are called intrinsic goals, whereas those that are externally related to future goals are called extrinsic goals. Vansteenkiste et al. (2004) demonstrated that intrinsic goal manipulation lessened stress in the task, while extrinsic goal manipulation increased stress toward performing the task. Given the conceptual similarity between intrinsic goals and endogenous instrumentality, and between extrinsic goals and exogenous instrumentality, it seemed reasonable to expect that exogenous instrumentality would increase negative emotion such as anxiety, stress, and pressure, while endogenous instrumentality would not.

Particularly, the strong focus on extrinsic outcomes such as course grade in exogenous instrumentality was expected to lower students' situational interest and, instead, to increase students' perception of pressure as negative predictor of intrinsic motivation. Exogenous instrumentality encourages students to place value on the outcome such as course grade because having a good grade in the course is necessary for them to realize their future goals. Students use course grade as a norm for relative comparison with others in academic setting and this situation increases competition among students. Ryan et al. (1983) suggested that competitive elements let students

perceive their learning environment as controlling and they experience increased pressure during task engagement as a result.

The observed relationship between exogenous instrumentality and achievement goals also helps determine the potential psychological mechanism linking exogenous instrumentality and achievement. Exogenous instrumentality related positively to both performance-approach and performance-avoidance goals in Study 2. Previous research made it clear that fear of failure is an antecedent of both performance-approach and performance-avoidance goals (Elliot & Church, 1997; Elliot & McGregor, 2001), which often result in cognitive disorganization and decreased performance (Elliot et al., 1999). Both performance-approach and performance-avoidance goals was linked positively to anxiety (Bong, Hwang, Noh, & Kim, 2014). The significant relationship demonstrated by exogenous instrumentality to both types of performance goals strongly suggests that the psychological state of stress, fear, and anxiety is a likely mediator in the relationship between exogenous instrumentality and reduced performance.

In sum, I hypothesized that endogenous instrumentality would positively predict situational interest and negatively predict pressure, whereas exogenous instrumentality would positively predict pressure and negatively predict situational interest. In addition, I hypothesized that situational interest would positively predict grade and pressure would negatively predict grade (see Figure 6).

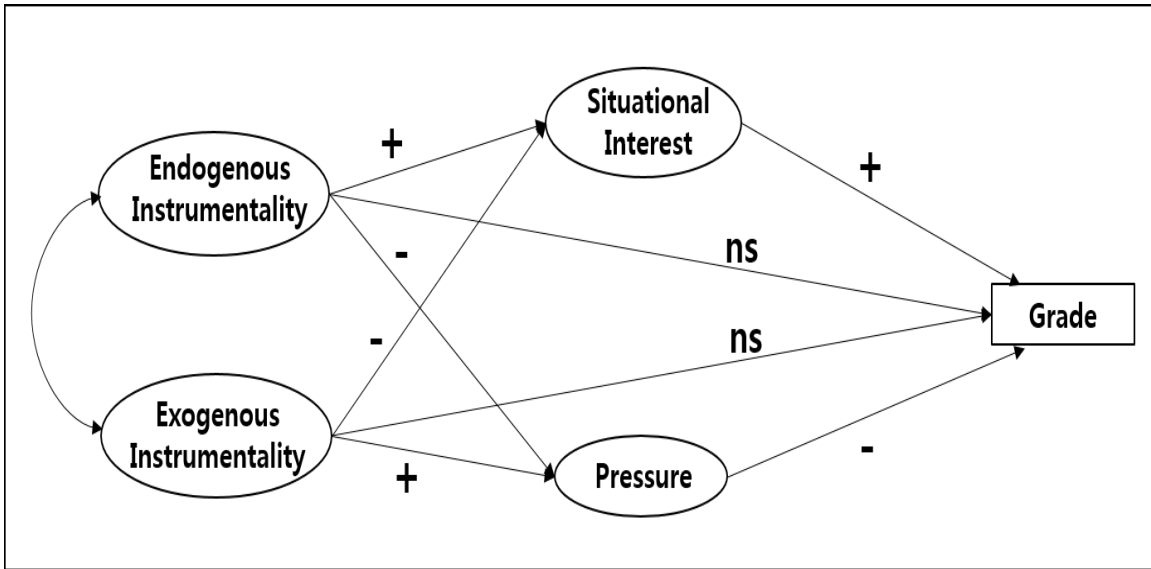


Figure 6. Hypothetical model of Study 3.

Method

Participants

A survey was administered a sample of 193 Korean high school freshmen. Participants were recruited from mathematics courses at an academic-track high school located in Seoul, Korea. For the majority of students attending academic high schools in Korea, going to college is top priority among their future goals. In particular, Korean high school students understand that mathematics, like English, is a core subject in terms of college admission because mathematics is an important part of the Korean Scholarly Aptitude Test (Korea Ministry of Education, Science and Technology, 2006). Therefore, many Korean students spend a lot of time studying mathematics every day after their regular class hours, regardless of their individual interest in the subject (Kim, Jiang, & Song, 2015).

In addition, Korean academic-track high schools offer two different curriculum tracks: liberal arts and natural sciences. High school students should select one of the two tracks at the end of their first year in high school. Mathematics is a critical subject in this decision-making process. Because of these circumstances, I expected that Korean high school freshman would have high perceptions of endogenous instrumentality, exogenous instrumentality, or both, toward mathematics. The sample consisted of 46.1% female and 53.9% male. Participants' ages ranged from 16 to 17 years, with a mean age of 17.5 years ($SD = .45$).

Procedure

Participant recruitment was conducted through in-class announcement in their first-year high school mathematics classes. The survey was presented in a hard-copy format and administrated during a regular class period. It took approximately 20 minutes to complete the survey. Participants were assured that their individual responses would not be disclosed to the parents or teachers. Participation was voluntary and participants were assured that there would be no disadvantage for choosing not to participate.

Measures

Perceptions of instrumentality. The same Korean version of perceptions of instrumentality scale that was used in Study 2 assessed participants' endogenous and exogenous instrumentality again in Study 3.

Situational interest. The Student Motivation In the Learning Environment Scales (SMILES) is a multidimensional instrument developed to measure children's and adolescents' academic motivation and related constructs (Bong et al., 2012). The four-item situational interest subscale in SMILES was again adopted to assess situational

interest in Study 3 (e.g., “I like the course that I am taking this semester” and “The course that I am taking this semester piques my interest”). A study conducted for the validity of SMILES by Bong et al. (2012) reported a coefficient alpha reliability for situational interest scale to be .88. The participants responded to the items, using a Likert-type response scale ranging from 1 (entirely disagree) to 7 (entirely agree). Participants were instructed to think only about the course they were currently being surveyed in when responding to these items.

Pressure. The Intrinsic Motivation inventory (IMI) was developed to measure individuals’ intrinsic motivation in various dimensions (Markland & Hardy, 1997; McAuley, Duncan, & Tammen, 1989; Ryan, 1982; Ryan, Mims, & Koestner, 1983). The pressure subscale of IMI was designed to assess academic burden in a specific learning situation as a negative predictor of intrinsic motivation and contains five positively and negatively worded items (e.g., “I was anxious while working in the math class this semester” and “I felt pressured while taking the math course in this semester”). A few studies reported construct validity evidence of this scale. One study conducted with Greek college students reported that the coefficient alpha reliability was .82 for the pressure scale (Tsigilis & Theodosiou, 2003). The original version of pressure scale was developed in English. Because of this reason, the same translation and back-translation procedure (Brislin, 1986) used for translation of self-efficacy and perceptions of instrumentality in Study 2 was applied to translate the pressure scale. Participants responded using a Likert-type scale ranging from 1 (*not at all true*) to 7 (*very true*).

Course Grade. With consent, participants' self-reported midterm mathematics grades were obtained. The highest possible grade was 100 and the lowest possible grade was 0.

Data Analysis

Missing values were less than 1.6% across all items. To deal with missing values, the expectation-maximization (EM) algorithm was applied using SPSS 16.0 software. All subscale scores for endogenous and exogenous instrumentality, situational interest, and pressure were obtained by computing a mean score of all relevant survey items for each participant. Course grade were converted to a Z-score for SEM analyses. Descriptive statistics, including the means, standard deviations, maximum-minimum item scores, skewness, and kurtosis were computed and checked for normality along with coefficient alpha for reliability evidence (Cronbach, 1951). Then bivariate correlations between all variables were also examined.

Next, structural equation modeling was performed using AMOS 18. In structural equation modeling, items were used as observed indicators for each corresponding latent factor. The chi-square statistics, Tucker-Lewis Index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used to evaluate the goodness-of-fit of the model. Hu and Bentler (1999) suggested that TLI and CFI values above .95 indicated an acceptable model fit. For RMSEA, values less than .05 indicated good model fit and those between .05 and .08 suggested a reasonable model fit (Browne & Cudeck, 1993).

Significance of mediation effect in the structural equation model was examined using the phantom model approach (Macho & Ledermann, 2011). Specific phantom

representing each indirect effect was added to the main structural model and tested for the significance. Significance of indirect effect was tested by applying the bias-corrected percentile bootstrapping with 1,000 randomly selected samples and 95% confidence intervals was applied (Kline, 2011).

Results

Descriptive Statistics

Table 9 presents descriptive statistics of all variables in Study 3. All variables followed approximate normal distributions according to the statistical criteria of skewness and kurtosis (Kline, 2011). Mean scores for endogenous and exogenous instrumentality were 3.37 and 3.85 on the 1-5 response scale respectively. These results reported that exogenous instrumentality was relatively higher than endogenous instrumentality in Study 2, which showed conflicting results as noted in Study 1 and 2 with college students. Mean scores for situational interest and pressure were 3.89 and 3.96 on the 1-7 response scale respectively. Mean of course grade was 0 because it was converted to a Z-score.

Table 10 shows the results of a bivariate correlational analysis among the variables in Study 3. Endogenous and exogenous instrumentality correlated positively with each other ($r = .49$) as shown in Study 1 and 2. In addition, endogenous instrumentality was positively correlated with both situational interest ($r = .53$) and course grade ($r = .41$) and negatively correlated with pressure ($r = -.48$). Exogenous instrumentality was also positively correlated with both situational interest ($r = .20$) and course grade ($r = .27$). However, there was no significant correlation between exogenous instrumentality and pressure. Situational interest and pressure correlated negatively with

each other ($r = -.59$). Course grade was positively correlated with situational interest ($r = .39$) and negatively correlated with pressure ($r = -.42$).

Table 9

Descriptive Statistics for All Variables in Study 3

Variable	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurt	α
Endogenous instrumentality	3.37	.80	1.00	5.00	-.35	.57	.72
Exogenous instrumentality	3.85	.73	1.00	5.00	-.68	2.00	.77
Situational interest	3.89	1.41	1.00	7.00	.03	-.18	.91
Pressure	3.96	1.25	1.00	7.00	-.16	.12	.76
Course grade	54.35	28.39	.00	100	-.05	-1.25	

Note. Listwise $N = 193$. Min = minimum; Max = maximum; Skew = skewness; Kurt = kurtosis.

Table 10

Correlations among All Variables in Study 3

Variable	1	2	3	4
1. Endogenous instrumentality	-			
2. Exogenous instrumentality	.49**	-		
3. Situational interest	.53**	.20**	-	
4. Pressure	-.48**	-.13	-.59**	-
5. Course grade	.41**	.27**	.39**	-.42**

Note. Listwise $N = 193$.

** $p < .01$.

Structural Equation Modeling

Structural Equation Modeling was conducted to examine overall relationships among the variables in Study 3. In measurement models and structural models, items were used as indicators of latent variables except course grade. The measurement model demonstrated a satisfactory fit, $\chi^2(93, N = 193) = 167.52, p < .001$ TLI = .93, CFI = .95, RMSEA = .06 [90% CI = .05, .08]. All factor loading were significant at $p < .001$ with the standardized factor loadings ranged in magnitude from .47 to .95. After measurement model was checked, the hypothesized model including only direct paths was administered for the purpose of testing relative prediction of each endogenous and exogenous instrumentality on course grade. Model fit statistics indicated a satisfactory fit, $\chi^2(18, N = 193) = 30.90, p < .05$, TLI = .95, CFI = .97, RMSEA = .06 [90% CI = .02, .10]. The resulted reported that endogenous instrumentality positively predicted course grade ($\beta = .53$). However, exogenous instrumentality did not predict course grade.

Next, situational interest and pressure were investigated as mediating variables in the model to test a mediating role of situational interest and pressure in the association between students' perceptions of instrumentality and their achievement. The disturbance term of situational interest and pressure were allowed to covary. The model demonstrated a satisfactory fit, $\chi^2(94, N = 193) = 171.89, p < .001$, TLI = .93, CFI = .95, RMSEA = .06 [90% CI = .05, .08]. Figure 7 displays the standard path coefficients among the latent variables. Endogenous instrumentality positively predicted situational interest ($\beta = .84$) and negatively predicted pressure ($\beta = -.82$). In contrast, exogenous instrumentality negatively predicted situational interest ($\beta = -.30$) and positively predicted pressure ($\beta = .38$). However, neither endogenous nor exogenous instrumentality directly predicted

course grade. Whereas situational interest did not predict mathematics grade significantly, pressure did. Pressure negatively predicted course grade.

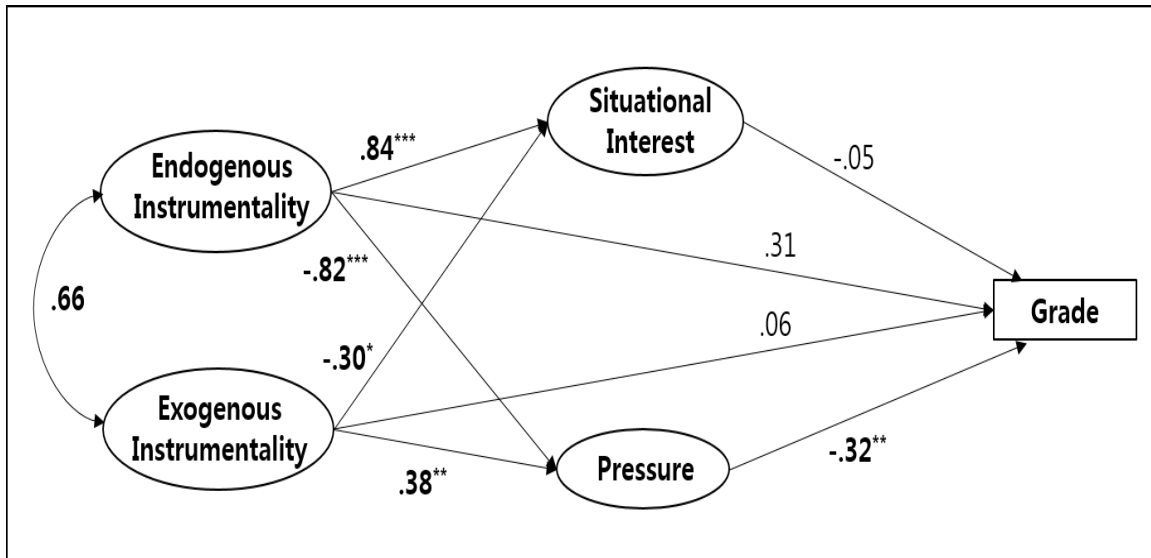


Figure 7. Standardized path coefficients from the model tested in Study 3.

Note. Listwise $N = 193$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Next, the significance of mediation effects in the structural equation model was tested using the bootstrapping method (Macho & Ledermann, 2011). Table 11 presents the results of the mediation test. As can be seen, pressure significantly mediated the path from endogenous instrumentality to course grade (bootstrap 95% CI [.07, .72], $p < .05$). Pressure also significantly mediated the path from exogenous instrumentality to course grade (bootstrap 95% CI [-.47, .00], $p < .05$).

Table 11

Summary of Mediation Effects in Study 3

Path	β	<i>B</i>	<i>SE</i>	95% CI
Endo PI → Pressure → Grade	.26	.31*	.17	[.07, .72]
Exo PI → Pressure → Grade	-.12	-.14*	.12	[-.47, .00]

Note. Listwise $N = 193$. Bootstrap $J = 1,000$. CI = confidence interval; Endo PI =

endogenous instrumentality; Exo PI = exogenous instrumentality.

* $p < .05$.

Discussion

Results from Study 3 supported the main hypotheses. Endogenous instrumentality and exogenous instrumentality had different relationships with situational interest and pressure. In addition, endogenous instrumentality negatively predicted and exogenous instrumentality positively predicted pressure, which in turn negatively predicted math course grade. Study 3 results showed that only pressure mediated the path from endogenous and exogenous instrumentality to course grade. Even though endogenous instrumentality positively predicted and exogenous instrumentality negatively predicted situational interest, situational interest did not predict math course grade.

SEM results from Study 3 showed that exogenous instrumentality negatively predicted situational interest even though bivariate correlation results showed that exogenous instrumentality had a significantly positive correlation with situational interest. One possibility about these opposite results could be explained by multicollinearity because endogenous and exogenous instrumentality highly correlated each other. However, there was another possibility which could explain these opposite

results. SEM controlled for common variance between endogenous and exogenous instrumentality. When the variance in exogenous instrumentality which overlapped with endogenous instrumentality was controlled for, the remaining variance in exogenous instrumentality maintained negative relationship with situational interest.

Study 3 results showed that students who perceived learning from present tasks as instrumental means for attaining their valued future goals perceived less pressure and students who perceived an outcome such as grade as instrumental means for attaining their valued future goals perceived more pressure during task engagement. In contrast, students who perceived learning from present tasks as instrumental means for attaining their valued future goals reported more situational interest and students who perceived an outcome as an instrumental means for attaining their valued future goals reported less situational interest. It meant that endogenous and exogenous instrumentality could have a different relationship with students' intrinsic motivation.

Pressure is known to be a negative predictor of intrinsic motivation (Ryan et al., 1983) and situational interest was believed as an important variable in explaining intrinsic motivation (Deci & Ryan, 1985). Results from Study 3 partially supported previous researches that showed that extrinsic motivation undermined students' intrinsic motivation (Deci & Ryan, 1985, Ryan et al., 1996). Instrumentality was regarded as a type of extrinsic motivation because perceiving a present task as meaningful means for future success was not inherently related to the task itself (Lens et al., 2009). In this sense, it is noteworthy that some types of extrinsic motivation can support intrinsic motivation and others cannot (Simons et al, 2003, 2004).

Even though situational interest failed to directly predict course grade in Study 3, it had some important educational implications in terms of interest development. Hidi and Renninger (2006) suggested that interest could have been developed through a four-phased model from situational interest to individual interest. They defined situational interest as an outcome by an interaction between a person and a specific situation and individual interest as long-lasting personal disposition. According to Hulleman et al. (2010), individual perception of task value can enhance situational interest and situational interest can be developed to individual interest over time. Therefore, it is carefully assumed that situational interest may not directly predict students' achievement in the short-term perspective, but the situational interest will help students develop individual interest, which will enhance students' motivation and achievement in a long-term perspective.

Results from Study 3 showed that there was psychological mechanism that accounted for the relationship between perceptions of instrumentality in present tasks and students' achievement in academic settings. In particular, the psychological mechanism was affected differently by how students perceived instrumental role of present tasks for their future success. Instrumentality emphasizing learning from present tasks for achieving valued future goals enhanced students' motivation and further achievement, whereas instrumentality emphasizing an outcome such as a grade for achieving valued future goals weakened their motivation and further achievement. Therefore, to support students' motivation and achievement, it is necessary for teachers or parents to help them focus on the connected relationship between present learning and future success instead of the relationship between outcomes from present tasks and future success.

CHAPTER 7

General Discussion

As a way to support students' motivation and achievement in academic settings, perceptions of instrumentality has been discussed using FTP framework and expectancy-value theory (Eccles & Wigfield, 2002; Husman et al., 2004). Although the positive role of instrumentality in achievement-related behaviors has been well-established (Hulleman et al., 2010; Husman & Lens, 1999; Malka & Covington, 2005; Simons et al, 2003), little was known about the different antecedents and consequences between endogenous and exogenous instrumentality.

This study mainly investigated the differential relationships among two different types of instrumentality, academic achievements, and motivational variables (incremental beliefs about intelligence, self-efficacy, achievement goals, situational interests, and pressure). Three studies were conducted to investigate the relationship between each type of instrumentality and students' achievement and motivational variables such as achievement goals and situational interests and the moderating role of self-efficacy on the relationship.

Study 1 was conducted to investigate how endogenous and exogenous instrumentality was related to incremental beliefs about intelligence and students' achievement, respectively. In addition, it was examined whether self-efficacy moderated the relationship between each type of instrumentality and achievement.

Study 2 was conducted to determine how endogenous and exogenous instrumentality affected three different types of achievement goals: mastery, performance-approach, and performance-avoidance goals. The interaction between

endogenous instrumentality and self-efficacy and the interaction between exogenous instrumentality and self-efficacy were examined to determine if there was a moderating effect by self-efficacy to account for the relationship between each type of instrumentality and achievement goals.

Study 3 investigated the role of endogenous and exogenous instrumentality in predicting students' intrinsic motivation and achievement.

The main findings of these studies were as follows: (1) incremental beliefs about intelligence positively predicted endogenous instrumentality; however, they did not predict exogenous instrumentality; (2) endogenous instrumentality positively predicted grade regardless of students' self-efficacy level, whereas exogenous instrumentality positively predicted the grades of students with high self-efficacy and negatively predicted the grades of students with low-self-efficacy; (3) endogenous instrumentality negatively predicted mastery goals positively and performance-avoidance goals, whereas exogenous instrumentality positively predicted both performance-approach and performance avoidance goals; (4) students with high self-efficacy were less likely to adopt performance-avoidance goals when they perceived more endogenous instrumentality; however, there was no difference in the adoption of performance-avoidance goals as students with low self-efficacy perceived more endogenous instrumentality; (5) endogenous instrumentality was a positive predictor of situational interest and a negative predictor of pressure, whereas exogenous instrumentality was a negative predictor of situational interest and as a positive predictor of pressure; (6) there was a mediating effect of pressure on the relationship between each type of instrumentality and grade.

Differential Effects of Instrumentality Type

A large body of evidence has indicated that perception of instrumentality has an adaptive function that enhances learning strategy use, interest, and achievement (Hulleman et al., 2008; Hulleman et al., 2010; Husman & Hilpert, 2007; Malka & Covington, 2005). However, there were little researches which tried to distinguish instrumentality type and to examine a unique role of each type of instrumentality in prediction students' motivation and achievement. Findings from present study showed that endogenous instrumentality was a positive predictor of motivation and achievement, whereas exogenous instrumentality was not. Specifically, endogenous instrumentality was positively related to incremental beliefs about intelligence, grade, mastery goals, and situational interest and negatively related to performance-avoidance goals and pressure. In contrast, exogenous instrumentality was positively related to both performance-approach and performance avoidance goals, and situational interest was positively related to pressure.

A different effect occurs from endogenous and exogenous instrumentality on students' motivation and achievement, respectively. Results indicate that endogenous instrumentality supports students' motivation and further achievement in a positive way, whereas exogenous instrumentality negative affects students' motivation and achievement. Therefore, it is necessary to understand that instrumentality can have a different effect on student' motivation and achievement depending on how the individual student perceives the connected relationship between a present task and future goal attainment.

Moderating Role of Self-Efficacy

It has been well established that self-efficacy is a powerful predictor of achievement and perception of task value is an important predictor of task choice and task engagement (Wigfield & Eccles, 1992). Although several studies showed the interactive relationship between perception of instrumentality and self-efficacy in interest development (Godes et al, 2007; Hulleman et al, 2010), the findings were mixed. For example, students with low self-efficacy in math felt more burdens when they were told the importance of math for their future success than students with high self-efficacy were (Godes et al., 2007). In contrast, instrumentality intervention was more helpful for students with low self-efficacy than students with high self-efficacy in interest development (Hulleman et al., 2008). One interesting finding in this study is that self-efficacy moderated the relationship between instrumentality and students' motivation and achievement. In particular, exogenous instrumentality was a positive predictor of students' grade when those students had high self-efficacy, whereas it was a negative predictor of grade for students with low self-efficacy.

In addition, the level of self-efficacy also interacted with endogenous instrumentality in predicting performance-avoidance goals. Students with high self-efficacy were less likely to adopt performance-avoidance when they perceived more endogenous instrumentality. However, there was no difference in the adoption of performance-avoidance goals as students with low self-efficacy perceived more endogenous instrumentality. Although the moderating effect of self-efficacy was not found in the relationship between endogenous instrumentality and course grade in Study 1, or in the relationship between instrumentality, mastery, and performance-approach

goals in Study 2, it is possible that self-efficacy plays a unique role in explaining the relationship between instrumentality and achievement motivation.

Role of Instrumentality in Supporting for Intrinsic Motivation

According to Deci and Ryan (1985), intrinsic motivation can be undermined by extrinsic incentive. Ryan et al. (1996) also suggested that instrumentality discouraged the intrinsic value of a task because instrumentality was not inherently related with the task itself. Instrumentality sometimes focused on extraneous aspects of learning such as a grade for future success and extrinsic valuing process could weaken the inherent interest or enjoyment (Eccels et al., 1998; Kover & Worrell, 2010). However, Hulleman et al. (2008) discovered that individuals' perception of instrumentality played a positive role in interest development. In addition, empirical evidence has showed that extrinsic motivation could have a different effect on intrinsic motivation depending on its quality (Deci & Ryan, 2000; Simons et al., 2004; Vansteenkiste et al., 2004).

The findings of this study showed that instrumentality played an important role in predicting students' intrinsic motivation and achievement in two different ways depending on how they perceived the instrumental value of present tasks for their future success. First, when students focused on the instrumental value of learning from present tasks for achieving their valued future goals, in other words, endogenous instrumentality, it supported intrinsic motivation. Second, when students focused on instrumental value of an outcome such as a grade from present tasks for future goal attainment, or exogenous instrumentality, it weakened intrinsic motivation. Therefore, educational researchers, teachers and parents need to be careful when they emphasize the instrumental role of present tasks in order to enhance students' motivation and achievement.

Educational Implications of the Study

Recently, many researchers have emphasized the role of instrumentality in academic settings to support students' motivation and achievement. Despite a considerable body of research on instrumentality, the fact that instrumentality is a context dependent construct has been overlooked and most empirical studies have measured both the instrumental value of learning and grades in one simultaneous dimension

This study was mainly conducted to investigate the distinct role of endogenous and exogenous instrumentality play in understanding students' motivation and achievement. First, this study revealed that endogenous and exogenous instrumentality differed in their contribution to achievement, achievement goals, and intrinsic motivation. Second, this study showed that the interactive relationship between instrumentality type and self-efficacy predicted students' achievement and adoption of achievement goals.

This study has several educational implications. Instrumentality is often emphasized to help students who experience difficulty learning due to a lack of motivation in educational contexts. Especially, an emphasis on endogenous instrumentality which focused on the usefulness of learning from present tasks for future success would be beneficial for students' motivation and achievement regardless of their level of self-efficacy. In addition, endogenous instrumentality enhanced situational interest, which would help students develop individual interest and thus they would persist in task engagement.

However, the function of exogenous instrumentality should be interpreted with caution, particularly for students with low self-efficacy, because it was positively related to pressure and resulted in poor achievement as a result. Therefore, self-efficacy should

be considered when developing a motivational intervention program or designing an effective learning environment for at-need students.

Limitations and Further Research

Despite the promising implications found in this study, several limitations and suggestions for future research need to be addressed. First, all participants were recruited from required courses. Therefore, results from the present study reported relatively high perception of instrumentality in both types. However, instrumentality was recognized as a context dependent construct (Husman & Lens, 1999). Further research is needed to investigate if perceptions of instrumentality can be affected by course type.

Second, this study measured perceptions of instrumentality one time before students took the midterm. Therefore, it was not possible to investigate temporal changes in perceptions of instrumentality and the effect of change on further motivation and achievement over the semester. In addition, it can be assumed that the test results affected students' self-efficacy or perceptions of instrumentality. Therefore, a logical step for future research is to utilize longitudinal research to compare changes in self-efficacy and perceptions of instrumentality before and after students realize their current achievement level.

Finally, participants were high school and college students. The difference in school level will affect perceptions of instrumentality because students may develop or have different future goals depending on their age. Therefore, future research is required to investigate the role of future goals in predicting perceptions of different types of instrumentality at various school levels.

Conclusion

The results from this study suggest the careful use of instrumentality as a way to support students' motivation and achievement in academic settings. This study examined the unique contribution of endogenous and exogenous instrumentality in predicting students' motivation and achievement. First of all, the positive role of endogenous instrumentality was supported. Endogenous instrumentality was a stronger predictor of mastery goals and situational interest than exogenous instrumentality. In addition, endogenous instrumentality decreased the pressure which was a negative predictor of intrinsic motivation. In contrast, exogenous instrumentality weakened students' motivation and achievement. Particularly, students with low self-efficacy showed less achievement when they perceived high exogenous instrumentality than students with high self-efficacy. Overall, the results demonstrated distinctive role of each type of instrumentality in understanding students' achievement motivation.

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APPENDIX A

INCREMENTAL BELIEFS ABOUT INTELLIGENCE SCALE ITEMS

For each of following statements, please indicates how you feel about the value of your course for your future, using the following scale.

Response scale:

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Items

1	No matter how much intelligence you have, you can always change it quite a bit.
2	No matter who you are, you can change your intelligence a lot.
3	You can always greatly change how intelligent you are.

APPENDIX B

PERCEPTIONS OF INSTRUMENTALITY SCALE ITEMS

For each of following statements, please indicates how you feel about the value of your course for your future, using the following scale.

Response scale:

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Items

1	I will use the information I learn in this class in other classes I will take in the future.
2	What I learn in this class will be important for my future occupational success.
3	I will not use what I learn in this class.
4	I will use the information I learn in this class in the future.
5	The grade I get in this class will not affect my ability to continue on with my education.
6	What grade I get in this class will not be important for my future academic success.
7	I must pass this class in order to reach my academic goals.
8	The grade I get in this class will affect my future.

APPENDIX C

SELF-EFFICACY SCALE ITEMS

For each of following statements, please indicates how true it is for you, using the following scale:

Response scale:

1	2	3	4	5	6	7
Not at all true of me			Somewhat true of me			Very true of me

Items

1	I believe I will receive an excellent grade in this class.
2	I'm certain I can understand the most difficult material presented in the readings for this course.
3	I'm confident I can understand the basic concepts taught in this course.
4	I'm confident I can understand the most complex material presented by the instructor in this course.
5	I'm confident I can do an excellent job on the assignments and tests in this course.
6	I expect to do well in this class.
7	I'm certain I can master the skills being taught in this class.
8	Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.

APPENDIX D

ACHIEVEMENT GOAL SCALE ITEMS

For each of following statements, please indicates, most appropriate number of each statement, using the following scale:

Response scale:

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

Items

Items

1	The purpose of my study in this course is to improve my skills
2	My goal in this course is to learn what I did not know.
3	My goal in this class is to understand the contents as thoroughly as possible
4	The reason I am studying is to learn as much as possible from this course.
5	The reason I am studying is to gain new knowledge from this course.
6	The purpose of my study in this course is to demonstrate my ability.
7	My goal in this course is to get better grade than other students.
8	The reason I am studying in this course is to show that I am better than other students.
9	My goal in this course is to do well compared to other students.
10	The purpose of my study in this course to get recognition of my ability from others.
11	The purpose of my study in this course to hide the lack of my ability.
12	My goal in this course is not to get lower grade than other students.
13	The reason I am studying in this course is to hide my poorer performance than other students.
14	My goal in this course is to avoid doing poorly compared to other students.
15	The purpose of my study in this course is not to demonstrate my incompetence.

APPENDIX E
SITUATIONAL INTEREST SCALE ITEMS

For each of following statements, please indicates, most appropriate number of each statement, using the following scale:

Response scale:

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

Items

1	I like this course this semester.
2	This course arouses my interest this semester
3	This course draws my attention this semester
4	This course is passed quickly this semester.

APPENDIX F
PRESSURE SCALE ITEMS

For each of following statements, please indicates, most appropriate number of each statement, using the following scale:

Response scale:

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

Items

1	I do not feel nervous at all in this course this semester.
2	I feel very tense in this course this semester.
3	I am very relaxed in this course this semester.
4	I am anxious in this course this semester.
5	I feel pressured in this course this semester.

APPENDIX G
IRB APPROVAL LETTER



APPROVAL: EXPEDITED REVIEW

Marilyn Thompson
Social and Family Dynamics, T. Denny Sanford School of (SSFD)
M.Thompson@asu.edu

Dear Marilyn Thompson:

The IRB approved the protocol from 6/22/2016 to 6/21/2017 inclusive. Three weeks before 6/21/2017 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 6/21/2017 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Wonsik Kim
Jenefer Husman
Wonsik Kim

APPENDIX G
DATA USE AGREEMENT

Data Provider: Brain and Motivation Research Institute (*bMRI*), Korea University
Contact Name and Title: Sungil Kim, Director of Brain and Motivation Research Institute
Email: sungkim@korea.ac.kr
Phone: +82-2-3290-2304

Data Recipient: Wonsik Kim
Email: wkim7@asu.edu
Phone: +82-10-2296-1965

This Data Use Agreement is made and entered into on April 14th, 2016 by and between Sungil Kim, Director of Brain and Motivation Research Institute, Korea University, hereafter “Provider” and Wonsik Kim, hereafter “Recipient.”

1. This Agreement applies to the research data collected by *bMRI* research team.
2. Except as otherwise specified herein, Data Recipient may make Uses and Disclosures of the Data Set consistent with the purpose of the research as described in the application for the following research project: “Endogenous and Exogenous Instrumentality on Student Motivation and Achievement”
3. Recipient agrees to not to Use or Disclose the Data Set (or components) for any purpose other than as described for the Research Project or as Required by Law.
4. Recipient will use appropriate administrative, physical and technical safeguards to prevent use or disclosure of the Data Set other than as provided for by this Agreement.
5. Recipient will report to the Provider any use or disclosure of the Data Set not provided for by this Agreement of which the Recipient becomes aware within 15 days of becoming aware of such use or disclosure.

7. Recipient will not identify any personal information except gender and age contained in the Data Set.

8. This Agreement shall not be assigned by Recipient without the prior written consent of the Provide

9. Each party agrees that it will be responsible for its own acts and the results thereof to the extent authorized by law and shall not be responsible for the acts of the other party or the results thereof.

IN WITNESS WHEREOF, the parties have executed this Agreement effective upon the Effective Date set forth above.

**Authorized Representative of
Brain and Motivation Research Institute**

Recipient

Name: Sungil Kim
Kim

Name: Wonsik

Title: Director of Brain and motivation research Institute

Date: 4. 14. 2016

Date: 4. 14. 2016