

**ASSESSING AGENCY FOR LEARNING:
AGENCY FOR LEARNING
AND
MEASURING AGENCY FOR LEARNING: VALIDATING THE AGENCY
FOR LEARNING QUESTIONNAIRE (AFLQ)
AND
AGENCY AS A MEDIATOR OF ACADEMIC ACHIEVEMENT**

by

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ABSTRACT

Agency for Learning: Agency is both an individual and a social entity. Personal and social aspects of agency in learning are integral in a student's effectiveness to regulate, control, and monitor their own learning. This chapter introduces a theoretical model of agency for learning (AFL). AFL presents agentic processes (intentionality, forethought, self-regulation, and self-reflectiveness) as mediating factors between personal, environmental, and behavioural influences. AFL extends social cognitive theory by incorporating aspects of developmental, historical, and sociocultural theorizing that emphasize the integral nature of agency within the regulating processes necessary for learning. Further, this chapter examines how agency is currently studied in research and provides evidence from the literature that agency plays a more pivotal role in learning than previously thought.

Keywords: Agency, Agency for Learning, Learning Theory, Agentic Processes, Intentionality, Forethought, Self-Regulation, Self-Efficacy, Modes of Agency

Measuring Agency for Learning: Agency is inherent in students' ability to regulate, control, and monitor their own learning. An individual enacts their agency to regulate their cognitive, affective, and behavioural processes as they interact with environmental factors. This chapter traces the development of the Agency for Learning Questionnaire (AFLQ) and examines the internal consistency, predictive validity, and psychometric properties of this new instrument. An initial pool of 50 items covering four dimensions of agentic functioning was generated. Using two independent data samples the item pool was psychometrically analyzed, organized, and reduced using a combination of exploratory factor analysis and item response theory. Results indicate that the final scales have excellent internal consistency, significant predictive validity, and strong psychometric properties.

Keywords: Agency, Agency for Learning, Intentionality, Planfulness, Forethought, Self-Regulation, Self-Efficacy, Agency for Learning Questionnaire

Agency as a Mediator of Academic Achievement: Agency is an emergent capability that is manifested in individual abilities to interact with personal, behavioural, environmental, and social factors. AFL theorizes that agentic processes mediate the effects of other personal, behavioural, and environmental factors. The purpose of the present study is to examine the mediating relationship of agency and its component processes relative to goal-orientation, self-regulated study strategy use, social identification, student perceptions of the fairness of the learning environment and academic achievement. Results of this study indicate that agentic processes act as significant mediators and the role of specific agentic processes was found to vary in strength depending on the context.

Keywords: Agency, Agency for Learning, Mediation Analysis, Intentionality, Forethought, Self-Regulation, Self-Efficacy, Planfulness, Goal-orientation, Social Identification

for Nick

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CHAPTER 1: INTRODUCTION

Agency is a deliberative, reflective activity in which individuals select, frame, choose, and execute actions to achieve an outcome (Martin, et al., 2003). Agency accounts for the transition of possible ideas, thoughts, and beliefs, to tangible, goal-directed, observable behaviours (Nachtomý, 2007). Individuals use their capacity for reason to consider possible outcomes of their ideas, thoughts, and beliefs to commit to achieving those outcomes they establish as goals. Individuals act as agents when they transition from reasoning about an outcome to establishing the outcome as a goal and acting to achieve it. As agents with a capacity for self-understanding and self-awareness, we have the metacognitive ability to make decisions, reflect upon long-term goals, and pursue courses of action directed toward those goals. Carrying out goal-directed actions involves prerequisite knowledge, experience, and abilities (Little, et al., 2002). These prerequisite skills are acquired and affected by the environment and life conditions in which the agent is situated.

Agency as an Emergent Capability

Human beings do not merely react to life conditions, but have the power to act and change the conditions that mediate their lives (Holtzkamp, 1983; Roth, 2004; Roth & Lee, 2007). Changes in agency result from the influences of personal and environmental factors on the cognitive mechanisms of thought and action. For example, the emergence of agency within the learning context has variable effects on the patterns of interaction and connection among students and teachers. These effects ultimately have an impact on the performance, productivity, evolution, and sustainability of the learning environment

(Johnson, et al., 2003). Agency is an emergent capability that is manifested in student abilities to interact with personal, behavioural, environmental, and social factors.

Agency emerges as a socially mediated ability exercised through human interaction (Mead, 1934). As an emergent capability, agency develops out of the capabilities of reflective thought and intentional action situated within a socio-cultural context (Martin, 2003). Emergence, from an ontological perspective, is a non-reducible phenomenon. A capability is emergent if it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). Martin, Sugarman, and Thompson (2003) explain emergence by analogy to water, one of many analogies used for that purpose in scholarly literatures ranging from artificial intelligence to physiology (see Kim, 1999). Water has its own properties that are complex and novel and are not a sum of the properties of its components: oxygen and hydrogen. Oxygen and hydrogen have unique individual properties that are necessary for the creation of water, however, water also has properties that are uniquely its own. When a sufficient heat source is applied to water, it boils. Water molecules act in response to this external force and the property of the water changes from liquid to gas. Martin et al. propose that agency, like water, possesses emergent properties generated by a combination of mental and social events; but is not reducible to those component influences. The properties of agency change when external environmental forces interact with personal and behavioural factors to produce an action.

Internal personal factors, behavioural patterns, and environmental influences require agency to facilitate learning. These factors, in turn, also influence agency development. For example, students express agency by mediating the interactions among

their beliefs in their knowledge of the subject matter, their motivation to learn, and their pre-existing plans of where, when, and how they are going to learn. As a result of these beliefs, plans, and actions students adapt and change their approach to similar learning situations the next time they are encountered.

Students do not act in isolation but choose particular action plans depending upon the situation. For example, most students wish to receive good grades on final exams so they can increase their grade point average and their likelihood of getting into a university of their choice. These students believe that they will get good grades if they study. How these students study for their exams involves deciding when and where to study and which study tactics to use. The students' desire for good grades becomes their reason for action and they use their judgement to select and apply study tactics they believe will help them realize their goals. Whether students achieve good grades on their exams determines their success. Ultimately, agency emerges as a result of a combination of cognitive, affective, behavioural, and social-environmental events (Martin, et al., 2003) and is essential for learning.

Agency is integral in a students' ability to regulate, control, and monitor their own learning. Students enact agency through their ability to regulate their cognitive, affective, and behavioural processes as they interact with factors in the environment which, "entails not only a behavioural skill in self-managing environmental contingencies, but also the knowledge and the sense of personal agency to enact this skill in relevant contexts" (Zimmerman, 2000, p. 14). Mechanisms of agency involve the interaction between intentionality, forethought, self-regulation, and self-reflection (Bandura, 2001, 2006).

Agentic Processes

All goal-directed systems are intentional (Lewis, 1990). Intentionality is an awareness and will to act in a particular way based on an idea or mental state (Lewis, 1990; Owen, 2009). Intentional mental states include psychological attitudes directed toward persons, objects, and events in the world such as needs, wants, and desires (Bloom & Tinker, 2001; Roitblat, 1990). Intentions are realized through goal setting and planning. These plans are hierarchically structured, partially formed, and future directed (Bratman, 2009). Planful competence, also defined in the literature as planfulness, is the thoughtful, assertive, and self-controlled process that underlies one's choices about institutional involvements (i.e. school and career) and interpersonal relationships (Clausen, 1991, 1993). Planful competence is uniquely concerned with the capacity to select social settings that best match an individual's goals, values, and strengths (Shanahan, 2000). Planfulness helps students to project their agency in an organized way over time. Agency is projected through forethought.

Forethought is a temporal extension of agency and involves the ability to anticipate the outcomes of actions (Bandura, 2001). In academic learning, forethought involves task analysis, motivational beliefs, and goal setting for the specified academic task. Motivation is "a student's willingness or desire to be engaged and commit effort to completing a task" (Wolters, 1998, p. 294). A student who is better able to regulate their motivation and remain engaged will learn more than a student who is less skilled at regulating their motivation. Students who are considered good self-regulated learners are often characterized as students with adaptive motivational beliefs and have many different cognitive strategies that they are very skilled at using (Pintrich, 2004; Wolters,

1999). Through the exercise of forethought, students motivate themselves and guide their actions in anticipation of future events. Students then regulate their behaviour to achieve their established goals.

During self-regulation, students engage in strategies to monitor and implement plans developed by forethought. Self-regulation “refers to self-generated thoughts, feelings, and actions that are planned and adapted to the attainment of personal goals” (Zimmerman, 2000, p. 14). In the development of academic competence, this stage is particularly important because the strategies learners employ or develop are critical if they are to achieve their desired outcome. Research on proactive learners suggests that a large percentage of these learners control environmental variables, such as minimizing distractions in their study space by using earplugs while they study (Corno, 1993; Corno & Kanfer, 1993). Using self-control strategies, proactive learners exercise self-observational processes to metacognitively monitor their progress. Self-observation processes include self-monitoring, mentally tracking one’s performance, and self-recording which involves a physical record of how one is doing (Zimmerman, 2004). Learners who use self-recording strategies demonstrate enhanced self-regulatory processes which in turn improve goal attainment (Zimmerman & Kitsantas, 1997, 1999). To develop agency through self-regulatory competence learners must also continuously reflect and evaluate their progress on a task.

Personal reflection and introspection are necessary for self-improvement. Through these metacognitive activities, students judge the correctness of their plans against the outcomes of their actions. Whether one believes that they can produce a certain action is as important as having the skills available to succeed. Self-efficacy is a

self-reflective belief in one's capability to succeed and is an essential condition of human functioning (Bandura, 1997). Self-efficacy is a generative property, meaning it is a belief that originates within the self. Self-efficacy is also an evaluative capacity in which one perceives one's abilities to perform a particular action. As self-efficacy is task-dependant, it is also multidimensional. As a multidimensional belief system, one's self-efficacy varies across realms of activity, within different levels of task demands, and under different circumstances. Self-efficacy for academic achievement is the belief that one has the ability and skill necessary to complete an academic task successfully. These beliefs contribute to a student's sustained interest, motivation, and performance in school. Evidence in the literature is consistent in showing that efficacy beliefs contribute significantly to levels of motivation and performance (e.g. Bandura & Jourden, 1991; Bouffard, et al., 2005; Locke, et al., 1984; Walker, et al., 2006). "Among the mechanisms of personal agency, none is more central or pervasive than people's beliefs in the capability to exercise some measure of control over their own functioning and environmental events" (Bandura, 2006, p. 170).

The existence of intentionality, forethought, self-reactiveness, and self-reflection as four distinct, yet relatable processes, is of critical importance in understanding learning. Through the interaction of these processes agency theory can be used to explain the causal relationship between action, the belief in one's abilities, and the belief in the power to originate action. Although agency is arguably the most central of psychological concepts, it is difficult to theorize and study within traditional psychological science and requires a reinterpretation of existing findings using alternative perspectives (Martin, et al., 2003).

Purpose of this Research

Understanding how agency develops and emerges within learning environments is a key factor in identifying why learning occurs. The focus of this dissertation research is not specifically on *what* agency is, as this has been well established (Bandura, 2001, 2006; Edwards, 2005; Emirbayer & Mische, 1998), but on *how* agency operates within the learning context. First, a theoretical model of agency for learning is presented that builds upon social cognitive theory (Bandura, 2001, 2006) and self-regulated learning (SRL, Zimmerman, 1998). Next, a framework for research is presented that enables the empirical investigation of agentic processes of intentionality, forethought, self-reactiveness (operationalized in this thesis as self-regulation), and self-reflectiveness (operationalized in this thesis as self-efficacy) in learning. Using this framework, the agency for learning questionnaire (AFLQ) was developed and validated. Finally, agentic processes are explored as mediating factors between various personal, environmental, and behavioural processes and academic achievement.

Research Questions

This research addresses the following questions:

- 1) How do students exhibit agency?
- 2) What conditions are necessary for students to develop agency for learning?
- 3) How can agentic processes be measured?
- 4) What role do agentic processes play in learning and academic achievement?

Significance of the Study

This research is significant because it demonstrates how agency can be studied empirically and in so doing extends agency as a theoretical concept. This research presents a model of agency for learning (AFL) that extends current views of agency and self-regulated learning (SRL) and enables educational psychologists to identify, measure, and study agentic processes in the context of learning. Empirical evidence presented in this dissertation demonstrates that agentic capabilities mediate the effects of various personal, environmental, and behavioural processes on academic achievement and provides support for how agency affects individual goal orientation and the use of self-regulated strategies for learning. This research is significant because it provides a theoretically grounded empirical framework in which to examine agentic processes and provides evidence for how learning environments can be designed to promote agency. The model and instrument presented in this dissertation align self-regulated learning with developments in the field of agency and provides a starting point for further study of the interaction between personal, environmental, and behavioural processes in learning.

Dissertation Organization

Chapter Two introduces a theoretical model of AFL. This model incorporates aspects of developmental, historical, sociocultural theorizing and extends social cognitive theory by situating agentic capabilities as mediating factors between the effects of personal, behavioural, and social-environmental factors within the learning context. Further, this chapter examines how agency is currently studied in SRL research and provides evidence from the literature that agency plays a more pivotal role in learning

than previously thought. This chapter argues for a rethinking of learning theories to account for agency and outlines the implications of this move for future research and practice.

Chapter Three explores the measurement of agentic processes using self-report instruments. Using data from two validation studies, this chapter presents the AFLQ and provides validation evidence using item response theory.

Chapter Four examines the relationship of agentic processes to academic achievement, goal orientation, the use of self-regulated study strategies, and explores the effects of social factors on agency for learning. Using structural equation modelling and mediation analysis, this chapter models the mediating relationships of agentic processes between goal orientation, self-regulated strategy use, social identification, and student perceptions of the learning environment on academic achievement. This analysis provides empirical support for AFL theory.

Chapter Five provides an integrated summary of these findings, outlines the limitations of the research presented in this dissertation, discusses the implications of this research on current scholarship, and provides an outline for a future research program.

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CHAPTER 2: AGENCY FOR LEARNING

Abstract

Agency is both an individual and a social entity. Personal and social aspects of agency in learning are integral in a student's effectiveness to regulate, control, and monitor their own learning. This chapter introduces a theoretical model of agency for learning (AFL). AFL presents agentic processes (intentionality, forethought, self-regulation, and self-efficacy) as mediating factors between personal, environmental, and behavioural influences. AFL extends social cognitive theory by incorporating aspects of developmental, historical, and sociocultural theorizing that emphasize the integral nature of agency within the regulating processes necessary for learning. Further, this chapter examines how agency is currently studied in research and provides evidence from the literature that agency plays a more pivotal role in learning than previously thought. This research argues for a rethinking of learning theories to account for agency and outlines the implications of this move for future research and practice.

Introduction

Agency is the capability for individuals to consciously choose, influence, and structure their actions in order to achieve a desired outcome (Emirbayer & Mische, 1998; Gecas, 2003). Agency accounts for the transition of possible ideas, thoughts, and beliefs, to tangible, goal-directed, observable behaviours (Nachtomy, 2007). Individuals use their capacity for reason to consider possible outcomes of their ideas, thoughts, and beliefs to commit to achieving those outcomes they establish as goals. Individuals act as agents when they transition from reasoning about an outcome to establishing the outcome as a goal and acting to achieve it. Contemporary views of agency in philosophy discuss agency in the terms of human action (e.g. Mele, 2003) and describe it as “the capability of individual human beings to make choices and to act on those choices in ways that make a difference in their lives” (Martin, 2004, p. 135). As social beings, agents make decisions and enact them on themselves and their environment. Thus, agency arises within developmental, historical, and social cognitive contexts.

Agency in a Developmental Context

Agency is distributed and requires activity in the world. In interactionist developmental theorizing, infants and young children interact with the world and know and learn in the context of these interactions without knowing what they know (Campbell, Christopher, & Bickhard, 2002; Christopher & Campbell, 2008). Campbell et al. (2002) describe this knowing as Knowing Level 1 or ‘being-in-the-world.’ At this level, infants and young children learn functional patterns for interacting with their

environment through semi-guided trial and error. Children develop patterns of interaction and understand what goals to have as “emotion, motivation, and value are all intertwined; they function as different aspects of the same interactive pattern” (p.805). With cognitive maturation, around the age of four children develop the capacity to be conscious of their own thinking and that of others. This more mature, conscious developmental level is called Knowing Level 2. At this level, children develop values and become conscious about their actions. This reflective abstraction enables the child to have an explicit sense of self and engage in strategies for managing their actions to achieve positive goals (i.e. knowing the difference between ‘good’ and ‘bad’). Put another way, “the child *is* an identity, but does not yet *have* one” (p.808). At Knowing Level 3, the child begins to identify with and evaluate values they want to hold on to (meta-values). At this stage, the child begins to believe ‘good’ and ‘bad’ things, as opposed to just identifying them. Meta-values at Level 3 enable children to begin to articulate what kind of person they want to be or avoid being. Knowing Level 4 enables the analysis, comparison, and critique of different meta-value (moral) conceptions. At this level, the child can now “compare his or her self to a system of alternatives, judge it against values, and construct it according to those judgements” (p.808). Interactivism integrates pre-reflective and tacit cognitive processes, embodied and procedural knowledge, and participation in social practices into a developmental framework in which more reflective, deliberative types of agency are emergent properties (Christopher & Campbell, 2008). Knowing Levels are not intended to be developmental stages as people function in different task environments at different levels of knowing and agency. Agency develops through our activity in the

physical and sociocultural world and “once emergent is capable of exerting an irreducible influence on subsequent activity in the world” (Martin, 2004, p. 141).

Agency in an Historical, Sociocultural Context

“...much of our agency is a matter of selectively picking up sociocultural practices that already are available to use by virtue of our sociocultural embeddedness and adapting and using such possibilities as psychological tools and resources for deliberation, choice, and action. We thus *originate* in the sense of interpretively taking up (and possibly modifying and adapting) practices, ideas, and possibilities for acting that already are available, at least to some extent, in the sociocultural contexts in which we exist” (emphasis added; Martin, Sugarman, & Thompson, 2003, p. 115).

A person is an identifiable, embodied individual with being, self-understanding, and agentic capabilities (Martin, Sugarman, & Hickinbottom, 2010). Martin, Sugarman, and Hickinbottom (2010) conceptualize agency as having two aspects. The first aspect conforms to standard philosophical conceptions of the reflective and deliberative agent capable of intentional action in accordance with his or her own desires and choices. The second aspect states that deliberative, reflective agency emerges from prereflective activity as part of the developmental process of individuals within a collective world. Building on this perspective, Martin et al. describe the process of the agentic development of persons.

Infants mature and develop within inescapable historical and sociocultural context. Similar to Campbell et al.’s (2002) perspective of being-in-the -world, Martin et

al. characterize the interaction of caregivers and others as providing the infant with the “various practices, forms, and means of personhood and identity extant within the particular society and culture” (p. 33). At this point, infants’ understanding and agency is prereflective and tacit. Infants’ development proceeds through the internalization and appropriation of sociocultural practices as psychological tools based on continued interactions with their caregivers and others. This is similar to the manner described by Vygotsky (1978). Once this appropriation and internalization are enabled, the individual is transformed into a being in which reflective, intentional agency is possible. Through this transformation, self, identity, and agency are emergent. This person is now capable of understanding some of what being in the world consists of (through its history, culture, and social relations and practices). For Martin and colleagues, personhood (self, identity, and agency) is both embodied and emergent, and arises within the activity and interactivity of human beings within the biophysical and sociocultural world, enabling a recursive understanding of the self as experiencing, understanding, intending, and acting.

Agency in a Social Cognitive Context

Agency is “the power to originate action” (Bandura, 2001, p. 3). Agency in social cognitive theory (SCT; Bandura, 1986) is present in the ability of people to regulate and control their cognition, motivation, and behaviour through the influence of existing self-beliefs (i.e. self-efficacy). SCT understands human functioning in terms of processes of triadic reciprocal causation among internal personal factors, behavioural patterns, and environmental influences — all operating as interacting determinants that affect one another bi-directionally (Bandura, 2001, 2006). SCT considers the self-as-agent to

encompass four core features of human agency — intentionality, forethought, self-reactiveness (herein referred to as self-regulation), and self-reflectiveness. In SCT, this is an agent that is both determined and determining. Agency arises within social structures and contexts, and once emergent may exert influence capable of altering social, cultural contexts, and structures (Bandura, 1986, 2000, 2001, 2006). In SCT, behavioural, cognitive, and other personal factors, as well as environmental influences operate as determinants of (causal influences on) each other. The regulation of personal processes is inherently an individual endeavour, however, the individual (self) does not operate in isolation and requires the meditative efforts of others and aspects of the sociocultural environment to develop and operate in a goal-directed manner.

Agency is enacted through shared practices and beliefs, and the mediative efforts of others. Agency “embodies the endowments, belief systems, self-regulatory capabilities and distributed structures and functions through which personal influence is exercised” (Bandura, 2001, p. 2). Much of what individuals seek to achieve is only possible through “socially interdependent effort” (Bandura, 2001, p. 13) and requires other agents. From a social cognitive perspective, agency is as an emergent, dynamic process through which personal control interacts with that of another individual or a group to promote self and communal development. As agency is both personal and social, the realization of both personal and communal agency frequently requires a commitment to shared intentions, and the coordination of independent plans of action (Bandura, 2006).

Agency for Learning

Personal and social aspects of agency are integral in students' abilities to regulate, control, and monitor their own learning. Agency for Learning (AFL) proposes that agency is an emergent capability that is manifested in student abilities to interact with personal, behavioural, environmental, and social factors in the learning context. Agency development and expression within learning can be described as socially situated, temporal, and emergent.

Agency is socially situated. Agency emerges as a socially mediated capability scaffolded and exercised within human interaction (Mead, 1934). Social and group interactions in learning communities develop and evolve through practices and expressions of human agency. Agency is as an emergent, dynamic process through which personal control interacts with the efforts of another individual or group to promote self and communal development. Collective endeavours require commitment to shared intentions and coordination of independent plans of action (Bandura, 2006). Students express agency in ways associated with their motivational orientation, intentionality, and choice, and relates to their ability to engage these characteristics in learning contexts to achieve their goals.

Agency is temporal. Agency is a “temporally embedded process of social engagement informed by the past (in its habitual aspect), but also oriented toward the future (as a capacity to imagine alternative possibilities) and toward the present (as a capacity to contextualize past habits and future projects within the contingencies of the moment)” (Emirbayer & Mische, 1998, p. 963). Agentive ability exists within a temporal and recursive pattern through which an individual exercises personal influence that in

turn affects environmental processes that then affect further personal self-processes. Agency is enabled through an understanding of our being and acting within the world; projecting backward and forward in time, as a recursive understanding we have of ourselves and our capabilities that “once emergent is capable of exerting an irreducible influence on subsequent activity in the world” (Martin, 2004, p. 141).

Agency is emergent. As an emergent capability, agency develops out of the constituent capabilities of reflective thought and intentional action situated within a socio-cultural context (Martin, 2003). Emergence, from an ontological perspective, is a non-reducible phenomenon. A construct is emergent if it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). Martin, Sugarman, and Thompson (2003) explain emergence by analogy to water, one of many analogies used for that purpose in scholarly literatures ranging from artificial intelligence to physiology (see Kim, 1999). Water has its own properties that are complex and novel and are not a sum of the properties of its components: oxygen and hydrogen. Oxygen and hydrogen have unique individual properties that are necessary for the creation of water, however, water also has properties that are uniquely its own. When a sufficient heat source is applied to water, it boils. Water molecules act in response to this external force and the property of the water changes from liquid to gas. Martin et al. propose that agency, like water, possesses emergent properties generated by a combination of mental, biological, and social components; but is not reducible to those components. The exact make-up of our agentic capability constantly changes as environmental forces interact with personal and behavioural factors to produce intentions and actions.

A capability is emergent if it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). Agency emerges through self-generated intentional action and can only be explained by the interaction between its component influences (Figure 1). Agency involves intentionality, forethought, self-regulation, and self-reflection (Bandura, 2001, 2006).

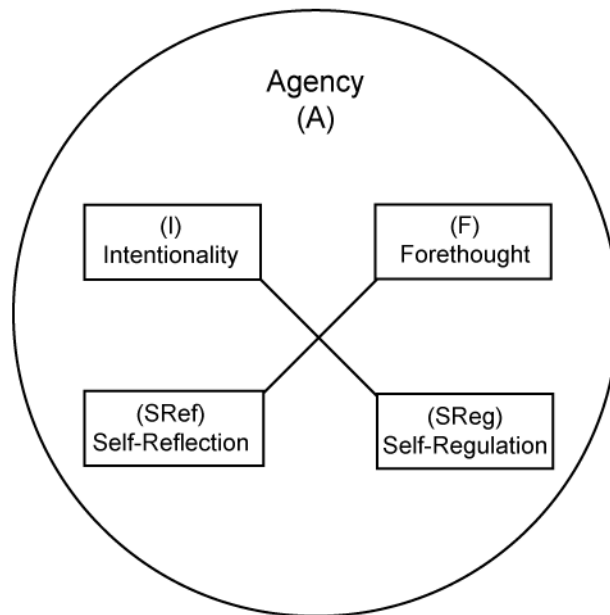


Figure 1. The multi-dimensional aspects of agency. *I* is intentionality; *F* is forethought; *SReg* is self-regulation; *SRef* is self-reflection; and *A* is agency. The solid lines represent intentional, conscious emergent influences.

Agentic Properties

Intentionality. All goal-directed systems are intentional (Lewis, 1990).

Intentionality is an awareness and will to act in a particular way based on an idea or mental state (Lewis, 1990; Owen, 2009). Intentional mental states include psychological attitudes directed toward persons, objects, and events in the world such as needs, wants, and desires (Bloom & Tinker, 2001; Roitblat, 1990). Intentions are realized through goal

setting and planning. These plans are hierarchically structured, partially formed, and future directed (Bratman, 2009). Planful competence, also defined in the literature as planfulness, is the thoughtful, assertive, and self-controlled process that underlies one's choices about institutional involvements (i.e. school and career) and interpersonal relationships (Clausen, 1991, 1993). Planful competence is uniquely concerned with the capacity to select social settings that best match an individual's goals, values, and strengths (Shanahan, 2000). Planfulness helps students to project their agency in an organized way over time. Agency is projected through forethought.

Forethought. Forethought is a temporal extension of agency and involves the ability to anticipate the outcomes of actions (Bandura, 2001). In academic learning, forethought involves task analysis, motivational beliefs, and goal setting for the specified academic task. Motivation is “a student's willingness or desire to be engaged and commit effort to completing a task” (Wolters, 1998, p. 294). A student who is better able to regulate their motivation and remain engaged will learn more than a student who is less skilled at regulating their motivation. Students who are considered good self-regulated learners are often characterized as students with adaptive motivational beliefs and have many different cognitive strategies that they are very skilled at using (Pintrich, 2004; Wolters, 1999). Through the exercise of forethought, students motivate themselves and guide their actions in anticipation of future events. Students then regulate their behaviour to achieve their established goals.

Self-Regulation. During self-regulation, students engage in strategies to monitor and implement plans developed through forethought. Self-regulation “refers to self-generated thoughts, feelings, and actions that are planned and adapted to the attainment

of personal goals” (Zimmerman, 2000, p. 14). In the development of academic competence, this stage is particularly important because the strategies learners employ or develop are critical if they are to achieve their desired outcome. Research on proactive learners suggests that a large percentage of these learners control environmental variables, such as minimizing distractions in their study space by using earplugs while they study (Corno, 1993; Corno & Kanfer, 1993). Using self-control strategies, proactive learners exercise self-observational processes to metacognitively monitor their progress. Self-observation processes include self-monitoring, mentally tracking one’s performance, and self-recording which involves a physical record of how one is doing (Zimmerman, 2004). Learners who use self-recording strategies demonstrate enhanced self-regulatory processes which in turn improve goal attainment (Zimmerman & Kitsantas, 1997, 1999). To develop agency through self-regulatory competence learners must also continuously reflect and evaluate their progress on a task.

Self-reflectiveness. Personal reflection and introspection are necessary for self-improvement. Through these metacognitive activities, students judge the correctness of their plans against the outcomes of their actions. Whether one believes that they can produce a certain action is as important as having the skills available to succeed. Self-efficacy is a self-reflective belief in one’s capability to succeed and is an essential condition of human functioning (Bandura, 1997). Self-efficacy is a generative property, meaning it is a belief that originates within the self. Self-efficacy is also an evaluative capacity in which one perceives one’s abilities to perform a particular action. As self-efficacy is task-dependant, it is also multidimensional. As a multidimensional belief system, one’s self-efficacy varies across realms of activity, within different levels of task

demands, and under different circumstances. Self-efficacy for academic achievement is the belief that one has the ability and skill necessary to complete an academic task successfully. These beliefs contribute to a student's sustained interest, motivation, and performance in school. Evidence in the literature is consistent in showing that efficacy beliefs contribute significantly to levels of motivation and performance (e.g. Bandura & Jourden, 1991; Bouffard, Bouchard, Goulet, Cenoncourt, & Couture, 2005; Locke, Frederick, Lee, & Bobko, 1984; Walker, Greene, & Mansell, 2006). "Among the mechanisms of personal agency, none is more central or pervasive than people's beliefs in the capability to exercise some measure of control over their own functioning and environmental events" (Bandura, 2006, p. 170).

Modes of Agency

Agency is a deliberative, reflective activity in which individuals select, frame, choose, and execute actions to achieve an outcome (Martin, et al., 2003). AFL incorporates aspects of developmental, historical, sociocultural theorizing and extends SCT by situating agentic capabilities as mediating factors between the effects of personal, behavioural, and social-environmental influences within the learning context. Agency is enacted through three different modes: direct personal agency, proxy agency, and collective agency (Bandura, 2001). Individual agency operates through proxy and collective action.

Proxy Agency

Proxy agency is a socially mediated mode of agency through which individuals attempt to get others to act at their will to secure outcomes they desire (Bandura, 2001, 2006). Situations in which individuals employ proxy agency occur when they do not have the will, ability, or skill to act for themselves to continue their own self-development. For example, a student relies on their teacher to instruct them in domains in which they do not already have ability. Students may also choose to exercise proxy agency when they believe that another individual can “do it better” (Bandura, 2001). Seeking an intermediary, in this case a teacher or another student, to direct personal control on behalf of the agent requires a belief on the part of the agent that the intermediary, or proxy, has the ability to assist them in meeting an objective. “Proxy agency [thus] relies heavily on perceived social efficacy for enlisting the meditative efforts of others” (Bandura, 2001, p. 13).

Collective Agency

Collective agency relies on people’s shared beliefs in their collective power to attain desired outcomes (Bandura, 2001, 2006). Collective agency enables people to act together on a shared belief through interactive, coordinated, and dynamic means. SCT rejects a duality of agency and social structure stressing that shared beliefs, such as collective efficacy, is not merely a sum of individual self-efficacy of group members (Bandura, 2001, 2005, 2006). It is people acting as a group through which collective efficacy emerges. In the case of a classroom, students may come to identify the strengths

of individual members of the class and collectively utilize these strengths to complete a class project.

Each of these modes of agency exercises aspects of the core features of human agency (intentionality, forethought, self-regulation, and self-reflectiveness) through collective means. Proxy agency reveals the willingness of the agent to surrender some of their personal control to another individual to achieve a desired outcome. “Productive participation with others in socially meaningful activities to achieve common goals require[s] forms of communal agency that go well beyond individual strategizing and problem solving” (Martin & McLellan, 2008, p. 443). In addition to proxy and collective agency, the existence of intentionality, forethought, self-regulation, and self-efficacy as four distinct, yet relatable processes, are of critical importance in understanding learning. Through the interaction of these processes, AFL theory is used to help explain the relationship between action, the belief in one’s abilities, and the belief in the power to originate action. Although agency is arguably the most central of psychological concepts, it is difficult to theorize and study within traditional psychological science and requires a reinterpretation of existing findings using alternative perspectives (Martin, et al., 2003). What follows is a potential reinterpretation of three areas of research from the AFL perspective: self-regulated learning, shared cognition, and co-regulation.

Applications in Existing Research

Self-regulated Learning and Agency

Models of self-regulated learning (SRL) understand regulatory behavior as largely the responsibility of the learner. One of the major themes in models of SRL is the

relationship of the self to volitional control (decision-making), motivation, and metacognitive monitoring. Identifying the pattern of interrelationships between SRL and related individual difference constructs is a major challenge in SRL research (Boekaerts, Pintrich, & Zeidner, 2001; Dinsmore, Alexander, & Loughlin, 2008; Martin & McLellan, 2008) . Individual difference constructs currently studied in conjunction with SRL align with the core processes of agency as previously outlined. However, challenges in defining SRL have contributed to an incoherent theoretical paradigm (Dinsmore, et al., 2008; Lajoie, 2008; Martin & McLellan, 2008; Schunk, 2008).

Confusion among researchers exploring the relationship between metacognition, self-regulation, and self-regulated learning has contributed to a disjointed theoretical paradigm within which to empirically study learning processes (see Dinsmore, et al., 2008; Lajoie, 2008; Schunk, 2008). Dinsmore et al. (2008) conducted a detailed review of the literature on the conceptualizations of metacognition, self-regulation, and self-regulated learning, and discovered that surprisingly few researchers explicitly defined the constructs they were studying. Only 57% of studies explicitly defined self-regulation, 69% defined self-regulated learning, and 32% defined metacognition. Further, Dinsmore et al. exposed problems with construct definition, measurement alignment, and found noticeable variability in the degree to which measures were explicated by researchers. AFL theory provides a framework to explain how the many individual difference constructs studied in SRL interact with personal, behavioural, and social-environmental factors to provide a more holistic and contextual view of learning.

Shared Cognition and Agency for Learning

Social psychology attempts to describe social life. It asks how people's thoughts, feelings, and behaviours are influenced by the implied, imagined, or actual presence of other people (Thompson & Fine, 1999). Current models of socially shared cognition as reviewed by Thompson & Fine (1999) in contemporary social-psychological research represent new approaches to the study of groups. Key processes focus on the potency of immediate interaction, reciprocal influence processes between individuals and groups, goal-directed behavior, negotiated processing of information and ideas, and the maintenance and enhancement of social identity (Thompson & Fine, 1999). Socially shared cognition involves group behaviour as the core unit of study, places an emphasis on social activity and the coordination among individuals in a dyad or group, and emphasizes the development of that dyad or group through social interaction (Thompson & Fine, 1999).

Contemporary researchers in socially shared cognition view members of a group as interdependent. An integrative model of socially shared meaning in groups proposed by Thompson and Fine (1999) attempts to integrate many of the common processes in existing models of socially shared cognition. This model contains three central processes, motivation, social interaction, and shared meaning. Motivation refers to the causes that instigate the necessity for shared meaning. Social interaction, on the other hand, refers to the "complex interaction that occurs between individuals that perceive themselves as interdependent" (p. 295). Shared meaning mediated by aspects of cognition, affect, and behavior through mental models, shared mental representations, and distributed cognition make up the final factor in the Thompson and Fine model. In relation to collective agency

this model of socially shared cognition provides direct linkages to processes through which people act together on a shared belief through interactive, coordinated, and dynamic means. Individuals in a social setting are thus, dynamically interdependent.

Co-regulation and Agency for Learning

Co-regulation is a coordination and interdependence of personal and situational forces (Markus & Nurius, 1984). Co-regulation occurs among individuals, objects, and settings within the classroom (McCaslin & Hickey, 2001). As in SRL, a central aspect of this process involves goal setting, and the monitoring and regulating of factors required to achieve those goals. Co-regulation of learning is also an interaction of personal, behavioural, and environmental processes although it occurs between a single ‘self’ in the classroom environment and an ‘other’, usually another student or teacher. Co-regulation involves the exercise of proxy agency.

Co-regulation is a result of an individual resolution to seek the meditative efforts of others to achieve a personal goal. When students work in dyads, co-regulation (and ultimately aspects of socially shared cognition) includes the coordination of goals and activities within the dyad, and the development and change of the dyad through interaction (Thompson & Fine, 1999). Of critical importance in the social interaction of a group or dyad is the commitment to seek goals through ‘goal coordination’ (McCaslin & Hickey, 2001). Through a process of negotiation, the identification, evaluation, and coordination of goals involves cooperation and collective efficacy to achieve a “common ground” through the convergence of ideas (Ickes & Gonzalez, 1994). The interaction of individual and social factors in the negotiation and collective goal-setting process

requires motivation, influence, and interpersonal skill exercised through proxy agency. Models of co-regulation reveal the interaction of individual and social factors.

Heuristic factors in co-regulation encompasses motivation (motive and goal setting), enactment (overt and covert strategies) and evaluation (self-evaluation and teacher-evaluation) (McCaslin & Hickey, 2001). Internal personal factors (motive and goals), behavioural patterns (covert and overt strategies), and environmental influences (teacher-evaluation) require proxy agency to effectively scaffold the learning process. Through the exercise of proxy agency, students effectively motivate, influence their environment through overt strategies (enlist assistance) and receive feedback in the form of evaluation from peers and teachers. The teacher, as a mediator in the classroom, provides supportive instructional scaffolds and opportunity to promote the return of the responsibility of learning to the student and is the eventual link to self-regulation (Hadwin, Wozney, & Pontin, 2005; McCaslin & Hickey, 2001; Meyer & Turner, 2002). The eventual return of responsibility of learning to the student is the final phase of the reciprocal process of influence of environmental feedback on the behavior and self-processes of the student. Agency is ultimately a continuum through which personal influence is exercised and environmental influences, in return, influence personal self-processes.

Conclusion

Agency is integral to students' ability to regulate, control, and monitor their own learning. Students enact agency through their ability to regulate their cognitive, affective, and behavioural processes as they interact with factors in the environment which, "entails

not only a behavioural skill in self-managing environmental contingencies, but also the knowledge and the sense of personal agency to enact this skill in relevant contexts” (Zimmerman, 2000, p. 14). AFL implies a more unified approach to the study of learning processes in individual and social settings. AFL presents agentic capabilities as mediating factors between personal, environmental, and behavioural processes. AFL is situated within a social cognitive view and extends this view by incorporating aspects of developmental, historical, and sociocultural theorizing that emphasize the integral nature of agency on the regulating processes necessary for learning. AFL presents a more complete picture of how individuals regulate and use their influence to meet personal and collective goals and provides a framework that enables further study of learning in the classroom context.

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CHAPTER 3: MEASURING AGENCY FOR LEARNING: VALIDATING THE AGENCY FOR LEARNING QUESTIONNAIRE (AFLQ)

Abstract

Agency is inherent in students' ability to regulate, control, and monitor their own learning. An individual enacts their agency to regulate their cognitive, affective, and behavioural processes as they interact with environmental factors. This article traces the development of the Agency for Learning Questionnaire (AFLQ) and examines the internal consistency, predictive validity, and psychometric properties of this new instrument. An initial pool of 50 items covering four dimensions of agentic functioning was generated. Using two independent data samples the item pool was psychometrically analyzed, organized, and reduced using a combination of exploratory factor analysis and item response theory. The final scale has two forms, a long form (AFLQ-L, 42 items) and a short form (AFLQ-S, 28 items) that assesses agentic functioning across four distinct dimensions including: intentionality (planfulness, decision competence), forethought (intrinsic and extrinsic motivation), self-regulation, and self-reflectiveness (as examined through self-efficacy). Results indicate that the final scales have excellent internal consistency, significant predictive validity, and strong psychometric properties. Implications and directions for future research are discussed.

Introduction

Agency is the capability of individuals to make choices and to act on those choices in ways that make a difference in their lives (Martin, 2004b). Agency is in operation only when individuals self-reflect and identify external influences that are most nurturing to the self. Students enact their agency to manage their cognitive, affective, and behavioural processes as they interact with environmental factors. Personal and social aspects of agency in self-regulation are integral to a student's ability to regulate, control, and monitor their own learning. Although often mentioned as an important influence in the self-regulated learning (SRL) literature, agency has never been measured (see Karoly, et al., 2005; Martin, 2004; Zimmerman, 2000).

Research in educational psychology over the past 20 years has done much to explain the role of the cognitive system in relation to perception, affect, motivation, and behaviour (e.g. Jarvenoja & Jarvela, 2009; Pintrich, 2004; Wolters & Yu, 1996). Efforts to understand how these processes integrate with each other and the impact of social and environmental influences are starting to emerge (e.g. Beishuzen, 2008; deJong, et al., 2005; Greene, et al., 2010). However, confusion among researchers exploring the relationship between metacognition, self-regulation, and self-regulated learning has contributed to a disjointed theoretical paradigm in which to empirically study these processes (see Dinsmore, et al., 2008; Lajoie, 2008; Schunk, 2008). Dinsmore et al. (2008) conducted a detailed review of the literature on the conceptualizations of metacognition, self-regulation, and self-regulated learning, and discovered that surprisingly few researchers explicitly defined the constructs they were studying. Only 57% of studies explicitly defined self-regulation, 69% defined self-regulated learning,

and 32% defined metacognition. Further, Dinsmore and colleagues exposed problems with construct definition, measurement alignment, and found noticeable variability in the degree to which measures were explicated by researchers. For example, they found that the scope of SRL identified in the literature was quite large and that typically the measures of SRL were also broad, often involving general measures of academic behaviour (e.g. MSLQ; Pintrich, et al., 1993). As a result of this broad operationalization it was unclear how “these broad measures that [sought] to generalize across multiple times and situations, as well as across cognitive, motivational, emotional, and behavioural domains, [could] fairly and accurately gauge monitoring or capture the dynamic interplay of person, environment, and behavior that is the hallmark of self-regulation” (p. 409). However, Dinsmore et al. found commonalities in the research literature on metacognition and self-regulation that revealed “a marriage between self-awareness and intention to act that aligns these bodies of work” (p. 409). Agency theory provides a conceptualization of this “marriage” and explains how these and other self-processes interact with personal, behavioural, and social-environmental factors to provide a more holistic and contextual view of learning.

Agency for Learning (AFL; Code, 2010) extends social cognitive theory by situating agentic capabilities as mediating factors between the effects of personal, behavioural, and social-environmental aspects on the self. AFL posits that agency “is an emergent entity that is manifested in individual abilities to interact with personal, behavioural, environmental, and social factors in the learning context” (Code, 2010, p. 2). Ultimately, agency is an emergent capability that is intentional, self-generated, and has external sources of influence.

Agency is an emergent capability brought about through conscious intentional action. Emergence refers to “the arising of novel and coherent structures, patterns, and properties during the process of self-organization” (Goldstein, 1999, p. 49). A capability is emergent if it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). Since agency emerges through self-generated intentional action; it can only be explained by the interaction between its component influences. These component influences are represented by an individual’s intentionality, forethought, self-regulation, and self-reflection.

Multidimensional Aspects of Agency

Intentionality

Intentionality is an awareness and will to act in a particular way based on an idea or mental state (Lewis, 1990; Owen, 2009). Intentions are actualized through goal setting and planning. Planfulness involves the extent to which individuals report making rational, rather than impulsive, decisions (Hitlin & Elder Jr, 2007). Students exhibit planful competence if they have the capability to select social settings that best match their goals, values, and strengths (Shanahan, 2000). This competence helps students to project their agency in an organized way over time. The projection of agency is managed by forethought.

Forethought

Forethought involves the ability to anticipate the outcomes of actions. Through the exercise of forethought, students motivate themselves and guide their actions in

anticipation of future events. Self-determination theory distinguishes between three different types of motivation orientation and intentionality based on different goals (Deci & Ryan, 2000). Students are intrinsically motivated if they do something because it is inherently interesting or enjoyable, extrinsically motivated if they are externally driven into action and amotivated if they do not value the activity. Once motivated to act, students regulate their behaviour to achieve their established goals.

Self-Regulation

Self-regulation is “an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment” (Pintrich, 2000, p. 453). In the development of academic competence the strategies learners select and use are critical if they are to achieve their desired outcome. Self-regulation for academic achievement implies a conscious awareness and involves selecting and deploying appropriate strategies in order to achieve explicit or implicit learning goals (Jain & Dowson, 2009). Agency develops through continuous reflection and evaluation on task progress.

Self-Reflection

Self-reflection is a functional self-awareness in which students reflect on their personal efficacy, thoughts, actions, the meaning of their pursuits, and make corrective adjustments if necessary (Bandura, 2006). Self-reflection inherently involves students judging the correctness of their plans against the outcomes of their actions. This

“metacognitive capability to reflect upon oneself and the adequacy of one's thoughts and actions is the most distinctly human core property of agency” (Bandura, 2006, p. 165). Self-efficacy is a self-reflective belief in one’s capability to succeed and is an essential condition of human functioning (Bandura, 1997). These “beliefs act as determinants of behaviour by influencing the choices that individuals make, the effort they expend, the perseverance they exert in the face of difficulties, and the thought patterns and emotional reactions they experience” (Pajares, 1996, p. 325). Self-efficacy beliefs contribute to a student’s sustained interest, motivation, and performance in school.

Purpose of this Research

Students enact agency through their ability to regulate their cognitive, affective, and behavioural processes as they interact with factors in the environment. Aspects of intentionality, forethought, self-regulation, and self-reflectiveness (operationalized in this thesis as self-efficacy) are often studied independently in the literature (e.g. Gestsdottir & Lerner, 2007; Kitsantas, 2008; Little, 1998; Loedewyk & Winne, 2005; Wolters & Yu, 1996). These agentic factors need to be studied and interpreted collectively to fully examine the role these processes play in learning. AFL presents a framework in which to study agentic processes and provides a means to re-interpret existing findings (Code, 2010). The purpose of this research is to develop a self-report instrument that measures the multidimensional aspects of agency in learning. Using classical test theory and item response analysis this study examines the internal consistency, predictive validity, and the psychometric properties of this new instrument, the agency for learning questionnaire (AFLQ).

General Method

Overview of Item Response Theory

IRT is a collection of mathematical and statistical methods used to analyze items and scales, create and administer psychological instruments, and measure individuals on psychological constructs (Reise, et al., 2005). An IRT analysis of items on a psychometric instrument relates the *level* or degree to which a student holds some attribute, the *content* of the item, and the *probability* that a student at a certain level will answer the item in a particular way. For example, on a measure of self-efficacy that assesses a student's belief in their ability to self-regulate their learning (Zimmerman, et al., 1992a), a student may answer "strongly disagree", scored at level 1, to the following item: "I finish homework assignments by deadlines." A score of 1 on this item indicates that this student is not very likely to hand in their homework on time. An IRT analysis of this item would compare the student's response on this item to the likelihood of responses on other items. A student's calculated ability level on this self-efficacy scale corresponds to the student's level of self-efficacy for self-regulated learning. Using IRT, researchers are able to characterize how a student with low self-efficacy for self-regulated learning is likely to respond to other items measuring the same construct. Researchers are able to characterize how a student with a lower level on a latent construct is likely to respond to other items, even on different psychometric instruments. This assumption makes estimates of respondent ability independent of item functioning, which is an improvement over classical methods of analysis.

IRT addresses several limitations of classical analysis. First, in IRT the standard error of measurement (SEM) is allowed to vary across individuals in a population rather than being fixed at the same value for everyone. Estimating the variation in standard error on individual scores is significant because it enables an empirical distinction between individuals with high ability and low ability on a latent construct and makes estimations of significance more accurate. The key advantage of this conceptualization is that measurement accuracy is defined as specific to the ability level rather than at the test level. Therefore, better estimations of measurement accuracy can be established. This is different than coming up with more accurate score estimates, though that is also true in IRT, through optimal use of response data. Item functioning is represented independently of the sample, improving interpretations of construct validity. Ability estimates are represented independently of the items on the instrument, contributing to a better understanding of overall reliability (Hambleton, et al., 1991).

Item Generation and Refinement

A pool of items corresponding to the multidimensional aspects of agentic functioning was generated based on several existing instruments used in educational psychological research. These instruments were selected for inclusion based on three criteria. First, the instruments were to be designed and validated for university or college aged student. Second, instruments were selected based on their theoretical foundations and similarities to modes of agentic functioning. Third, validation evidence for the instruments must have been available in the literature. Finally, internal consistencies must have been reported in a validation study and be above acceptable levels $\alpha_0 > .70$

(Tabachnick & Fidell, 2006). An initial item pool was formed by selecting questions from these instruments which assessed along the four component elements of agency described by AFL theory. To select items appropriate for assessing a range of ability levels along the four dimensions, a selection method outlined by Fletcher and Nusbaum (2010) was used to reduce the number of items in the pool and come up with the final AFLQ. This procedure included an analysis of content (to reduce redundancies and maximize content validity), factor loadings (to ensure relationship with construct, factorial validity, and construct validity), and fit with the IRT model. To produce an instrument that will assess a wide range of abilities items must have at minimum good item discrimination ($a > .75$), assess difficulties between $-2.0 < \theta < 2.0$, and test information $I(\theta) > 4.0$. Each of the measures selected as a basis for the item pool are described below.

Intention. The Melbourne Decision Making Questionnaire (MDMQ, Mann, et al., 1997) and the Adolescent Decision Making Questionnaire (ADMQ, Tunistra, et al., 2000) measure decision making patterns based on decision conflict theory (see Janis & Mann, 1977). Decision conflict theory concerns decision-making styles through elements of self-confidence, vigilance, panic, evasiveness, and complacency. Janis and Mann (1977) classify these factors into two categories, adaptive and maladaptive decision-making patterns. An adaptive pattern involves carefully deliberated behaviour such as vigilance and self-confident decision-making. Reported internal consistencies of the original scales that were used with several samples of university students are $\alpha = .63$ for self-confidence and $\alpha = .80$ for vigilance (Mann, et al., 1997; Tunistra, et al., 2000). Six items comprising the self-confidence subscale representing aspects of intentionality

defined in AFL were adapted to measure decision competence (e.g., “The decisions I make turn out well”). Six items from the vigilance subscale representing aspects of planfulness in AFL were adapted to measure planful competence (e.g., “I try to be clear about my objectives before choosing”). Students indicated to what extent each of the statements corresponded to them using a 5-point Likert scale (1 = *does not correspond* and 5 = *corresponds exactly*).

Intention and forethought. The Academic Motivation Scale (AMS; Vallerand, et al., 1992) measures academic motivation and intentionality based on the tenets of self-determination theory (see Deci & Ryan, 1985; Deci, et al., 1991). The AMS is a 28-item inventory that measures intrinsic motivation (12 items), extrinsic motivation (12 items), and amotivation (4 items). Reported reliability estimates of the original French-Canadian version (EME, Vallerand, et al., 1989) ranged from $\alpha = .76$ to $.86$. For the translated English version reliability estimates ranged between $\alpha = .83$ to $.86$. All items in the English version were added to the initial item pool. Students rated the degree to which each statement presently corresponded to the reasons they went to college on a 5 point Likert scale (1 = *does not correspond* and 5 = *corresponds exactly*). An example of an intrinsic motivation item on this scale is “for the intense feelings I experience when I am communicating my own ideas to others” and extrinsic motivation item is “for the material and/or social benefits of being a University graduate”.

Self-regulation. The volitional components inventory (VCI; Kuhl & Fuhrmann, 1998) is a 52-item inventory that measures competence in self-regulation (12 items, $\alpha = .81$), self-control (8 items, $\alpha = .77$), volitional development (12 items, $\alpha = .83$), self-access (12 items, $\alpha = .82$); and general life stress (8 items, $\alpha = .83$). Only items from the self-

regulation subscale of the VCI were added to the initial item pool. Students rated the degree to which each statement applied to them and their situation using a 4 point Likert scale (1 = *not at all* and 4 = *in full*). An example of a self-regulation item is “when a task gets boring I usually know how to make it interesting again”.

Self-reflection. Self-reflection is operationalized in this thesis as self-efficacy. The self-efficacy for self-regulated learning scale (11 items, $\alpha = .87$) originally created by Bandura in 1989 and published by Zimmerman, Bandura and Martinez-Pons (1992b) was modified for use in this study. Students rated their degree of confidence on a list of tasks using a 7 point Likert scale (1 = *not well at all* and 7 = *very well*). An example of a self-efficacy item is “arrange a place to study without distractions”.

Sample 1

Method

Participants. Data were collected via an anonymous Web survey from a convenience sample of second year undergraduate students ($N = 1056$) enrolled in five sections of organic chemistry taught by one of three instructors in the fall semester of 2007 at a Canadian university. Students recruited for voluntary participation were given a bonus mark to their final course grade (0.5% bonus grade) and had 8 weeks to complete the survey. The response rate was 73.5% ($N = 776$, 498 Female). Approximately 95% of the respondents were between the ages of 18 and 23.

Measures. An initial pool of 50 items was created from various instruments measuring agentic factors of intentionality and forethought (AMS; Vallerand, et al.,

1992), self-regulation (VCI; Kuhl & Fuhrmann, 1998), and self-efficacy (Zimmerman, et al., 1992b). The instructions and response scales were as follows.

- Intentionality and forethought (28 items): “Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons why you go to college”; (1 = *does not correspond* and 5 = *corresponds exactly*).
- Self-regulation (11 items): “Please rate the degree to which each statement applies to you or your current situation, using the given scale”; (1 = *not at all* and 4 = *in full*).
- Self-reflectiveness (11 items): “Using the scale below, indicate to what extent each of the following statements presently corresponds to you”; (1 = *not well at all* and 7 = *very well*).

Data Analysis

A classical analysis, including an exploratory factor analysis was conducted to assess the unidimensionality of each scale, a primary assumption required for unidimensional-IRT analysis (Hambleton, et al., 1991). Following each scale’s classical analysis several IRT procedures were used. First, local item independence must be established. Local independence means that, when controlling for examinee trait level(s) the test items are not correlated (are independent). Local item independence is estimated using Yen’s Q_3 statistic (1993). Second, Yen’s Q_1 (1981) and Drasgow’s chi-square (1995) were used to determine the fit of the data to the IRT model chosen for this analysis. A 2PPC IRT model was selected because the items being analysed are Likert-style. Finally, to analyze item parameters (difficulty and discrimination) and overall

measurement characteristics, item response functions (IRF), item information functions (IIF), category response curves (CRC), test information functions (TIF), and standard error of measurement (SEM) graphs were used. The classical analytical procedures and factor analysis was performed using SPSS (SPSS, 2009b). IRT analysis was performed using PARDUX (Burket, 2002), and graphing performed MODFIT (Stark, 2002).

Results

Academic Motivation Scale (AMS)

Descriptive statistics. Table 1 presents the results of the classical analysis for the AMS. Items identified as poorly discriminating were 1, 5, 12, 19, and 26. Items 5, 12, 19 and 26 comprise the amotivation subscale. If CTT were the only procedure performed during this analysis it would be acceptable to remove these items completely. However, there was little additional information as to why the items on the amotivation subscale performed so poorly so further IRT analysis was warranted. The distribution of item correlations (*CITC*) was from -.123 to .669.

Table 1

Classical Item Analysis of the AMS ($\alpha = .87$, $CI_{95} = .86, .88$)

Item	M ^a	SD	CITC ^b	α^c	Response Category ^d				
					1	2	3	4	5
1	3.82	1.01	0.207	0.873	24	62	147	336	207
2	3.62	0.88	0.446	0.867	9	65	252	333	117
3	4.24	0.87	0.355	0.869	10	23	96	291	356
4	2.72	1.02	0.508	0.865	100	214	294	138	30
5	1.80	1.03	-0.123	0.881	404	204	108	41	19
6	3.09	1.03	0.581	0.863	54	161	280	222	59
7	3.35	1.20	0.536	0.864	84	90	199	278	125
8	4.05	0.95	0.394	0.868	16	33	131	309	287
9	3.46	1.01	0.533	0.865	30	99	236	303	108
10	4.18	0.85	0.325	0.870	6	29	100	329	312
11	2.47	1.09	0.488	0.866	170	238	230	112	26
12	1.94	1.13	-0.083	0.881	376	194	112	67	27
13	3.24	1.06	0.634	0.862	54	134	263	247	78
14	3.30	1.16	0.621	0.862	76	103	218	272	107
15	3.89	1.06	0.395	0.868	28	53	155	281	259
16	3.69	0.96	0.500	0.866	18	69	199	336	154
17	3.81	0.95	0.471	0.866	16	63	154	364	179
18	2.31	1.11	0.496	0.865	216	248	196	85	31
19	1.44	0.80	-0.064	0.877	553	129	74	13	7
20	3.17	1.08	0.648	0.861	61	141	255	243	76
21	3.15	1.22	0.579	0.863	99	129	209	235	104
22	3.85	1.01	0.351	0.869	24	50	163	317	222
23	3.64	0.96	0.450	0.867	20	72	206	345	133
24	3.56	1.03	0.439	0.867	31	84	220	302	139
25	2.68	1.14	0.547	0.864	132	225	225	148	46
26	1.58	0.92	-0.091	0.879	501	154	80	31	10
27	3.19	1.06	0.669	0.861	56	138	262	246	74
28	3.40	1.12	0.639	0.861	57	103	209	285	122

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

^a Item mean is a CTT indicator of difficulty. ^b Indicates item discrimination. ^c α if item is deleted; ^d 1 = does not correspond; 2 = corresponds a little; 3 = corresponds moderately; 4 = corresponds a lot; 5 = corresponds exactly.

Exploratory factor analysis. An exploratory factor analysis (EFA) was used to assess latent dimensionality since the original validation of the AMS was preliminary (Vallerand, et al., 1992) and further validation studies have demonstrated mixed results (e.g. Fairchild, et al., 2005). Factors were extracted using Varimax rotation with Kaiser

Normalization. The EFA on this data set revealed a three-factor structure (as based on the Scree plot): Intrinsic motivation ($\alpha = 0.92$, $CI_{95} = .91, .93$), extrinsic motivation ($\alpha = 0.95$, $CI_{95} = .84, .87$), and amotivation ($\alpha = 0.80$, $CI_{95} = .78, .83$). All calculated internal consistencies were above the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). The factor structure of the AMS is reported in Table 2. Several items identified in the literature as representing extrinsic motivation (items 3, 7, 10, 14, 17, 21, and 25) loaded on the first factor, intrinsic motivation. From this point forward, these items were analysed as part of the intrinsic motivation subscale. Correlations among the sub-scales are in Table 3.

Table 2

Rotated Factor Pattern and Structure Matrices for the AMS, Communalities, Means, and Standard Deviations

Item	Factor 1	Factor 2	Factor 3	h^2	M	SD
Factor 1: Intrinsic Motivation						
2	.625	-.293		.535	3.62	.880
4	.554	-.130	.275	.408	2.72	1.024
6	.675		.160	.504	3.09	1.034
9	.671	-.251		.602	3.46	1.008
11	.560	-.233	.365	.640	2.47	1.085
13	.730		.147	.568	3.21	1.063
16	.710	-.313		.666	3.69	.963
18	.555	-.204	.426	.777	2.31	1.110
20	.729		.208	.589	3.17	1.083
23	.673	-.311	-.106	.619	3.64	.956
25	.621	-.190	.295	.567	2.68	1.139
27	.780		.107	.636	3.19	1.064
Factor 2: Extrinsic Motivation						
1		.591	-.135	.411	3.82	1.012
3	.492		-.385	.462	4.24	.873
7	.486	.314	.204	.483	3.35	1.197
8	.320	.662	-.254	.626	4.05	.945
10	.427	.246	-.451	.507	4.18	.849
14	.564	.412	.137	.559	3.30	1.157
15	.295	.706	-.179	.650	3.89	1.059
17	.488	.276	-.151	.353	3.81	.951
21	.522	.383	.213	.590	3.15	1.223
22	.224	.765	-.177	.705	3.85	1.006
24	.380	.349		.274	3.56	1.031
28	.635	.304		.695	3.40	1.124
Factor 3: Amotivation						
5	-.420	.357	.574	.686	1.80	1.026
12	-.349	.290	.568	.591	1.94	1.134
19	-.351	.243	.686	.684	1.44	.804
26	-.382	.281	.670	.718	1.58	.920

Note: AMS = Academic Motivation Scale; h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Table 3

Correlations among the AMS Subscales

	1	2	3
1. Intrinsic Motivation	1		
2. Extrinsic Motivation	.244**	1	
3. Amotivation	-.287**	.015	1

** Correlation is significant at the 0.01 level (2-tailed).

Assessment of local dependence. Parameter estimations for the AMS are in Table 4. Separate IRT analyses were performed on each of the three AMS scales. The success of an IRT analysis and the use of the 2PPC model depends on the assumption that the latent variable being measured is unidimensional and locally dependent. When items on a scale are locally dependent, test information functions and reliabilities may be overestimated. Local dependence also indicates that the items may be assessing the same content. Yen's Q_3 statistic is a common way to infer this relationship. There were several clear violations of local independence where Q_3 comparisons were significant at $p < 0.01$. The following groups of items on the intrinsic motivation scale were locally dependent: 6, 13, 11; 18, 16, 23; and 18, 25. The following groups of items on the extrinsic motivation scale were locally dependent: 3, 10, 7; 14, 7, 21; 14, 21; 1, 22, 7; 28, 14, 28; and 21, 28. No items on the amotivation scale were locally dependent. **Items identified as locally dependent were revised for Sample 2.**

Estimation of IRT model-fit parameters. Yen's Q_1 chi-square goodness-of-fit test was computed for each item on the AMS. A Q_1 value indicates whether the IRT model selected for the analysis was appropriate. Bolded items in Table 4 indicate that these items do not fit the specified IRT model and have Q_1 values outside the accepted range of

$|z| = 4.6$. Items 5, 12 and 26 were removed due to their lack of fit to the IRT model as they had a $\chi^2/df > 3$. Items 19 and 27 could not be estimated because of an estimation failure and were removed from subsequent analysis. It was noted that items 5, 12, 19 and 26 comprise the amotivation subscale. Additional items with low discrimination values ($a < .75$) were revised for Sample 2.

Table 4

Estimated Item Parameters for the AMS Using the 2PPC Model and Item-Fit Statistics

Item	a^a	δ_1	δ_2	δ_3	δ_4	χ^2	DF	χ^2/DF	Z	Prob.
Intrinsic Motivation										
2	1.316	-4.528	-2.567	-0.423	1.961	22.42	35	0.641	-1.50	0.656
4	0.920	-1.504	-0.443	1.193	2.610	31.06	35	0.887	-0.47	0.430
6	1.167	-2.450	-1.022	0.537	2.485	37.31	35	1.066	0.28	0.523
9	1.583	-3.716	-2.044	-0.252	2.298	49.52	35	1.415	1.73	0.616
11	1.086	-1.027	0.072	1.420	2.953	22.02	35	0.629	-1.55	0.367
13	1.300	-2.539	-1.312	0.298	2.350	42.23	35	1.207	0.86	0.552
16	1.700	-4.547	-2.712	-0.846	1.869	24.74	35	0.707	-1.23	0.674
18	0.994	-0.639	0.366	1.537	2.375	24.11	35	0.689	-1.30	0.328
20	1.262	-2.344	-1.164	0.302	2.332	32.70	35	0.934	-0.28	0.543
23	1.344	-3.620	-2.230	-0.696	1.826	45.17	35	1.291	1.21	0.661
25	1.228	-1.504	-0.118	1.046	2.656	30.51	35	0.872	-0.54	0.420
27 ^b	--	--	--	--	--	--	--	--	--	--
Extrinsic Motivation										
1	0.789	-1.852	-1.421	-1.019	0.754	56.07	35	1.602	2.52	0.706
3	0.619	-1.599	-1.935	-1.356	-0.144	41.99	35	1.200	0.84	0.809
7	0.533	-0.458	-0.997	-0.332	1.052	39.20	35	1.120	0.50	0.587
8	1.943	-3.974	-3.519	-1.897	0.569	30.96	35	0.885	-0.48	0.764
10	0.863	-2.848	-2.059	-1.583	0.185	27.29	35	0.780	-0.92	0.794
14	0.913	-1.144	-1.186	-0.201	1.556	64.77	35	1.851	3.56	0.574
15	1.937	-3.484	-2.906	-1.387	0.763	24.43	35	0.698	-1.26	0.722
17	0.775	-2.273	-1.442	-1.040	0.994	35.35	35	1.010	0.04	0.702
21	0.685	-0.775	-0.723	-0.053	1.261	56.47	35	1.613	2.57	0.537
22	1.810	-3.432	-2.893	-1.351	1.112	22.68	35	0.648	-1.47	0.714
24	0.699	-1.678	-1.348	-0.382	1.110	83.99	35	2.400	5.86	0.640
28	0.725	-1.238	-1.056	-0.327	1.252	46.16	35	1.319	1.33	0.601

Item	a ^a	δ1	δ2	δ3	δ4	χ ²	DF	χ ² /DF	Z	Prob.
<i>Amotivation</i>										
5	3.142	-1.063	0.855	2.010	2.285	123.76	23	*5.381	14.86	0.199
12	2.665	-1.031	0.436	1.253	2.067	196.13	23	*8.527	25.53	0.234
19 ^b	--	--	--	--	--	--	--	--	--	--
26	3.310	-0.054	1.356	2.176	3.075	62.81	23	2.731	5.87	0.144

Note: Bolded items have a Q₁ beyond the critical value of $z = 4.6$ and do not fit the specified IRT model

^a Items have been scaled using a factor of 1.702. ^b Item could not be estimated due to an estimation failure

* Items with an asterisk (*) have a $\chi^2/df > 3$ therefore they do not fit the specified IRT model and are poorly calibrated.

Test Information Function and Standard Error of Measurement. The test information function and standard errors describe the precision of a test as an instrument for establishing examinee ability across the latent trait scale (Doran, 2005). Plots of the test information function (TIF) and standard error of measurement (SEM) for intrinsic motivation are in Figure 2. Since the target instrument is to measure a broad range of abilities, the TIF should be fairly flat, reflecting the desire to produce a test that would provide (approximately) equally precise estimates over the ability scale (Hambleton, et al., 1991). The TIF for intrinsic motivation revealed that the measurement accuracy of this subscale with Information $I(\theta) > 6.0$ is best between theta values of $-2.5 < \theta < 2.5$.

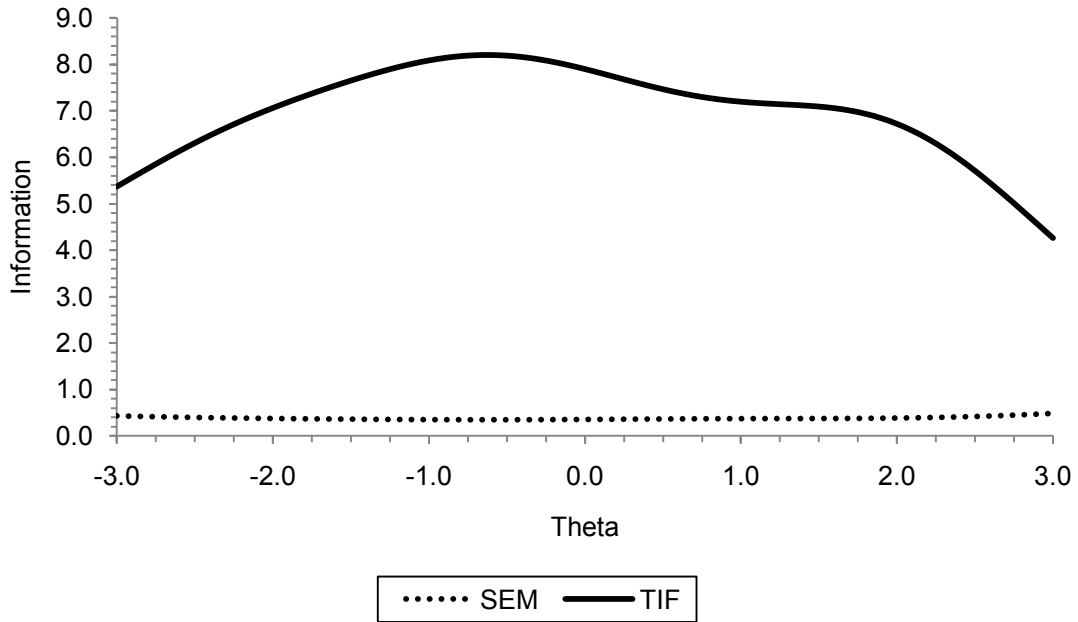


Figure 2. Test information function (TIF) and standard error of measurement (SEM) for intrinsic motivation.

Plots of the TIF and SEM for extrinsic motivation are in Figure 3. The TIF for extrinsic motivation revealed that the measurement accuracy of this subscale with $I(\theta) > 6.0$ is best between theta values of $-3.0 < \theta < 1.0$. Items on the high end of this scale above $\theta = 1.0$ are not as precise and have higher SEM values.

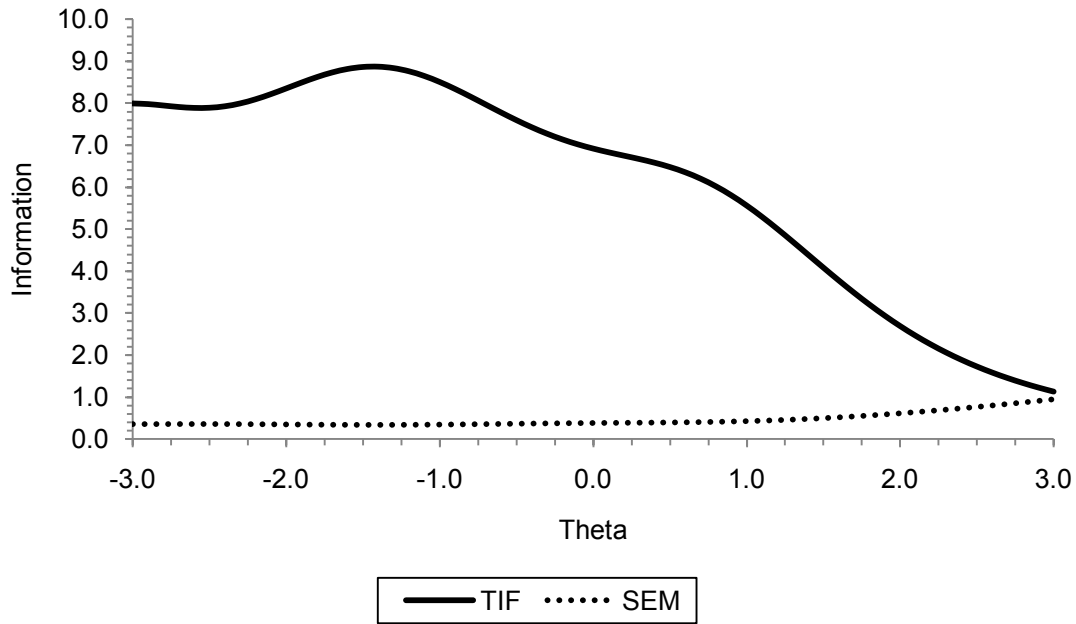


Figure 3. Test information function (TIF) and standard error of measurement (SEM) for Extrinsic Motivation.

Self-Regulation Scale of the Volitional Components Inventory (SR-VCI)

Descriptive statistics. Results of the classical analysis of the SR-VCI are in Table 5. None of the items on this scale had a *CITC* < .25, had good overall discrimination, and differentiated well between students who rated the degree to which each statement applied to them. Item response frequencies are also listed in Table 5.

Table 5

Classical Item Analysis of Self-Regulation Scale of the VCI ($\alpha = .87$, $CI_{95} = .86, .88$)

Item	M^a	SD	$CITC^b$	α^c	Category ^d			
					1	2	3	4
3	1.28	0.718	0.427	0.848	86	424	230	36
14	1.50	0.833	0.476	0.847	85	305	299	87
15	1.45	0.724	0.453	0.848	61	349	320	46
16	1.11	0.825	0.455	0.848	188	357	192	39
27	1.33	0.808	0.303	0.850	109	357	252	58
28	1.38	0.821	0.460	0.847	99	355	251	71
29	1.23	0.799	0.505	0.847	133	374	224	45
32	1.45	0.790	0.404	0.849	76	345	285	70
40	1.56	0.717	0.450	0.848	36	334	338	68
41	1.09	0.735	0.403	0.849	153	420	180	23
42	1.23	0.746	0.490	0.847	109	413	217	37

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

a Item mean is a CTT indicator of difficulty. b Indicates item discrimination. c α if item is deleted; d 1 – Not at all; 2 – Somewhat; 3 – For the most part; 4 – In full.

Exploratory factor analysis. An EFA was performed to assess latent dimensionality of the SR-VCI given that the population used for this study was culturally different than the original validation study (Kuhl & Fuhrmann, 1998) and only selected items from the VCI were used. Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a one-factor structure for self-regulation (as based on the Scree plot). The internal consistency estimate for the SR-VCI subscale ($\alpha = 0.87$, $CI_{95} = .85, .88$) was above the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). The factor structure of the SR-VCI is reported in Table 6.

Table 6

Rotated Structure Matrices for the SR Subscale of the VCI, Communalities, Means, and Standard Deviations

Item	Factor 1	h^2	M	SD
3	.602	.410	1.28	.718
14	.603	.375	1.50	.833
15	.619	.406	1.45	.724
16	.720	.586	1.11	.825
27	.519	.275	1.33	.808
28	.596	.398	1.38	.821
29	.683	.518	1.23	.799
32	.577	.583	1.45	.790
40	.520	.341	1.56	.717
41	.570	.376	1.09	.735
42	.728	.602	1.23	.746

Note: VCI = Volitional Components Inventory; h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Assessment of local dependence. Parameter estimations of items on the SR-VCI are presented in Table 7. There were two violations of local independence on the SR-VCI where Q_3 comparisons are significant at $p < 0.01$. The following grouped items are locally dependent: 32, 40; and 32, 41. These items were revised for Sample 2 to improve dimensionality.

Estimation of IRT model-fit parameters. Bolded items in Table 7 indicate that these items do not fit the specified IRT model and have values outside the accepted range of $|z| = 4.6$. Items 28 and 41 were removed due to their lack of fit to the 2PPC model.

Table 7

*Estimated Item Parameters for the Self-Regulation Scale of the VCI Using the 2PPC**Model and Item-Fit Statistics*

Item	a ^a	δ_1	δ_2	δ_3	χ^2	DF	χ^2 / DF	Z	Prob.
3	1.386	-2.548	0.863	3.277	27.86	26	1.07	0.26	0.426
14	1.165	-2.146	0.017	2.054	20.11	26	0.77	-0.82	0.500
15	1.300	-2.807	0.131	3.054	35.57	26	1.37	1.33	0.484
16	2.002	-1.681	1.297	3.992	24.10	26	0.93	-0.26	0.369
27	0.876	-1.665	0.434	2.110	29.82	26	1.15	0.53	0.445
28	1.053	-1.941	0.431	2.063	67.88	26	2.61	5.81	0.460
29	1.690	-2.106	0.889	3.401	34.22	26	1.32	1.14	0.411
32	0.880	-2.074	0.214	1.989	38.31	26	1.47	1.71	0.483
40	0.904	-2.925	-0.057	2.170	20.11	26	0.77	-0.82	0.521
41	1.087	-1.501	1.161	3.213	61.08	26	2.35	4.86	0.365
42	2.190	-2.939	1.207	4.405	18.79	26	0.72	-1.00	0.412

Note: Bolded items have a Q1 beyond the critical value of $|z| = 4.6$ and do not fit the specified IRT model.

^a Items have been scaled using a factor of 1.702.

* Items with an asterisk (*) have a $\chi^2/df > 3$ therefore they do not fit the specified IRT model and are poorly calibrated.

Test Information Function and Standard Error of Measurement. Plots of the

TIF and SEM for the SR-VCI are in Figure 4. The TIF for the SR-VCI revealed that the measurement accuracy of this subscale with $I(\theta) > 4.0$ is best between theta values of $-3.0 < \theta < 3.0$.

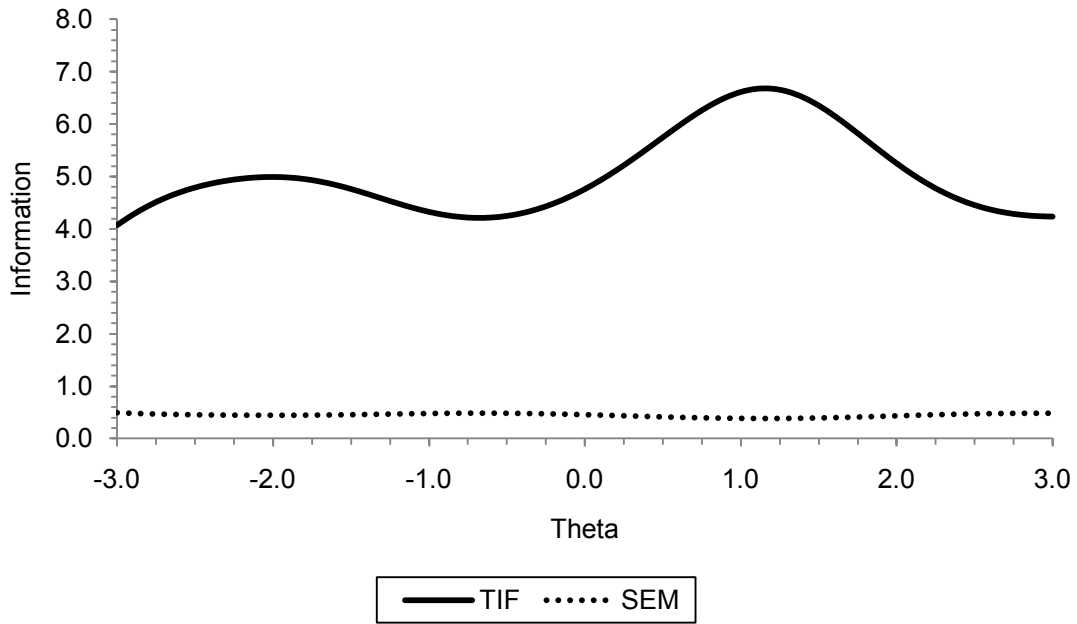


Figure 4. Test Information Function (TIF) and Standard Error of Measurement (SEM) for the SR-VCI.

Self-Efficacy for Self-Regulated Learning (SE-SRL)

Descriptive statistics. Results of the classical analysis of the SE-SRL are in Table 8. None of the items on this scale had a *CITC* < .25, had good overall discrimination, and differentiated well between students who stated how confident they felt performing a particular task. Item response frequencies are also listed in Table 8.

Table 8

Classical Item Analysis of Self-Efficacy for Self-Regulated Learning Scale ($\alpha = .87$, $CI_{95} = .85, .88$)

Item	M ^a	SD	CITC ^b	α^c	Category ^d						
					1	2	3	4	5	6	7
1	5.670	1.506	0.485	0.876	16	16	48	59	184	119	334
2	4.081	1.394	0.573	0.874	39	44	186	184	233	49	41
3	4.536	1.256	0.689	0.871	17	19	113	196	300	75	56
4	4.822	1.448	0.384	0.879	25	28	81	126	289	120	107
5	3.996	1.578	0.455	0.877	67	59	162	180	194	58	56
6	4.500	1.371	0.621	0.872	27	22	115	202	262	78	70
7	4.634	1.407	0.582	0.873	23	25	104	179	265	90	90
8	4.465	1.325	0.586	0.873	25	26	115	199	268	94	49
9	4.537	1.515	0.524	0.875	34	33	121	154	259	78	97
10	4.329	1.385	0.646	0.871	37	29	124	210	257	66	53
11	3.479	1.656	0.475	0.877	110	117	185	147	135	36	46

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

^a Item mean is a CTT indicator of difficulty. ^b Indicates item discrimination. ^c α if item is deleted; ^d 1 = *not well at all*; 3 = *not too well*; 5 = *pretty well*; 7 = *very well*.

Exploratory factor analysis. An EFA was used to assess latent dimensionality of the SE-SRL given that the population used for this study was post-secondary students and the original validation study was with school age children (Zimmerman, et al., 1992b). Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA of this data set revealed a one-factor structure of self-efficacy for self-regulated learning (as based on the Scree plot):. The internal consistency estimates for the SE-SRL subscale ($\alpha = 0.87$, $CI_{95} = .85, .88$) were above the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). The factor structure of the SE-SRL is reported in Table 9.

Table 9

Rotated Structure Matrices for Self-Efficacy for Self-Regulated Learning, Communalities, Means, and Standard Deviations

Item	Factor 1	h^2	M	SD
1	.607	.429	5.67	1.506
2	.711	.542	4.08	1.394
3	.813	.677	4.54	1.256
4	.469	.264	4.82	1.448
5	.480	.439	4.00	1.578
6	.770	.594	4.50	1.371
7	.727	.528	4.63	1.407
8	.540	.298	4.47	1.325
9	.626	.394	4.54	1.515
10	.784	.627	4.33	1.385
11	.439	.269	3.48	1.656

Note: AMS = Academic Motivation Scale; h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Assessment of local dependence. Parameter estimations of items on the SE-SRL are presented in Table 10. There was one violation of dimensionality where the Q_3 comparison is significant at $p < 0.01$. Items 6 and 7 are locally dependent. These items were revised for Sample 2 to improve dimensionality.

Estimation of IRT model-fit parameters. All items listed in Table 10 fit the specified IRT model and did not have values outside the accepted Q_1 range of $|z| = 4.6$. Items 1, 4, 5, 8, 9, and 11 had low discrimination values ($a < .75$) and were revised for Sample 2.

Table 10

Estimated Item Parameters for Self-Efficacy for Self-Regulated Learning Using the 2PPC Model and Item-Fit Statistics

Item	a ^a	δ_1	δ_2	δ_3	δ_4	δ_5	δ_6	χ^2	DF	χ^2/DF	Z	Prob.
1	0.72	-1.14	-1.92	-0.78	-1.46	0.37	-0.79	37.01	53	0.70	-1.55	0.78
2	1.09	-1.48	-2.24	-0.28	-0.01	2.35	1.66	48.57	53	0.92	-0.43	0.51
3	1.98	-3.67	-4.10	-1.79	-0.48	2.61	2.95	44.48	53	0.84	-0.83	0.59
4	0.40	-0.51	-1.33	-0.59	-0.86	0.97	0.34	53.98	53	1.02	0.09	0.64
5	0.35	-0.10	-1.14	-0.14	-0.02	1.36	0.30	64.76	53	1.22	1.14	0.50
6	1.39	-1.92	-3.03	-1.27	-0.26	1.96	1.74	45.88	53	0.87	-0.69	0.58
7	1.09	-1.72	-2.48	-1.11	-0.46	1.54	1.08	43.02	53	0.81	-0.97	0.61
8	0.59	-0.72	-1.91	-0.75	-0.28	1.30	1.18	73.04	53	1.38	1.95	0.58
9	0.70	-0.79	-1.82	-0.51	-0.53	1.47	0.37	63.34	53	1.20	1.00	0.59
10	1.56	-2.00	-2.90	-1.22	-0.07	2.39	2.31	43.03	53	0.81	-0.97	0.55
11	0.33	-0.22	-0.53	0.24	0.18	1.50	0.04	54.29	53	1.02	0.13	0.41

Note: Bolded items have a Q1 beyond the critical value of $|z| = 4.6$ and do not fit the specified IRT model.

^a Items have been scaled using a factor of 1.702.

* Items with an asterisk (*) have a $\chi^2/df > 3$ therefore they do not fit the specified IRT model and are poorly calibrated.

Test Information Function and Standard Error of Measurement. Plots of the TIF and SEM for the SE-SRL are in Figure 5. The TIF for the SE-SRL revealed that the measurement accuracy of this subscale with Information (I) > 6.0 is best between theta values of $-3.0 < \theta < 3.0$.

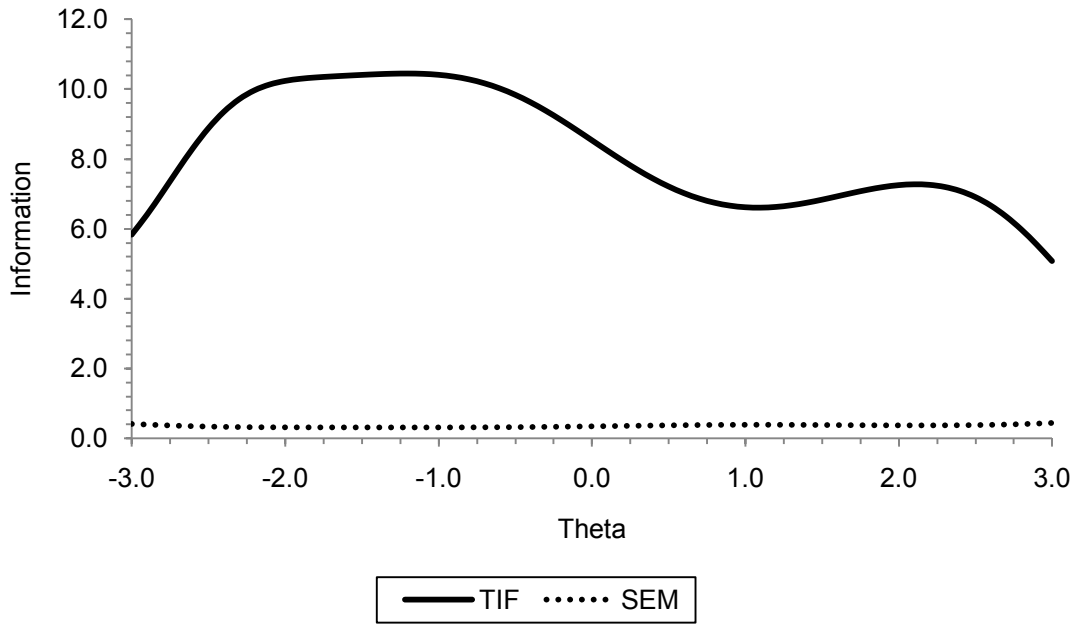


Figure 5. Test Information Function (TIF) and Standard Error of Measurement (SEM) for the SE-SRL.

Summary

Intentionality and forethought. A three factor model was revealed in the EFA of the AMS: Intrinsic motivation ($\alpha = 0.92$, $CI_{95} = .91, .93$), extrinsic motivation ($\alpha = 0.95$, $CI_{95} = .84, .87$), and amotivation ($\alpha = 0.80$, $CI_{95} = .78, .83$). Several items theoretically associated with extrinsic motivation (7 items) loaded on the intrinsic motivation factor. There were eight violations of local dependence on the extrinsic motivation scale and four violations on the intrinsic motivation scales. These items were revised for Sample 2. The four items on the amotivation scale were removed due to their lack of fit to the IRT model. Two items on the amotivation scale were also identified as poorly calibrated as they had a $\chi^2/df > 3$. Five items on the extrinsic motivation scale reported poor discrimination ($\alpha < .75$). The plots of the TIF and SEM for intrinsic motivation had the

best measurement precision with $I(\theta) > 6.0$ between theta values of $-2.5 < \theta < 2.5$. The plots of the TIF and SEM for extrinsic motivation had the best measurement precision with $I(\theta) > 6.0$ between theta values of $-3.0 < \theta < 1.0$.

Self-Regulation. A single factor model was revealed in the EFA for SR-VCI: Self-regulation ($\alpha = .87$, $CI_{95} = .85, .88$). There were two violations of local dependence. Two items on the scale did not fit the IRT model and were removed. Five items had low discrimination values ($a < .75$). The plots of the TIF and SEM for self-regulation had the best measurement precision with $I(\theta) > 4.0$ between theta values of $-3.0 < \theta < 3.0$.

Self-Efficacy. A single factor model was revealed in the EFA for SE-SRL: Self-efficacy ($\alpha = .87$, $CI_{95} = .85, .88$). There was one violation of local dependence. Six items had low discrimination values ($a < .75$). The plots of the TIF and SEM for self-efficacy had the best measurement precision with $I(\theta) > 6.0$ between theta values of $-3.0 < \theta < 3.0$.

Sample 2

The following changes were made to the item pool for administration to Sample 2. First, all items that violated the local dependence assumption and had low discrimination values were revised. Second, all items that did not fit the IRT model were removed. Third, items on the intentionality, forethought, and self-regulation scales were converted to a single Likert style inventory where students indicate to what extent each of the statements corresponds to them, using a 5-point scale (1 = *does not correspond* and 5 = *corresponds exactly*). To improve the discrimination of items on the self-efficacy scale the original Likert scale was changed from 7 options to 5 (1 = *not confident* and 5 = *extremely confident*). The instructions for each subscale were adapted to reflect the

aforementioned changes. Finally, since the intentionality scale did not reveal any aspects of planfulness in the EFA, 12 items from the MDMQ (Mann, et al., 1997) were modified to meet this requirement. An example of a planfulness item is “I consider how best to carry out a decision”. After these changes, there were 61 items remaining in the pool.

Method

Participants. Data were collected via an anonymous Web survey from a convenience sample of second year undergraduate students ($N = 1097$) enrolled in five sections of organic chemistry taught by one of three instructors in the fall semester of 2008 at a Canadian university. Students recruited for voluntary participation were given a bonus mark for participating (0.25% bonus grade) and had two weeks to complete the survey. The response rate was 77.5% ($N = 850$, 517 Female). Approximately 93% of the respondents were between the ages of 18 and 23.

Measures. The instructions and response scales were as follows.

- Intentionality (12 items) and self-regulation (11): “Using the scale below indicate to what extent each of the following items presently corresponds to you”; (1 = *does not correspond* and 5 = *corresponds exactly*).
- Forethought (27): “Using the scale below indicate to what extent each of the following items presently corresponds to one of the reasons why you go to University”; (1 = *does not correspond* and 5 = *corresponds exactly*).
- Self-reflectiveness (11 items): “Using the scale below rate your degree of confidence with each of the tasks”; (1 = *not confident* and 5 = *extremely confident*).

Data Analysis

The same analytical procedures from Sample 1 were used with Sample 2.

Results

Intention

Descriptive statistics. Results of the classical analysis of the intentionality scale are in Table 11. None of the items on this scale had a *CITC* < .25 indicating that all items had good overall discrimination and differentiated well between students of differing abilities. Item response frequencies are also listed in Table 11.

Table 11

Classical Item Analysis of the Intentionality Scale ($\alpha = .76$, $CI_{95} = .73, .78$)

Item	M ^a	SD	CITC ^b	α^c	Category ^d				
					1	2	3	4	5
4r	3.41	1.038	.421	.831	21	157	255	283	134
5r	3.78	1.102	.434	.830	23	101	187	266	273
8	3.33	.928	.592	.816	20	139	308	310	73
9	3.34	.934	.613	.814	30	112	321	314	73
10	3.56	.963	.486	.825	17	104	251	344	134
11	3.28	.782	.619	.816	18	88	409	304	31
12	3.76	.840	.468	.826	7	48	237	404	154
13	3.74	.788	.548	.821	6	44	233	447	120
16	3.61	.810	.469	.826	8	59	282	406	95
17r	3.52	1.047	.459	.827	22	122	268	267	171
18	3.77	.837	.455	.827	5	51	232	405	157
23	3.77	.906	.471	.826	11	64	209	389	177

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

^a Item mean is a CTT indicator of difficulty. ^b Indicates item discrimination. ^c α if item is deleted; ^d 1 = does not correspond; 2 = corresponds a little; 3 = corresponds moderately; 4 = corresponds a lot; 5 = corresponds exactly.

Exploratory factor analysis. An EFA was used to assess latent dimensionality given that the population used for this study was post-secondary students as opposed to school age children and adults in the original validation studies (Mann, et al., 1997; Tunistra, et al., 2000), and only selected items from these instruments were modified. Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a two-factor structure of intentionality (as based on the Scree plot): Planfulness ($\alpha = .82$, $CI_{.95} = .80, .84$) and decision confidence ($\alpha = .82$, $CI_{.95} = .80, .84$). Internal consistency estimates for the subscales were above the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). The factor structure of the intentionality scale is reported in Table 12. Correlations between the planfulness and decision confidence subscales are significant at $r = .357, p < .01$. From this point forward analyses of each factor on the intentionality scale were completed separately.

Table 12

Rotated Factor Pattern and Structure Matrices for the Intentionality Scale, Communalities, Means, and Standard Deviations

Item	Factor 1	Factor 2	h^2	M	SD
Factor 1: Planfulness					
12	.768		.593	3.76	.840
18	.745		.556	3.77	.837
23	.740		.552	3.77	.906
13	.728	.199	.569	3.74	.788
16	.662	.151	.461	3.61	.810
10	.638	.197	.446	3.56	.963
Factor 2: Decision Confidence					
8	.196	.790	.663	3.33	.928
9	.242	.777	.662	3.34	.934
17r		.737	.545	3.52	1.047
5r		.686	.473	3.78	1.102
4r		.676	.458	3.41	1.038
11	.411	.612	.544	3.28	.782

Note: h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Assessment of local dependence. Parameter estimations are presented in Table 13. Items 4 and 5 violated the unidimensionality assumption where the Q_3 comparison was significant at $p < 0.01$. Item 5 had the greater discrimination value and were kept for the final instrument.

Estimation of IRT model-fit parameters. Bolded items in Table 13 indicated that these items do not fit the specified IRT model and had values outside the accepted range of $|z| = 4.6$. Items 4r, 5r, 10, 16, and 17r were removed due to their lack of fit to the IRT model as they had a $\chi^2/df > 3$.

Table 13

Estimated Item Parameters for the Intentionality Scale Using the 2PPC Model and Item-Fit Statistics

Item	a ^a	δ1	δ2	δ3	δ4	χ ²	DF	χ ² /DF	Z	Prob.
Planfulness										
10	0.962	-2.958	-1.511	-0.396	1.521	133.63	35	*3.818	11.79	0.639
12	1.723	-4.904	-3.328	-1.026	2.050	46.24	35	1.321	1.34	0.691
13	1.676	-4.942	-3.367	-1.108	2.474	37.11	35	1.060	0.25	0.686
16	1.163	-3.687	-2.494	-0.515	2.260	72.97	35	2.085	4.54	0.653
18	1.568	-5.033	-3.059	-0.999	1.891	60.58	35	1.731	3.06	0.694
23	1.478	-4.048	-2.547	-1.029	1.605	68.39	35	1.954	3.99	0.693
Decision Confidence										
4r	0.603	-2.542	-0.736	-0.061	1.118	79.94	35	2.284	5.37	0.604
5r	0.619	-2.112	-0.976	-0.427	0.221	144.41	35	*4.126	13.08	0.696
8	2.965	-6.634	-2.933	0.424	5.143	58.07	35	1.659	2.76	0.581
9	3.093	-6.093	-3.368	0.413	5.330	56.12	35	1.603	2.52	0.585
11	1.368	-3.492	-2.403	0.578	3.964	34.25	35	0.979	-0.09	0.571
17r	0.832	-2.626	-1.250	0.006	0.980	127.80	35	*3.651	11.09	0.630

Note: Bolded items have a Q1 beyond the critical value of $|z| = 4.6$ and do not fit the specified IRT model.

^a Items have been scaled using a factor of 1.702.

* Items with an asterisk (*) have a $\chi^2/df > 3$ therefore they do not fit the specified IRT model and are poorly calibrated.

Test Information Function and Standard Error of Measurement. Plots of the TIF and SEM for planfulness are in Figure 6. The TIF for planfulness revealed that the measurement accuracy of this subscale with $I(\theta) > 3.5$ is best between theta values of $-2.0 < \theta < 2.0$. Although the information this scale provides is slightly lower than desired, it is close to the target $I(\theta) = 4$ and is acceptable.

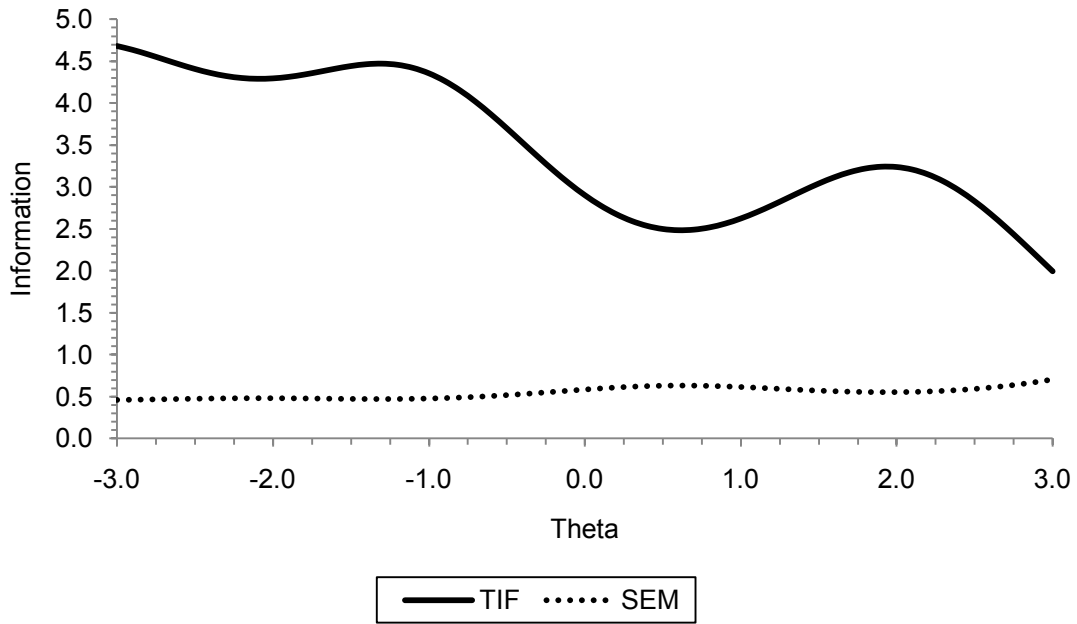


Figure 6. Test Information Function (TIF) and Standard Error of Measurement (SEM) for Planfulness.

Plots of the TIF and SEM for decision confidence are in Figure 7. The TIF for decision confidence revealed that the measurement accuracy of this subscale with $I(\theta) > 4.0$ is best at theta values of $\theta = -3.0$, and between $-3.0 < \theta < -0.5$. Further revisions of this scale are necessary to improve its assessment of a broader range of abilities.

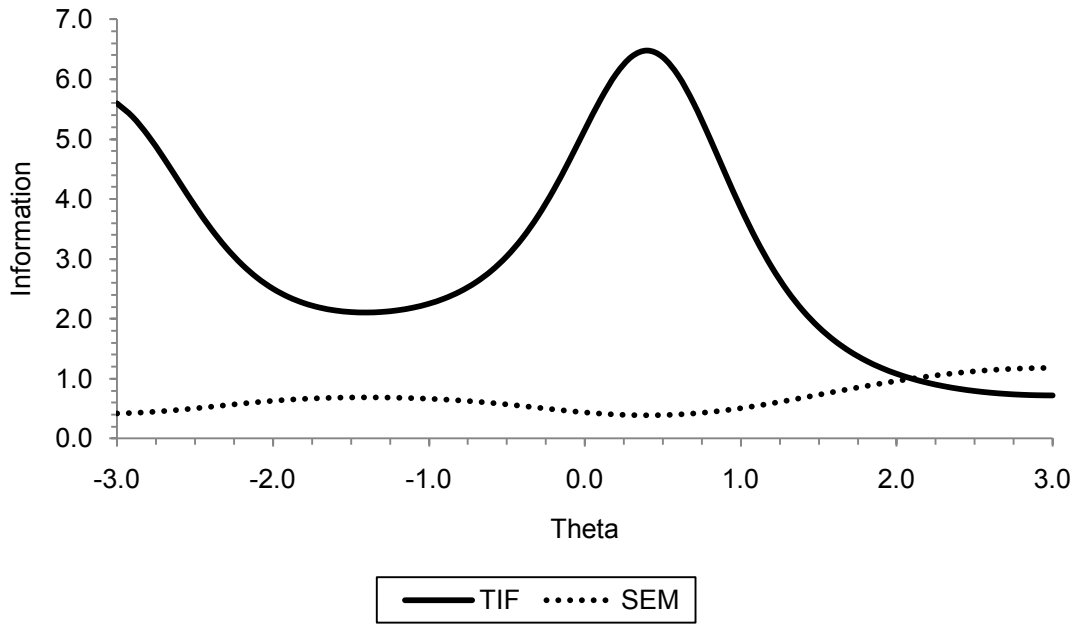


Figure 7. Test Information Function (TIF) and Standard Error of Measurement (SEM) for Decision Confidence.

Forethought

Descriptive statistics. Results of the classical analysis of the Forethought scale are in Table 14. None of the items on this scale had a *CITC* < .25, indicating that all items had good overall discrimination and differentiated well between students of differing abilities. Item response frequencies are also listed in Table 14.

Table 14

Classical Item Analysis of the Forethought Scale ($\alpha = .92$, $CI_{95} = .91, .92$)

Item	M ^a	SD	CITC ^b	α^c	Category ^d				
					1	2	3	4	5
1	3.20	1.094	.359	.915	71	139	272	281	87
2	3.74	.907	.542	.912	11	59	248	357	175
3	3.80	.923	.562	.912	11	66	201	378	194
4	2.98	1.090	.516	.912	76	220	264	225	65
5	3.92	.920	.497	.913	13	48	174	374	241
6	3.32	1.046	.597	.911	46	128	295	274	107
7	3.23	1.225	.263	.917	96	134	235	246	139
8	3.28	1.158	.439	.914	76	132	245	273	124
9	3.65	.976	.568	.911	19	84	238	342	167
10	3.74	.968	.600	.911	23	62	212	368	185
11	2.78	1.152	.462	.913	132	222	253	185	58
12	3.18	1.116	.610	.910	73	153	271	258	95
13	3.89	.915	.552	.912	14	51	172	393	220
14	2.93	1.261	.470	.913	138	190	214	207	101
15	3.35	1.130	.472	.913	66	122	238	298	126
16	3.55	1.033	.643	.910	35	92	248	324	151
17	2.63	1.220	.383	.915	191	217	208	180	54
18	3.40	1.099	.607	.911	54	116	252	295	133
19	3.31	1.076	.558	.911	52	134	269	285	110
20	3.44	1.026	.635	.910	37	111	260	322	120
21	3.22	1.265	.381	.915	104	141	217	236	152
22	2.32	1.204	.415	.914	279	218	199	109	45
23	3.76	.944	.566	.911	17	64	214	370	185
24	3.55	.977	.602	.911	29	74	285	323	139
25	2.80	1.177	.550	.912	140	204	261	178	67
26	3.45	1.062	.561	.911	46	105	253	315	131
27	3.72	.998	.617	.911	29	62	213	357	189

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

^a Item mean is a CTT indicator of difficulty. ^b Indicates item discrimination. ^c α if item is deleted; ^d 1 = does not correspond; 2 = corresponds a little; 3 = corresponds moderately; 4 = corresponds a lot; 5 = corresponds exactly.

Exploratory factor analysis. Based on findings from Sample 1, the following items were revised: 3, 7, 10, 14, 17, 21, and 25. An EFA was used to assess latent dimensionality because so many items were revised. Factors were extracted using

Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a two-factor structure (as based on the Scree plot): Intrinsic motivation ($\alpha = .92$, $CI_{95} = .91, .93$) and extrinsic motivation ($\alpha = .95$, $CI_{95} = .84, .87$). All calculated internal consistencies were above the acceptance threshold of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). The factor structure of the forethought scale is reported in Table 15.

Correlations among the extrinsic and intrinsic motivation were $r = .217$, $p < .01$. Several items in the literature that represented extrinsic motivation (items 5, 10, 12, 18, 19, 24, 26, and 27) loaded on factor 1, intrinsic motivation. These items were removed from subsequent analysis because of this theoretical discrepancy.

Table 15

Rotated Structure Matrices for Forethought, Communalities, Means, and Standard Deviations

Item	Factor 1	Factor 2	h^2	M	SD
Intrinsic Motivation					
20	.726	-.188	.515	3.22	1.265
16	.719		.526	3.55	1.033
6	.692	-.205	.538	3.32	1.046
23	.690	-.377	.640	3.76	.944
9	.681	-.330	.698	3.65	.976
13	.679	-.377	.671	3.89	.915
24	.664		.472	3.55	.977
10	.663		.534	3.74	.968
3	.661	-.220	.574	3.80	.923
2	.657	-.326	.683	3.74	.907
27	.653	.153	.480	3.72	.998
26	.651	-.184	.604	3.45	1.062
19	.644	-.161	.650	3.31	1.076
18	.643	.148	.546	3.40	1.099
12	.638	.148	.448	3.18	1.116
25	.622	-.147	.648	2.80	1.177
4	.586	-.116	.521	2.98	1.090
5	.547		.501	3.92	.920
11	.546	-.220	.590	2.78	1.152
Extrinsic Motivation					
	.377	.667	.678	3.28	1.158
8					
21	.324	.639	.515	3.22	1.265
14	.412	.620	.573	2.93	1.261
22	.357	.608	.565	2.32	1.204
7	.209	.600	.445	3.23	1.225
1	.314	.564	.578	3.20	1.094
15	.436	.534	.482	3.35	1.130
17	.358	.426	.428	2.63	1.220

Note: h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Assessment of local dependence. Parameter estimations are presented in Table 16. There were four violations of dimensionality (items 16, 20; and 11, 25) where Q_3

comparisons were significant at $p < 0.01$. Items 20 and 25 were kept for the final instrument because they had the highest discrimination for each pair.

Estimation of IRT model-fit parameters. Bolded items in Table 16 indicated that these items do not fit the specified IRT model and had values outside the accepted range of $|z| = 4.6$. Items 11, 17, 22, and 25 were removed due to their lack of fit to the IRT model.

Table 16

Estimated Item Parameters for the Forethought Scale Using the 2PPC Model and Item-Fit Statistics

Item	a ^a	δ1	δ2	δ3	δ4	χ ²	DF	χ ² /DF	Z	Prob.
Intrinsic Motivation										
2	1.81	-4.93	-3.18	-0.83	1.79	32.55	35	0.93	-0.29	0.68
3	1.25	-3.79	-2.22	-0.97	1.27	45.63	35	1.30	1.27	0.70
4	0.72	-1.60	-0.38	0.32	1.85	54.34	35	1.55	2.31	0.49
6	1.30	-2.54	-1.56	0.14	2.02	40.19	35	1.15	0.62	0.58
9	2.03	-4.78	-2.83	-0.77	2.03	35.92	35	1.03	0.11	0.66
11	0.71	-0.98	-0.26	0.54	1.83	139.37	35	*3.98	12.47	0.44
13	1.97	-4.86	-3.32	-1.60	1.48	29.06	35	0.83	-0.71	0.72
16	1.27	-2.61	-1.87	-0.40	1.57	36.08	35	1.03	0.13	0.63
20	1.51	-3.07	-1.86	-0.28	2.16	44.06	35	1.26	1.08	0.61
23	1.91	-4.57	-3.04	-1.09	1.78	40.62	35	1.16	0.67	0.69
25	0.81	-0.93	-0.40	0.64	1.76	109.03	35	*3.12	8.85	0.45
Extrinsic Motivation										
1	0.90	-1.54	-1.02	0.10	1.85	29.81	35	0.85	-0.62	0.55
7	0.65	-0.84	-0.78	0.02	0.95	91.02	35	2.60	6.70	0.56
8	1.47	-2.20	-1.32	0.04	1.94	51.12	35	1.46	1.93	0.57
14	1.15	-1.23	-0.38	0.36	1.73	60.97	35	1.74	3.10	0.48
15	0.95	-1.60	-1.11	-0.17	1.48	56.00	35	1.60	2.51	0.58
17	0.52	-0.36	0.01	0.32	1.60	75.20	35	2.15	4.80	0.41
21	0.96	-1.17	-0.79	0.03	1.08	68.22	35	1.95	3.97	0.55
22	1.08	-0.23	0.21	1.29	2.25	88.91	35	2.54	6.44	0.33

Note: Bolded items have a Q1 beyond the critical value of $|z| = 4.6$ and do not fit the specified IRT model.

^a Items have been scaled using a factor of 1.702.

* Items with an asterisk (*) have a $\chi^2/df > 3$ therefore they do not fit the specified IRT model and are poorly calibrated.

Test Information Function and Standard Error of Measurement. Plots of the TIF and SEM for intrinsic motivation are in Figure 8. The TIF for intrinsic motivation revealed that the measurement accuracy of this subscale with $I(\theta) > 6.0$ is best between theta values of $-3.0 < \theta < 2.5$. These values are similar to Sample 1.

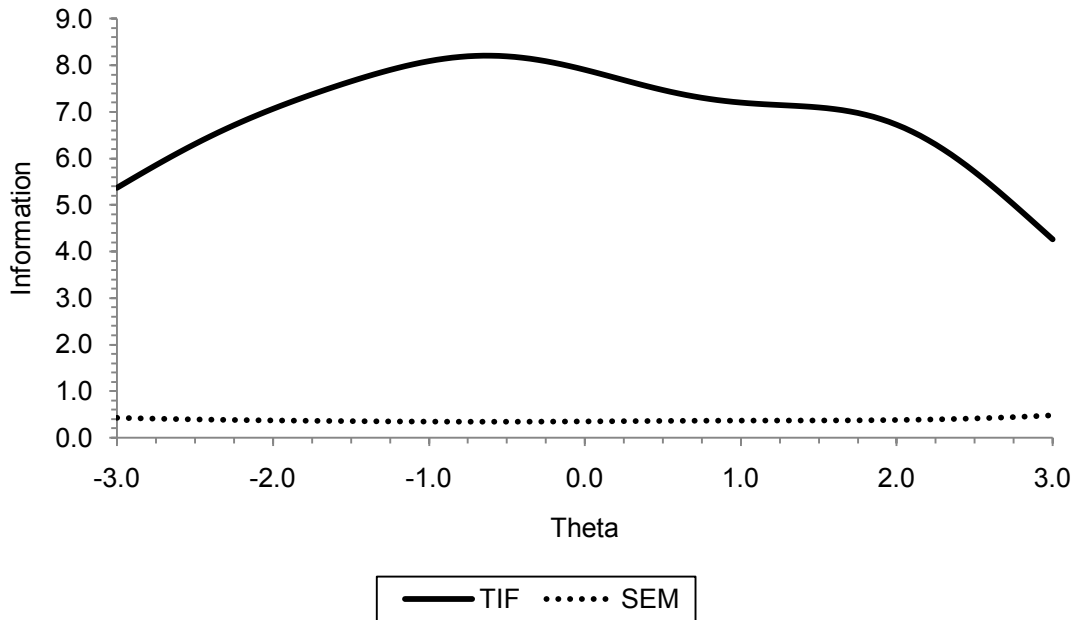


Figure 8. Test Information Function (TIF) and Standard Error of Measurement (SEM) for Intrinsic Motivation.

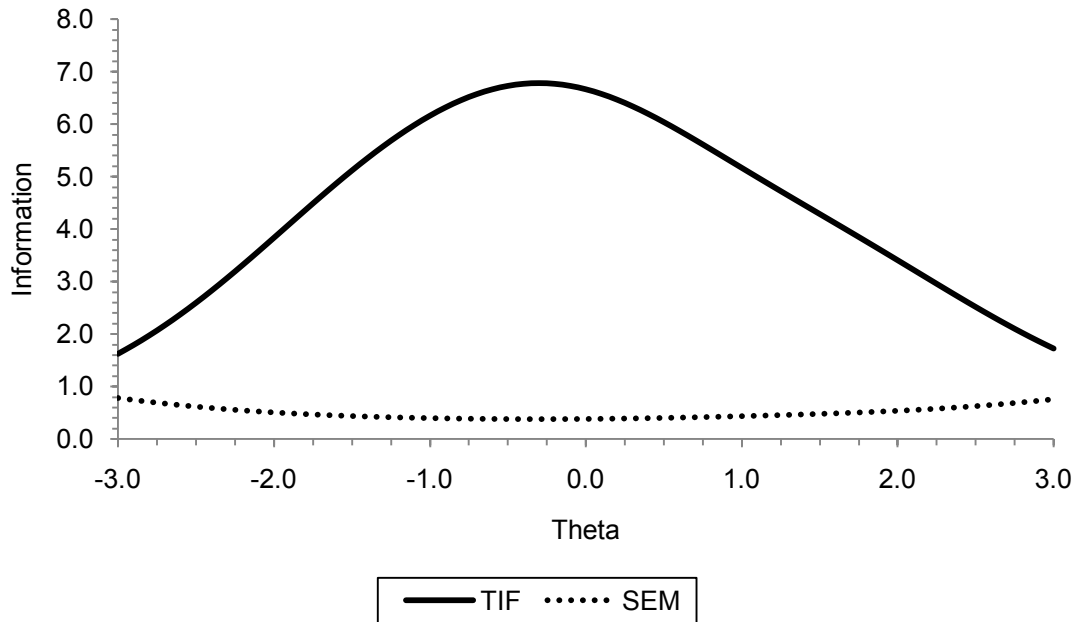


Figure 9. Test Information Function (TIF) and Standard Error of Measurement (SEM) for Extrinsic Motivation.

Plots of the TIF and SEM for extrinsic motivation are in Figure 9. The TIF for extrinsic motivation revealed that the measurement accuracy of this subscale with $I(\theta) > 4.0$ is best between theta values of $-2.0 < \theta < 2.0$. These values are an improvement over Sample 1.

Self-Regulation

Descriptive statistics. Results of the classical analysis of the self-regulation scale are in Table 17. None of the items on this scale had a $CITC < .25$, indicating that all had good overall discrimination and differentiated well between students of differing abilities. Item response frequencies are also listed in Table 17.

Table 17

Classical Item Analysis of the Self-Regulation Scale ($\alpha = .91$, $CI_{95} = .90, .92$)

Item	M ^a	SD	CITC ^b	α^c	Category ^d				
					1	2	3	4	5
1	2.81	1.028	.649	.906	83	250	306	166	45
2	3.02	1.069	.661	.905	65	214	279	224	68
3	3.04	.997	.713	.903	56	189	317	240	48
4	2.72	1.104	.743	.901	127	241	269	167	46
5	3.06	1.072	.635	.906	78	170	283	260	59
6	2.94	1.087	.632	.907	83	221	272	214	60
7	2.79	1.054	.684	.904	94	258	276	180	42
8	3.04	1.005	.657	.905	54	200	306	239	51
9	3.27	.921	.595	.908	26	140	318	308	58
10	2.70	.966	.579	.909	95	259	322	155	19
11	2.92	1.031	.763	.900	72	230	289	215	44

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

Exploratory factor analysis. All items were revised to include a Likert scale that was the same as the intentionality and forethought subscales. An EFA was used to assess latent dimensionality as a result of this change. Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a one-factor structure (as based on the Scree plot): Self-regulation. In addition, internal consistency estimate for the self-regulation subscale ($\alpha = .91$, $CI_{95} = .90, .92$) was above acceptable levels $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). Note that the internal consistency increased as a result of changing the Likert scale. The factor structure of the self-regulation subscale is reported in Table 18.

Table 18

*Rotated Factor Pattern and Structure Matrices for the Self-Regulation Scale,**Communalities, Means, and Standard Deviations*

Item	Factor 1	Factor 2	h^2	M	SD
1	.801	-.117	.521	2.81	1.028
2	.793	-.280	.526	3.02	1.069
3	.744		.553	3.04	.997
4	.717		.707	2.72	1.104
5	.697	.308	.480	3.06	1.072
6	.696	-.204	.485	2.94	1.087
7	.687	-.220	.524	2.79	1.054
8	.668	-.186	.581	3.04	1.005
9	.665	.207	.538	3.27	.921
10	.636	.365	.506	2.70	.966
11	.620	.347	.655	2.92	1.031

Note: h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Assessment of local dependence. Parameter estimations of items on the self-regulation scale are presented in Table 19. There were no significant violations of local independence as assessed by Q_3 comparisons at $p < 0.01$.

Estimation of IRT model-fit parameters. All items listed in Table 19 have good discrimination ($a < .9$) and fit the 2PPC IRT model selected. Item 3 could not be estimated by PARDUX due to an estimation failure.

Table 19

Estimated Item Parameters for the Self-regulation subscale Using the 2PPC Model and Item-Fit Statistics

Item	a ^a	δ_1	δ_2	δ_3	δ_4	χ^2	DF	χ^2/DF	Z	Prob.
1	1.26	-2.36	-0.48	1.16	2.76	31.45	35	0.90	-0.42	0.45
2	1.17	-2.49	-0.68	0.55	2.31	84.93	35	2.43	5.97	0.51
3 ^c	--	--	--	--	--	--	--	--	--	--
4	1.96	-2.49	-0.43	1.51	3.82	45.19	35	1.29	1.22	0.43
5	1.08	-1.95	-0.92	0.34	2.47	44.79	35	1.28	1.17	0.52
6	1.00	-1.95	-0.49	0.55	2.22	59.02	35	1.69	2.87	0.49
7	1.49	-2.49	-0.38	1.13	3.27	53.93	35	1.54	2.26	0.45
8	1.09	-2.57	-0.84	0.54	2.61	59.42	35	1.70	2.92	0.51
9	0.93	-2.95	-1.33	0.14	2.42	41.79	35	1.19	0.81	0.57
10	0.91	-1.76	-0.35	1.16	3.16	52.38	35	1.50	2.08	0.43
11	2.36	-4.06	-1.04	1.30	4.62	32.26	35	0.92	-0.33	0.48

Note: Bolded items have a Q1 beyond the critical value of $|z| = 4.6$ and do not fit the specified IRT model.

^a Items have been scaled using a factor of 1.702. ^c Item could not be estimated because of an estimation failure

Test Information Function and Standard Error of Measurement. Plots of the TIF and SEM for self-regulation are in Figure 10. The TIF for self-regulation revealed that the measurement accuracy of this subscale with $I(\theta) > 6.0$ is best between theta values of $-2.0 < \theta < 2$. This was an improvement over Sample 1.

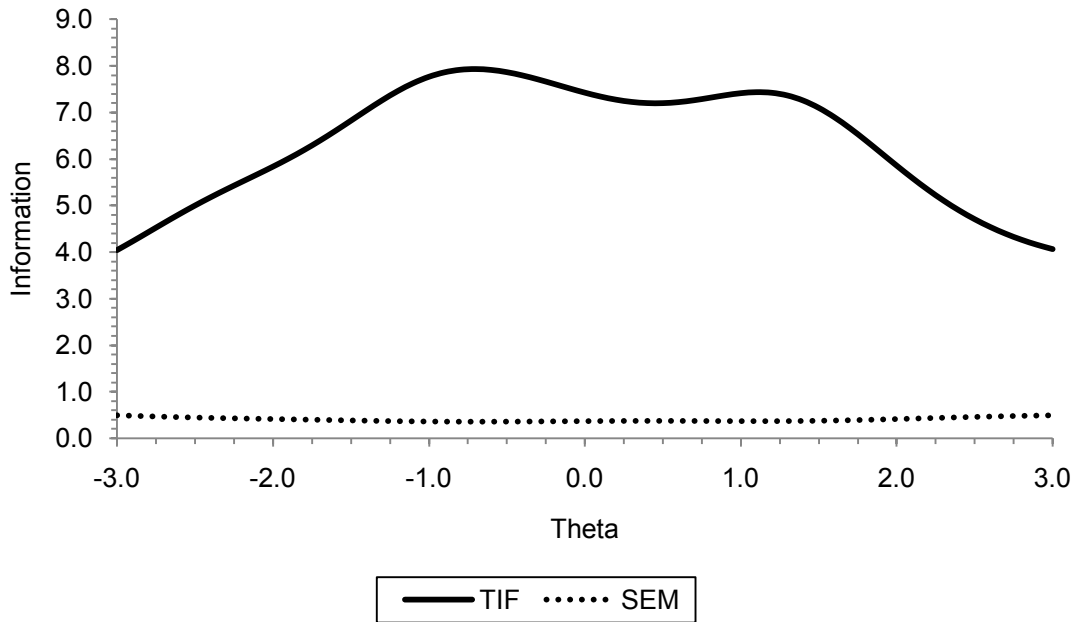


Figure 10. Test Information Function (TIF) and Standard Error of Measurement (SEM) for Self-regulation.

Self-Efficacy

Descriptive statistics. Results of the classical analysis of the self-reflectiveness scale are in Table 20. None of the items on this scale had a *CITC* < .25 indicating that all items had good overall discrimination and differentiated well between students who felt confident in performing a particular task. Item response frequencies are also listed in Table 20.

Table 20

Classical Item Analysis of Self-Reflectiveness Scale ($\alpha = .88$, $CI_{95} = .86, .89$)

Item	M ^a	SD	CITC ^b	α^c	Category ^d				
					1	2	3	4	5
1	4.04	.966	.450	.873	13	46	163	298	330
2	2.98	1.068	.601	.864	82	182	323	198	65
3	3.15	1.053	.617	.863	59	157	319	231	84
4	3.36	1.073	.594	.864	51	120	271	290	118
5	2.79	1.142	.467	.873	131	214	261	190	54
6	3.18	1.117	.685	.858	71	149	286	240	104
7	3.43	1.082	.699	.857	46	115	259	290	140
8	3.25	.983	.579	.865	43	127	333	272	75
9	3.41	1.073	.581	.865	40	130	261	283	136
10	3.16	1.036	.693	.858	58	146	324	244	78
11	2.61	1.178	.456	.874	180	215	271	122	62

Note: CITC = Corrected Item Total Correlation; Bolded items have a CITC < .25;

^a Item mean is a CTT indicator of difficulty. ^b Indicates item discrimination. ^c α if item is deleted; ^d 1 = *not confident*; 2 = *a little confident*; 3 = *moderately confident*; 4 = *very confident*; 5 = *extremely confident*.

Exploratory factor analysis. An EFA was used to assess latent dimensionality because the Likert scale was changed following the analysis with Sample 1 to a 5 point scale where students indicated their degree of confidence with each of the tasks (1 = *not confident* and 5 = *extremely confident*). Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a one-factor structure of self-efficacy (as based on the Scree plot). The internal consistency estimates for the self-reflectiveness subscale ($\alpha = .88$, $CI_{95} = .86, .89$) were above the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006). The factor structure of the self-reflectiveness scale is reported in Table 21.

Table 21

Rotated Structure Matrices for Self-Reflectiveness, Communalities, Means, and Standard Deviations

Item	Factor 1	h^2	M	SD
1	.484	.234	4.04	.966
2	.650	.422	2.98	1.068
3	.655	.429	3.15	1.053
4	.632	.400	3.36	1.073
5	.495	.245	2.79	1.142
6	.745	.556	3.18	1.117
7	.762	.580	3.43	1.082
8	.618	.382	3.25	.983
9	.629	.396	3.41	1.073
10	.746	.557	3.16	1.036
11	.483	.234	2.61	1.178

Note: AMS = Academic Motivation Scale; h^2 = communalities of the measured variables. Structure coefficients with values of .40 or greater are in bold.

Assessment of local dependence. Parameter estimations of items on the self-reflectiveness scale are presented in Table 22. There was one violation of local independence (items 3 and 4) where the Q_3 comparison was significant at $p < 0.01$. Item 3 was chosen for the final instrument because it had the greatest discrimination.

Estimation of IRT model-fit parameters. All items listed in Table 22 fit the specified IRT model and did not have values outside the accepted Q_I range of $|z| = 4.6$. Items identified during the Sample 1 analysis as having low discriminations, items 4 and 8, have improved. However, items 1, 5, and 11 still have low discrimination values and were removed from the final instrument.

Table 22

Estimated Item Parameters for Self-Reflectiveness Using the 2PPC Model and Item-Fit Statistics

Item	a ^a	δ_1	δ_2	δ_3	δ_4	χ^2	DF	χ^2/DF	Z	Prob.
1	0.65	-2.14	-1.76	-0.78	0.04	41.14	35	1.18	0.73	0.76
2	1.06	-1.75	-0.88	0.79	2.12	46.49	35	1.33	1.37	0.49
3	1.01	-1.99	-1.10	0.51	1.85	40.98	35	1.17	0.71	0.54
4	0.95	-1.87	-1.27	-0.02	1.52	42.36	35	1.21	0.88	0.59
5	0.58	-0.82	-0.28	0.49	1.70	45.70	35	1.31	1.28	0.45
6	1.76	-2.72	-1.46	0.47	2.41	32.76	35	0.94	-0.27	0.55
7	1.93	-3.49	-2.05	-0.11	2.17	37.22	35	1.06	0.27	0.61
8	0.96	-2.11	-1.39	0.32	2.04	63.95	35	1.83	3.46	0.56
9	1.01	-2.33	-1.23	-0.05	1.38	52.73	35	1.51	2.12	0.60
10	1.58	-2.75	-1.52	0.59	2.66	33.58	35	0.96	-0.17	0.54
11	0.52	-0.42	-0.26	0.98	1.09	69.30	35	1.98	4.10	0.40

Note: Bolded items have a Q1 beyond the critical value of $|z| = 4.6$ and do not fit the specified IRT model.

^a Items have been scaled using a factor of 1.702.

* Items with an asterisk (*) have a $\chi^2/df > 3$ therefore they do not fit the specified IRT model and are poorly calibrated.

Test Information Function and Standard Error of Measurement. Plots of the TIF and SEM for the SE-SRL are in Figure 11. The TIF for the self-reflectiveness scale revealed that the measurement accuracy of this subscale with $I(\theta) > 6.0$ is best between theta values of $-3 < \theta < 3$.

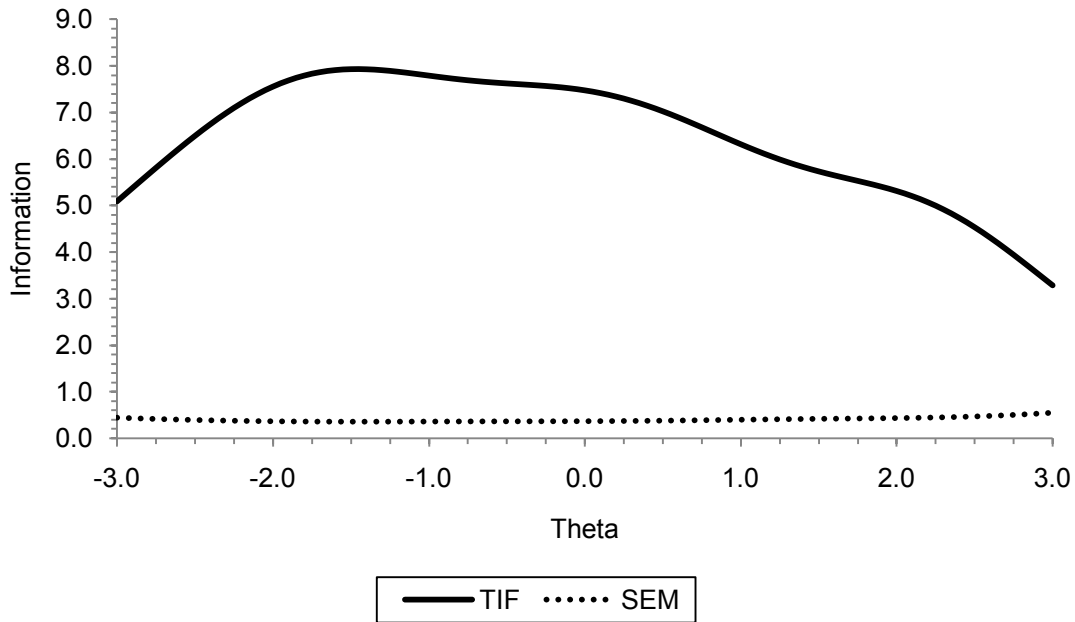


Figure 11. Test Information Function (TIF) and Standard Error of Measurement (SEM) for the Self-Reflectiveness Scale.

Summary

Intention. A two factor structure was revealed in the EFA of the intentionality scale: Planfulness (6 items, $\alpha = .82$, $CI_{.95} = .80, .84$) and decision confidence (6 items, $\alpha = .82$, $CI_{.95} = .80, .84$). A total of five items were removed due to their lack of fit to the IRT model: two from the planfulness scale, and three from the decision confidence scale. Three of these items were also identified as being poorly calibrated as they had a $\chi^2/df > 3$. The plots of the TIF and SEM for planfulness had the best measurement precision with $I(\theta) > 4$ between theta values of $-3.5 < \theta < 2.0$. The plots of the TIF and SEM for decision confidence had the best measurement precision with $I(\theta) > 4$ at theta of -3 and between theta values of $-.5 < \theta < .5$. This scale should be assessed with a different sample of students and refined to improve its measurement accuracy at a broader range of abilities.

Forethought. Based on the findings from Sample 1, 7 items were revised. A two factor structure was revealed in the EFA of the forethought scale: Intrinsic motivation ($\alpha = .92$, $CI_{95} = .91, .93$) and extrinsic motivation ($\alpha = .95$, $CI_{95} = .84, .87$). However, 8 of the items that loaded on intrinsic motivation were theoretically supposed to be associated with extrinsic motivation. These 8 items were removed from analysis because of this disparity. Three items on these subscales were removed due to their lack of fit to the IRT model. Two of these three items were also identified as poorly calibrated as they had a $\chi^2/df > 3$. After all of the removals, there were 7 items left on the intrinsic motivation scale and 9 items on the extrinsic motivation scale. The plots of the TIF and SEM for intrinsic motivation were similar to Sample 1 with the best measurement precision with $I(\theta) > 6$ between theta values of $-3.0 < \theta < 2.5$. The plots of the TIF and SEM for extrinsic motivation were improved over Sample 1 with the best measurement precision with $I(\theta) > 4$ between theta values of $-2.0 < \theta < 2$.

Self-regulation. Items on the self-regulation scale were revised to include the same Likert scale as the intentionality and forethought items. A single factor model was revealed in the EFA: Self-regulation ($\alpha = .91$, $CI_{95} = .90, .92$). There was a slight increase in internal consistency from Sample 1 and there were no violations of dimensionality. All items on this subscale fit the IRT model however one item could not be estimated due to an estimation failure. The plots of the TIF and SEM for self-regulation were improved over Sample 1 with the best measurement precision with $I(\theta) > 6$ between theta values of $-2.0 < \theta < 2.0$.

Self-efficacy. Items on the self-efficacy scale were revised to include a 5 point Likert scale asking students to rate their degree of confidence in completing a task. A

single factor model was revealed in the EFA: Self-efficacy ($\alpha = .88$, $CI_{95} = .86, .89$). Of the six items identified in Sample 1 as having low discrimination values ($a < .75$) three of them improved with Sample 2. The remaining three items were removed from the final instrument. The plots of the TIF and SEM for self-efficacy improved over Sample 1 with the best measurement precision with $I(\theta) > 6$ between theta values of $-3.0 < \theta < 3.0$.

The Agency for Learning Questionnaire

Following a process of selection outlined by Fletcher and Nusbaum (2010), two versions of the AFLQ are presented in Appendix A and Appendix B. Since Fletcher and Nusbaum (2010) used two independent data samples for cross validation which had an $N_{\text{total}} = 742$ further data collection for Sample 2 of the ALFQ research presented here was not warranted since $N_{\text{total}} = 850$. The Agency for Learning Questionnaire – Short Form (AFLQ-S, $\alpha = .90$, $CI_{95} = .89, .91$) and the Agency for Learning Questionnaire – Long Form (AFLQ-L, $\alpha = .93$, $CI_{95} = .92, .96$). The AFLQ-S has 28 items that measure agentic functioning along six dimensions: Intentionality – Planfulness (5 items), Intentionality – Decision Confidence (3 items), Forethought – Intrinsic Motivation (5 items), Forethought – Extrinsic Motivation (5 items), Self-Regulation – Self-Regulation (5 items), and Self-Reflectiveness – Self-Efficacy (5 items). The items on the AFLQ-S were selected based on their high discrimination values ($a > 1.0$). The AFLQ-L has 42 items that measure agentic functioning along six dimensions Intentionality – Planfulness (5 items), Intentionality – Decision Confidence (3 items), Forethought – Intrinsic Motivation (7 items), Forethought – Extrinsic Motivation (9 items), Self-Regulation – Self-Regulation (10 items), and Self-Reflectiveness – Self-Efficacy (8 items). Table 23 shows the

correlations among the AFLQ-L subscales. All correlations range between $r = .307$ and $.463$ and are significant at $p < .01$.

Table 23

Correlations among the AFLQ Subscales

	1	2	3	4
1. Intentionality	1			
2. Forethought	.366**	1		
3. Self-Regulation	.369**	.307**	1	
4. Self-Efficacy	.424**	.353**	.463**	1

** Correlation is significant at the 0.01 level (2-tailed).

Predictive Validity Analyses

Previous analyses have shown that self-reports of motivation and self-regulated learning in university students tend to be negatively skewed (e.g. Pintrich, et al., 1993). The means reported throughout this analysis show some evidence of being skewed. The means for planfulness ($M = 3.73$; $SD = .627$), decision confidence ($M = 3.31$; $SD = .768$), intrinsic motivation ($M = 3.53$; $SD = .756$), extrinsic motivation ($M = 3.45$; $SD = .697$), self-regulation ($M = 2.92$; $SD = .756$), and self-efficacy ($M = 3.70$; $SD = .882$) are all over 2.5 giving this distribution of scores a negative skew. These findings are consistent with previous work in this area. Correlations among the AFLQ-L scales suggest that the scales are related measures of the agentic processes (see Table 24). The planfulness, decision confidence, intrinsic motivation, extrinsic motivation, self-regulation, and self-efficacy scales were all positively correlated with one another, with r ranging from $.11$ to $.57$ at $p < .01$.

In terms of predictive validity of the scales on the AFLQ-L, Table 24 shows variable correlations with the final grade as a measure of academic performance.

Planfulness ($r = .121, p < .01$), decision confidence ($r = .136, p < .01$), intrinsic motivation ($r = .141, p < .01$), self-regulation ($r = .114, p < .01$), and self-efficacy ($r = .263, p < .01$) showed significant correlations with academic achievement at $p < .01$. Extrinsic motivation also showed a significant correlation with academic achievement ($r = .088$) at $p < .05$. These correlations are in the expected direction and are consistent with the literature. Students who said they approached their course work in a planful manner, also reported they were confident in their decisions, motivated to learn (either intrinsically or extrinsically), were good self-regulators, and had high self-efficacy for academic tasks were likely to achieve good grades. Overall, these student reports indicate a high degree of agency for learning.

Table 24

Correlations among the AFLQ Subscales with Academic Achievement

	1	2	3	4	5	6	7
1. Academic Achievement	1						
2. Planfulness	.121**	1					
3. Decision Confidence	.136**	.384**	1				
4. Intrinsic Motivation	.141**	.341**	.348**	1			
5. Extrinsic Motivation	.088*	.244**	.164**	.573**	1		
6. Self-Regulation	.114**	.164**	.505**	.379**	.183**	1	
7. Self-Efficacy	.263**	.317**	.405**	.405**	.235**	.463**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Concluding Discussion

Results of this study indicate that the scales on the AFLQ used with university students have excellent internal consistency, significant predictive validity, and strong psychometric properties. There are several implications to the development of the AFLQ

as a multidimensional assessment of agency. First, this research provides a valid, multidimensional measure of agency for learning based on existing theoretical and empirical findings. Building upon existing research contributes to the content validity necessary to conduct further research with this instrument. Second, the AFLQ enables educational psychologists to potentially identify, measure, and study agentic processes in the context of learning and within particular experimental and developmental designs. Understanding how agency develops and emerges within learning environments is a key factor in identifying why learning occurs. Finally, this research enables further exploration into the role of agentic processes and how they operate collectively, perhaps function as significant predictors of academic achievement, and interact with various personal, behavioural, and social-environmental processes.

Students enact agency through their ability to regulate their cognitive, affective, and behavioural processes as they interact with factors in the environment. The multidimensional aspects of agency including intentionality, forethought, self-regulation, and self-reflectiveness have often been studied independently in the literature. However, in order to examine the role these processes play in learning they need to be studied and interpreted collectively. Agency for learning (AFL; Code, 2010a) provides a framework in which to explore the relationship of agency to various personal, behavioural, and social-environmental factors. Building upon this framework, the AFLQ provides a means to empirically investigate these processes within the learning context.

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Appendix A

Table 25

Agency for Learning Questionnaire Short Form (AFLQ-S) (42 items, $\alpha = .90$, $CI_{95} = .89$, .91)

Item*	Category**
Instructions: Using the scale below, indicate to what extent each of the following statements presently corresponds to you.	
1. I take a lot of care before choosing.	IN (PC)
2. I consider how best to carry out a decision.	IN (PC)
3. I try to be clear about my objectives before choosing.	IN (PC)
4. When making decisions I like to collect a lot of information.	IN (PC)
5. I like to consider all of the alternatives.	IN (PC)
6. I feel confident about my ability to make decisions.	IN (DC)
7. I think that I am a good decision maker.	IN (DC)
8. The decisions I make turn out well.	IN (DC)
Instructions: Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons why you go to University.	
9. Because it is one of the best ways I have chosen to develop other aspects of my life	F (EM)
10. Because it is an extension of me	F (EM)
11. Because through school, I feel that I can now take responsibilities for changes in my life	F (EM)
12. Because training hard will improve my performance	F (EM)
13. Because I want to show myself that I can succeed in my studies.	F (EM)
14. Because I experience pleasure and satisfaction while learning new things.	F (IM)
15. For the pleasure I experience when I discover new things never seen before	F (IM)
16. For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.	F (IM)
17. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.	F (IM)
18. Because my studies allow me to continue to learn about many things that interest me.	F (IM)
Instructions: Using the scale below indicate to what extent each of the following statements presently corresponds to you.	
19. I know exactly how to decrease my nervousness.	SR (SR)
20. Most of the time I feel at peace with myself.	SR (SR)
21. I can rapidly relax myself even when I am in a state of strong internal	SR (SR)

Item*	Category**
tension.	
22. When something upsets me, I can easily calm down.	SR (SR)
23. I can reduce my tension level if it starts bothering me.	SR (SR)
Instructions: Rate your degree of confidence with each of the tasks below using the scale provided	
24. Study when there are other interesting things to do.	S (SE)
25. Always concentrate on school subject during class.	S (SE)
26. Plan my school work for the day.	S (SE)
27. Organize my school work.	S (SE)
28. Motivate myself to do school work.	S (SE)
<p><i>Note:</i> IN (PC) = Intentionality: Planful Competence; IN (DC) = Intentionality: Decision Competence; F (EM) = Forethought: Extrinsic Motivation; F (IM) = Forethought: Intrinsic Motivation; SR (SR) = Self-regulation: Self-Regulation; S (SE) = Self-Reflectiveness: Self-Efficacy</p> <p>*Items 1-23 uses a Likert scale from: 1 = <i>does not correspond</i> to 5 = <i>corresponds exactly</i>; Items 24-28 use a Likert scale from 1 = <i>not confident</i> to 5 = <i>extremely confident</i></p>	

Appendix B

Table 26

Agency for Learning Questionnaire Long Form (AFLQ-L) ($\alpha = .92$, $CI_{95} = .92, .93$)

Item*	Category**
Instructions: Using the scale below, indicate to what extent each of the following statements presently corresponds to you.	
1. I take a lot of care before choosing.	IN (PC)
2. I consider how best to carry out a decision.	IN (PC)
3. I try to be clear about my objectives before choosing.	IN (PC)
4. When making decisions I like to collect a lot of information.	IN (PC)
5. I like to consider all of the alternatives.	IN (PC)
6. I feel confident about my ability to make decisions.	IN (DC)
7. I think that I am a good decision maker.	IN (DC)
8. The decisions I make turn out well.	IN (DC)
Instructions: Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons why you go to University.	
9. Because it is part of the way in which I've chosen to live my life	F (EM)
10. For the prestige of being a University graduate.	F (EM)
11. Because it is one of the best ways I have chosen to develop other aspects of my life	F (EM)
12. Because it is an extension of me	F (EM)
13. Because I must go to University to feel good about myself	F (EM)
14. For the material and/or social benefits of being a University graduate.	F (EM)
15. Because through school, I feel that I can now take responsibilities for changes in my life	F (EM)
16. Because training hard will improve my performance	F (EM)
17. Because I want to show myself that I can succeed in my studies.	F (EM)
18. Because I experience pleasure and satisfaction while learning new things.	F (IM)
19. For the pleasure I experience while surpassing myself in my studies.	F (IM)
20. For the pleasure I experience when I discover new things never seen before	F (IM)
21. For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.	F (IM)
22. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.	F (IM)
23. Because my studies allow me to continue to learn about many things that interest me.	F (IM)
24. For the "high" feeling that I experience while reading about various interesting subjects.	F (IM)
Instructions: Using the scale below indicate to what extent each of the following	

Item*	Category**
<hr/> statements presently corresponds to you. <hr/>	
25. I know exactly how to decrease my nervousness.	SR (SR)
26. Most of the time I feel at peace with myself.	SR (SR)
27. I can rapidly relax myself even when I am in a state of strong internal tension.	SR (SR)
28. In most situations, I feel free to do as I please.	SR (SR)
29. I know how to motivate myself even when my endurance drops off.	SR (SR)
30. When something upsets me, I can easily calm down.	SR (SR)
31. Many things work out well because I approach them with lots of energy.	SR (SR)
32. When striving for a goal I can fully identify myself with my actions.	SR (SR)
33. When a task gets boring I usually know how to make it interesting again.	SR (SR)
34. I can reduce my tension level if it starts bothering me.	
<hr/> Instructions: Rate your degree of confidence with each of the tasks below using the scale provided <hr/>	
35. Study when there are other interesting things to do.	S (SE)
36. Always concentrate on school subject during class.	S (SE)
37. Take good <i>Notes</i> during class instruction.	S (SE)
38. Plan my school work for the day.	S (SE)
39. Organize my school work.	S (SE)
40. Remember information presented in lecture and textbooks.	S (SE)
41. Arrange a place to study without distractions.	S (SE)
42. Motivate myself to do school work.	S (SE)

Note: IN (PC) = Intentionality: Planful Competence; IN (DC) = Intentionality: Decision Competence; F (EM) = Forethought: Extrinsic Motivation; F (IM) = Forethought: Intrinsic Motivation; SR (SR) = Self-regulation: Self-Regulation; S (SE) = Self-Reflectiveness: Self-Efficacy

*Items 1-35 uses a Likert scale from: 1 = *does not correspond* to 5 = *corresponds exactly*; Items 36-43 use a Likert scale from 1 = *not confident* to 5 = *extremely confident*

CHAPTER 4: AGENCY AS A MEDIATOR OF ACADEMIC ACHIEVEMENT

Abstract

Agency is an emergent capability that is manifested in individual abilities to interact with personal, behavioural, environmental, and social factors. Agency for learning (AFL) theorizes that agentic processes mediate the effects of other personal, behavioural, and environmental factors. The purpose of the present study is to examine the mediating relationship of agency and its component processes (intentionality, forethought, self-regulation, and self-efficacy) relative to goal-orientation, self-regulated study strategy use, social identification, student perceptions of the fairness of the learning environment and academic achievement. Results of this study indicate that with the exception of performance-avoidance goal-orientation, agentic processes act as significant mediators and the role of specific agentic processes was found to vary in strength depending on the context. This research provides an alternative perspective to the study of agency and a framework that enables the re-interpretation of existing learning theory.

Introduction

Agency develops out of the capabilities and processes of reflective thought and intentional action situated within a socio-cultural context (Martin, 2003). Agency for Learning (AFL) extends social cognitive theory (SCT; Bandura, 1986, 2001, 2006) by incorporating aspects of developmental, historical, and sociocultural theorizing that emphasize the integral nature of agency within the regulating processes necessary for learning (see Campbell, et al., 2002; Martin, et al., 2010; Martin, et al., 2003). Agency development and expression within learning can be described as socially situated, cognitive, temporal, and emergent.

Agency emerges through conscious intentional action. A capability is emergent if it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). As agency emerges through self-generated intentional action; it can only be explained by the interaction between its component influences. The multidimensional aspects of agency are characterized by an individual's intentionality, forethought, self-regulation, and self-reflection (Figure 1). Intentionality is an awareness and will to act in a particular way based on an idea or mental state (Lewis, 1990; Owen, 2009), which is actualized through goal setting and planning. Forethought involves the ability to anticipate the outcomes of actions that students use to motivate themselves and guide their actions in anticipation of future events. Self-regulation is "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000a, p. 453). As a self-reflective belief, self-efficacy is a belief in one's capability to

succeed and is an essential condition of human functioning (Bandura, 1997). Findings in the literature suggest that individual aspects of agency mediate the relationship between desired outcomes, such as academic achievement, and various aspects of goal-orientation (Fan, et al., 2008; Schmidt & Ford, 2003), learning strategy use (Duyne, 2002; R. D. Johnson, et al., 2009; Zimmerman & Cleary, 2006), social identification (Hatchett, 2009) and perceptions of the learning environment (Bruce, et al., 2001; Moos & Azevedo, 2009).

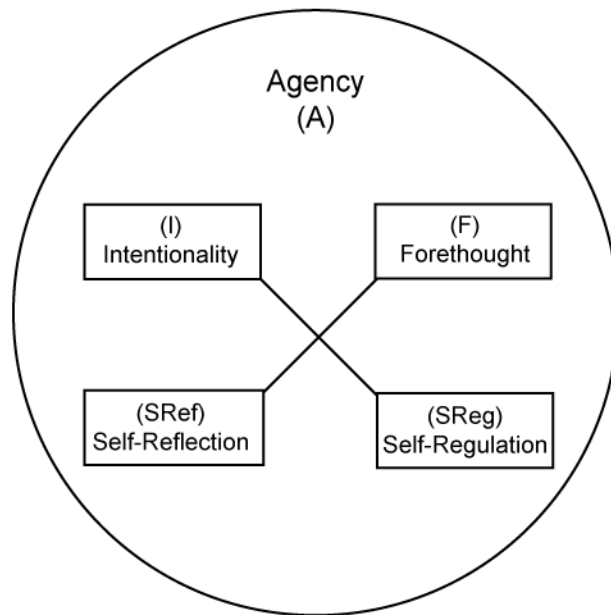


Figure 12. The multi-dimensional aspects of agency. *I* is intentionality; *F* is forethought; *SReg* is self-regulation; *SRef* is self-reflection; and *A* is agency. The solid lines represent intentional, conscious emergent influences.

Goal-Orientation

All models of self-regulated learning refer to some type of criterion or goal to which comparisons are made (Pintrich, 2000b). Orientation in goal theory concerns the underlying attitudes that give rise to certain actions. Therefore, goal-orientation concerns

the why of setting goals and motivations for achieving those goals. Achievement goals are defined as the purpose of task engagement, which provides a framework for how individuals perceive, interpret and approach learning situations (Elliot, 1999). Two major goal-orientations are described in the literature: mastery orientation and performance orientation (Dweck, 1998; Elliot, 1999; Pintrich, 2000b). Elliot (1999) describes these two goal-orientations as a dichotomy of performance goal versus mastery goal-orientation, where mastery goals focus on the development of competence within a task and performance goals focus on the demonstration of competence to others.

Mastery goals. Mastery goals focus on the development of competence or task-mastery. Students who adopt a mastery goal-orientation use positive processes to persist in the face of failure, use ‘deep’ process strategies during studying, and experience enhanced task enjoyment (Elliot, 1999). Mastery goals often indicate a positive relationship with performance (Elliot, et al., 2005).

Performance goals. Performance goals focus on the demonstration of competence relevant to others. In older motivational theories, students who adopted performance goals were depicted as only processing study materials at a superficial level, resulting in decreased task enjoyment, and withdrawal effort in the face of failure (Elliot, 1999). Performance goals were thought to indicate a negative relationship with performance (Elliot, et al., 2005).

Approach-avoidance dichotomy. Elliot and colleagues proposed adding the approach-avoidance distinction to the performance-mastery dichotomy based on historical and empirical evidence (Elliot, 1999; Elliot & Church, 1997; Elliot & McGregor, 2001). In this framework, the performance goal construct has separate

approach and avoidance orientations, revealing three independent achievement goals: a mastery-goal, focused on attaining self- or task-referential competence; a performance-approach goal, focused on attaining normative competence; and a performance-avoidance goal, focused on avoiding normative incompetence. In a review of the literature, Elliot et al. (2005) found that performance-approach goals are typically positive predictors of performance and performance-avoidance goals are typically negative predictors of performance. However, research has demonstrated that self-regulation along with a more adaptive goal orientation leads to the use of more adaptive cognitive strategies and better study habits, which ultimately enhances performance (Simmons, et al., 2004).

Self-Regulated Study Strategies

Students that develop competencies in self-regulated study strategies are more effective at learning and have greater retention of information for later use (Weinstein & Underwood, 1985). Weinstein and colleagues (Weinstein & Mayer, 1986; Weinstein & Underwood, 1985) studied effective students and categorized the various study strategies they used based on information processing theory. These strategies include: cognitive information-processing strategies, such as techniques for organizing and elaborating on incoming information to make it more meaningful; active study strategies, such as systems for note-taking and test preparation; and support strategies, such as techniques for organizing study time, coping with performance anxiety, and directing attention to the learning task at hand. In addition, they described a range of metacognitive strategies that learners can use to detect discrepancies between what they know and what they do not know and to monitor and direct their acquisition of the new information. Based on this

research a number of instruments were developed that have since been used by researchers, instructors, counsellors, and policy makers to assess students' study strategy use. Two of the most widely adopted instruments are the Learning and Study Strategies Inventory (LASSI; Weinstein, et al., 1987) and the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, et al., 1993). A search of bibliographic databases demonstrates that there is ample theoretical and empirical evidence in the literature to support the use of these instruments for a variety of purposes (e.g. McKeachie, et al., 1985; Prevatt, et al., 2006). However, recent research has suggested that there is a need to further explore the combined effects of social and environmental factors on the cognitive aspects of learning (Zimmerman & Cleary, 2006). Research based on SCT emphasizes the role of the environment and other social factors, such as identity style and social identification (e.g. Cameron, 1999; Jakubowski, 2003).

Social Identification

Social identity and group membership contributes to both self-definition and self-esteem. Social identity is part of an individual's self-concept that derives from membership in a social group (or groups) together with the value and emotional significance attached to that membership (Tajfel, 1978). Beliefs regarding one's capabilities to achieve particular goals (i.e. self-efficacy) are shaped, to some extent, by important identities, including those derived from social group membership (Cameron, 1999). A recent study by Cameron (1999) explored university students' social identification and efficacy related beliefs. These beliefs were operationalized in two ways: first in terms of the belief that group (university) membership facilitates the

achievement of hoped-for selves and the avoidance of feared selves, and second as one's perceived efficacy to attain these goals. Cameron hypothesized that social identification would be positively related to psychological well-being to the extent that it enhances group-derived efficacy. Results of Cameron's study replicate previous research demonstrating that group identification predicts self-esteem and psychological adjustment. "Efficacy beliefs (and, by implication, psychological well-being), may depend, to some extent, on the compatibility of goals and identities. Group memberships that are more closely related to important goals...are presumably more likely to engender feelings of competence and well-being" (Cameron, 1999, p. 187). Academic goals that are related to group membership are also related to the perceptions students have about their learning environment and their perceived relationship with their instructor (Lizzio, et al., 2007).

Learning Environment

Individuals are both a product and producer of their socio-cultural world (Martin, 2003; Martin, et al., 2003). As a result of interactions between people and their environmental, social systems (Bandura, 1997), agency emerges through the coordination and interdependence of personal and situational forces (Markus & Nurius, 1984). As individuals utilize, model, and emulate behaviours (cognitive and otherwise) projected by their peers and other agents in the learning environment, they effectively co-regulate their development of social competence. Through this process, individuals exploit the abilities of others to enhance their own capabilities, but also to facilitate their achievement of outcomes. In this context, individuals co-regulate within the learning environment to

achieve personal goals. Thus, involvement in learning communities is associated with enhanced academic performance, integration of academic and social experiences, gains in multiple areas of skill, competence, and knowledge, and overall satisfaction with the learning experience (Zhao & Kuh, 2004).

Purpose of this Research

Students enact agency through their ability to regulate their cognitive, affective, and behavioural processes as they interact with factors in the environment. Processes of intentionality, forethought, self-regulation, and self-reflectiveness are often studied independently in the literature (e.g. Gestsdottir & Lerner, 2007; Kitsantas, 2008; Little, 1998; Loedewyk & Winne, 2005; Wolters & Yu, 1996). However, to fully examine the role these processes play in learning they need to be studied and interpreted collectively. AFL presents a framework in which to study agency and provides a means to re-interpret existing findings within the context of other personal, behavioural, and social-environmental factors (Code, 2010a). The purpose of the present study is to examine the mediating relationship of agency and its component processes relative to goal-orientation, self-regulated learning strategy use, social identification, and student perceptions of the fairness of the learning environment, and academic achievement. Using structural equation modeling and mediation analysis this study investigates the mediational role agentic processes play in the learning context as described by AFL theory. The following research questions are investigated in this study.

Research Questions

- 1) Do agentic processes mediate the effects of goal-orientation, learning strategies, social identification, and student perceptions of the learning environment on academic achievement?
- 2) Do agentic processes mediate the effects of social identification and student perceptions of the learning environment on goal-orientation?
- 3) Do agentic processes mediate the effects of social identification and student perceptions of the learning environment on the use of learning strategies?

General Method

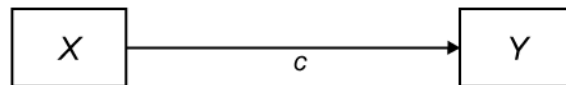
Overview of Mediation Analysis

Mediation analysis is one of the most common methods used in the behavioural sciences to assess the relationships between variables (Baron & Kenny, 1986; Preacher & Hayes, 2004, 2008). Mediation analysis implies a causal process that connects variables by modeling how an intervening (mediator) variable, transmits the influence of an independent variable, onto an outcome (Fairchild, et al., 2009). A mediator is a variable that accounts for all or part of the relation between a predictor and an outcome because the mediator is intermediate in the causal pathway from the independent variable to the dependent variable (MacKinnon, 2000).

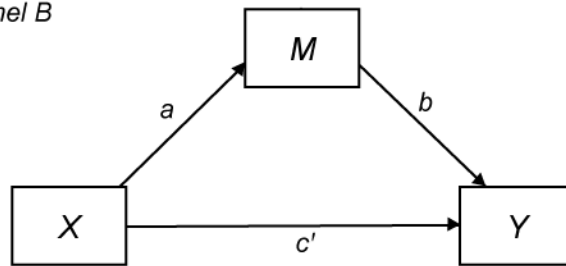
An illustration of simple and multiple mediation models is in Figure 13. A single or simple mediator model is shown in Panel B of Figure 13. Simple mediation involves one mediator variable (M) that transmits the total effects of the independent variable (X)

on the dependent variable (Y). A multiple mediator model is shown in Panel C of Figure 13. This panel shows that several mediator variables ($M_1, M_2 \dots M_j$) when taken as a set transmit a *total indirect effect* and when taken independently transmit a *specific indirect effect* of the independent variable (X) on the dependent variable (Y).

Panel A



Panel B



Panel C

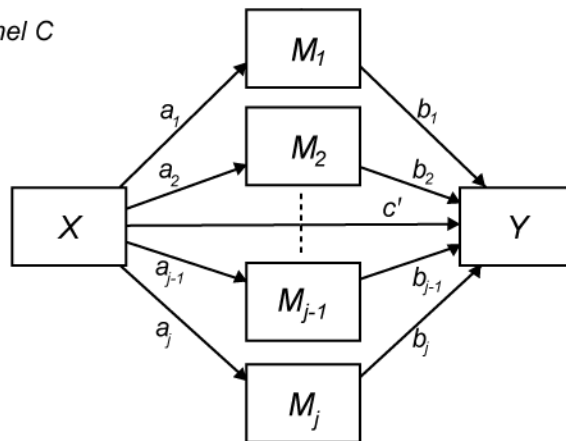


Figure 13. Illustration of simple and multiple mediation models. (Panel A) Illustration of a direct effect; X affects Y . (Panel B) Illustration of a simple mediation design; X is hypothesized to exert an indirect effect on Y through M . (Panel C) Illustration of a

multiple mediation design with j mediators; X is hypothesized to exert indirect effects on Y through $M_1, M_2, \dots M_j$.

Mediation hypotheses posit how, or by what means, an independent variable affects a dependent variable through one or more potential intervening variables, or mediators (Preacher & Hayes, 2008). An abundance of data exists in the literature establishing self-efficacy as a significant mediator of various personal variables on academic achievement and performance (e.g. Caprara, et al., 2008; Pajares & Miller, 1994; Pajares, et al., 1999; Thijs & Verkuyten, 2008). Since self-efficacy is theorized to be a core component of agency (Bandura, 2001, 2006), this study builds upon prior research (Pajares & Miller, 1994; Pajares, et al., 1999) and investigates the collective mediating relationship self-efficacy and other agentic processes (intentionality, forethought, and self-regulation) have on various personal, behavioural, and social-environmental factors. Using a cross-sectional correlational design, this research examines this mediating relationship using multiple mediation models.

Preacher and Hayes (2008) outline several advantages to specifying and testing multiple mediation models as opposed to separate mediation models. First, testing the total indirect effect of X on Y is analogous to conducting a regression analysis with several predictors. If an overall effect is found then one can suggest that the set of j variables mediates the effect of X on Y . Second, it is possible to determine the extent specific M variables mediate the $X \rightarrow Y$ effect. The extent of this specific mediation is *conditional* on the presence of the other mediators. Third, when multiple assumed mediators are considered within one model, the likelihood of parameter bias due to omitted variables is reduced. Finally, including several mediators in one model allows the

researcher to determine the relative magnitudes of the specific indirect effects associated with all mediators. There are two stages for investigating multiple mediator analysis: (1) investigate the total indirect effect, and decide whether the set of mediators transmits the effect of the independent variable to the dependent variable; and (2) investigate the specific indirect effect associated with each presumed mediator (Preacher & Hayes, 2008).

Agency as a capability of persons is emergent and has several component processes (intentionality, forethought, self-regulation, and self-efficacy) but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). Since AFL hypothesizes that agency arises through several interacting component processes (intentionality, forethought, self-regulation, and self-efficacy), multiple mediation analysis is used to evaluate the total indirect effects this set of variables has on the relationship between several independent and dependent variables. Each agentic process (intentionality, forethought, self-regulation, and self-efficacy) is tested as a separate mediator in each multiple mediation model and has its own specific indirect effect calculated. Since agency is emergent, it can only be *approximated* by the total effect of the set of mediators.

Participants and Procedure

Data were collected via an anonymous Web survey from a convenience sample of second year undergraduate students ($N = 1097$) enrolled in five sections of organic chemistry taught by one of three instructors in the fall semester of 2008 at a Canadian university. Students were recruited during the eighth week of this 13 week course for

voluntary participation and were given a bonus mark for participating (0.25% bonus grade). Students had two weeks to complete the survey. The response rate was 77.5% ($N = 850$, 517 Female) where 93% of the students were between the ages of 18 and 23.

Data Analysis

Following a brief classical analysis, dimensionality of the measures was assessed using either exploratory factor analysis (EFA) or structural equation modeling (SEM) depending upon whether existing validation data was available or if any modifications were made to items on the instrument. The following criteria was used to evaluate the adequacy of model fit in the SEM analysis: $\chi^2/df \leq 2.0$ (Hair, et al., 1995), CFI $\geq .90$, IFI $\geq .90$, and RMSEA $\leq .08$ (Browne & Cudeck, 1993). Analytical procedures for the classical, EFA, and SEM analysis were performed using SPSS (SPSS, 2009b), and AMOS (SPSS, 2009a).

To test for multiple mediation of agentic factors, bootstrapping Ordinary Least Squares regression procedures were used. Bootstrapping is a non-parametric resampling procedure that does not impose the assumption of normality of the sampling distribution and is a method recommended for testing mediation (Preacher & Hayes, 2008). Further, it involves repeatedly sampling from the data set and estimating the indirect effect in each resampled data set. Analytical procedures for the mediation analysis were performed using SPSS (SPSS, 2009b) and the INDIRECT SPSS macro (Preacher & Hayes, 2008).

Measures

Agency for learning. The Agency for Learning Questionnaire (ALFQ, Code, 2010) is a 42 item self-report instrument that assesses agentic functioning across four distinct dimensions: intentionality (planfulness, decision competence), forethought (intrinsic and extrinsic motivation), self-reactiveness (self-regulation), and self-reflectiveness (self-efficacy). Reported internal consistencies of the subscales range from $\alpha = .84$ to $\alpha = .92$. Students responded using a Likert scale of 1 = *does not correspond* to 5 = *corresponds exactly* on the intentionality, forethought, and self-regulation scales and a scale of 1 = *not confident* to 5 = *extremely confident* for the self-reflectiveness scale.

Social identification. The Social Identification Scale (SIS, Cameron, 2004) is a 12 item self-report instrument that assesses social identification along three dimensions: centrality, ingroup affect, and ingroup ties. Centrality refers to the frequency in which the group comes to mind (Gurin & Markus, 1989) and the subjective importance of the group to self-definition (Luhtanen & Crocker, 1992). Ingroup affect refers to specific emotions that arise from group membership (i.e. being glad or regretful). Ingroup ties refer to the extent to which group members feel 'stuck to' or part of particular social groups (Bollen & Hoyle, 1990). Reported internal consistencies of the SIS range from $\alpha = .74$ to $\alpha = .95$ (Cameron, 2004). Students responded using a Likert scale from 1 = *strongly disagree* to 5 = *strongly agree*. This scale was adapted to assess social identification with being a university student.

Fair learning environment. The Fair Learning Environment Questionnaire (FLEQ, Lizzio, et al., 2007) is a 16 item self-report instrument that assesses student perceptions of the fairness of their learning environment in terms of two conceptually

distinct factors: respectful partnership and systemic fairness. Students perceive a respectful partnership when they describe an environment that is both consistent and fair. Students characterize systemic fairness as an effective and fair academic system that provides readily accessible information, advice, and support. Reported internal consistencies of the subscales were $\alpha = .89$ (respectful partnership) and $\alpha = .77$ (systemic fairness). Students responded using a Likert scale from 1 = *strongly disagree* to 5 = *strongly agree*. This questionnaire was adapted and reduced to a 12 item scale for use in this study.

Learning strategies. The Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, et al., 1993) is an 81 item self-report instrument that consists of 6 motivation subscales and 9 learning strategies scales. The following learning strategies scales were used for this study (internal consistencies reported in Pintrich et al. are in parentheses): rehearsal ($\alpha = .69$, 4 items), elaboration ($\alpha = .75$, 6 items), organization ($\alpha = .64$, 4 items), critical thinking ($\alpha = .80$, 5 items), and metacognitive self-regulation ($\alpha = .79$, 12 items). Students responded using a Likert scale of 1 = *does not correspond* to 5 = *corresponds exactly*.

Achievement goals. The Revised Achievement Goal Questionnaire (AGQ-R, Elliot & Murayama, 2008) is a 12 item self-report instrument that measures achievement goals along four distinct dimensions (internal consistencies reported in the literature are in parentheses): mastery approach ($\alpha = .84$, 4 items), mastery avoidance ($\alpha = .88$, 4 items), performance approach ($\alpha = .92$, 4 items), and performance avoidance ($\alpha = .94$, 4 items). Students responded using a Likert scale from 1 = *strongly disagree* to 5 = *strongly agree*.

Academic achievement. Academic achievement in the context of this study is measured by final course grade. Final course grades were obtained from the instructors at the end of the course.

Results

Descriptive Statistics

Table 27 presents the results of the classical analysis of the variables used in this study. All variables were normally distributed based on skewness and kurtosis values presented in Table 27 and P-P plots (Appendix A). An examination of gender differences revealed that women reported significantly lower decision confidence than men $t(850) = 2.73, p < .05$; lower self-regulation $t(850) = 3.63, p < .05$; had a lower performance approach motivation orientation $t(850) = 2.52, p < .05$; used fewer critical thinking strategies $t(850) = 4.38, p < .05$; and achieved lower overall course grades, $t(850) = 4.60, p < .05$. Because gender was identified as a significant covariate along so many dimensions, all subsequent mediation analyses were controlled for this variable. Table 28 presents the zero-order correlations among the variables. Almost all of the variables were significantly correlated $p < .01$ with the exception of performance avoidance - achievement and performance avoidance - organizational strategies which were significantly correlated at $p < .05$. Rehearsal strategies - achievement, performance avoidance - self-regulation, performance avoidance - self-efficacy, performance avoidance - critical thinking strategies, and critical thinking strategies - social identification did not have significant correlations.

Table 27

Descriptive Statistics for Each Variable Along with Gender Differences

	Total Sample		S ^a	K ^b	α^c	Females		Males		t ^d	p	d ^e
	M	SD				M	SD	M	SD			
P	18.7	3.1	-.34	.38	.81	18.6	3.2	18.7	3.1	.50	.62	.04
DC	9.9	2.3	-.27	.01	.84	9.7	2.3	10.2	2.3	2.73	.01*	.19
IM	24.7	5.3	-.36	.23	.88	24.8	5.2	24.6	5.4	-.43	.66	-.03
EM	31.1	6.3	-.30	.44	.83	31.2	6.0	31.3	6.4	.33	.74	.02
SR	29.3	7.6	-.07	-.13	.90	28.4	7.3	30.3	7.7	3.63	.00*	.25
SEF	25.9	6.2	-.26	.00	.86	26.0	6.0	25.8	6.4	-.29	.77	-.02
LE	42.8	6.9	-.48	1.32	.85	42.4	7.1	43.3	6.5	1.78	.08	.12
MAp	11.7	2.2	-.55	.46	.77	11.6	2.1	11.7	2.2	.43	.66	.03
MAv	10.5	2.4	-.20	.07	.73	10.4	2.3	10.6	2.4	1.03	.30	.07
PAP	11.6	2.5	-.64	.59	.84	11.4	2.5	11.9	2.5	2.52	.01*	.18
PAv	11.5	2.7	-.69	.36	.86	11.4	2.6	11.8	2.7	1.93	.05	.13
SI	42.3	6.4	.02	-.29	.81	42.6	6.4	42.1	6.5	-1.20	.23	-.08
RS	12.3	3.1	-.27	-.12	.66	12.3	3.0	12.2	3.1	-.48	.63	.00
ES	20.0	4.4	-.36	.42	.81	19.9	4.5	20.0	4.4	.39	.69	.03
OS	13.1	3.1	-.18	-.02	.69	13.2	3.1	12.9	3.0	-1.48	.14	-.10
CT	14.0	4.3	-.06	-.38	.85	13.5	4.2	14.8	4.3	4.38	.00*	.31
SRS	32.3	6.6	-.34	.36	.84	32.2	6.6	32.5	6.6	.67	.50	.05
AA	66.6	16.2	-.59	.15	n/a	64.3	16.4	69.4	15.2	4.60	.00*	.32

Note: P = planfulness; DC = decision confidence; IM = intrinsic motivation; EM = extrinsic motivation; SR = self-regulation; SEF = self-efficacy; LE = respectful partnership in the learning environment; MAp = mastery approach; MAv = mastery avoidance; PAP = performance approach; PAv = performance avoidance; SI = social identification; RS = rehearsal strategies; ES = elaboration strategies; OS = organization strategies; CT = critical thinking strategies; SRS = self-regulated study strategies; AA = achievement;

^a S = Skewness ($SE = .08$); ^b K = Kurtosis ($SE = .17$); ^c α = Cronbach's alpha; ^d df = 850; ^e Cohen's d (effect size)

* Difference is significant at $p < .05$

Table 28

Descriptive Statistics and Zero-Order Correlations among Variables

	AA	P	DC	IM	EM	SR	SEF	LE	MAp	MAv	PAP	PAv	SI	RS	ES	OS	CT	SRS
AA	1																	
P	.121**	1																
DC	.136**	.384**	1															
IM	.141**	.341**	.349**	1														
EM	.088**	.244**	.164**	.573**	1													
SR	.114**	.164**	.505**	.379**	.183**	1												
SEF	.263**	.317**	.405**	.405**	.235**	.463**	1											
LE	.198**	.205**	.226**	.285**	.212**	.309**	.284**	1										
MAp	.241**	.323**	.239**	.458**	.322**	.220**	.442**	.293**	1									
MAv	.078*	.175**	.114**	.236**	.266**	.081**	.179**	.193**	.409**	1								
PAP	.316**	.245**	.226**	.259**	.348**	.118**	.270**	.226**	.528**	.319**	1							
PAv	.083*	.159**	.050**	.117**	.304**	-.027	.037	.200**	.252**	.428**	.577**	1						
SI	.114**	.212**	.260**	.347**	.348**	.290**	.329**	.291**	.250**	.170**	.217**	.160**	1					
RS	-.009	.144**	.107**	.177**	.233**	.221**	.329**	.214**	.222**	.170**	.167**	.149**	.099**	1				
ES	.251**	.330**	.337**	.458**	.280**	.386**	.563**	.343**	.429**	.221**	.287**	.097**	.232**	.472**	1			
OS	.155**	.268**	.256**	.336**	.253**	.360**	.522**	.310**	.342**	.114**	.243**	.085*	.212**	.537**	.675**	1		
CT	.190**	.172**	.287**	.344**	.204**	.426**	.411**	.216**	.310**	.157**	.199**	.017	.067	.396**	.607**	.489**	1	
SRS	.296**	.300**	.340**	.431**	.294**	.457**	.616**	.356**	.444**	.220**	.295**	.103**	.262**	.533**	.771**	.708**	.676**	1

Note: P = planfulness; DC = decision confidence; IM = intrinsic motivation; EM = extrinsic motivation; SR = self-regulation; SEF = self-efficacy; LE = respectful partnership in the learning environment; MAP = mastery approach; MAV = mastery avoidance; PAP = performance approach; PAV = performance avoidance; SI = social identification; RS = rehearsal strategies; ES = elaboration strategies; OS = organization strategies; CT = critical thinking strategies; SRS = self-regulated study strategies; AA = achievement;

**Correlation is significant at $p < .01$

*Correlation is significant at $p < .05$

Assessment of Dimensionality

Agency for learning. SEM was used to assess latent dimensionality because validation data for the AFLQ was already available (see Code, 2010b). In an initial test of the model, all hypothesized paths were significant. The model provided a good fit to the data: $\chi^2(785, N = 850) = 2415.9, p < .01, \chi^2/df = 3.08, CFI = .90, IFI = .91, RMSEA = .049$.

Social identification. An EFA was used to assess latent dimensionality because significant modifications were made to the original Social Identification Scale (Cameron, 2004). Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a single-factor structure: Social identification ($\alpha = 0.81, CI_{95} = .79, .83$). All calculated internal consistencies were above the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006).

Fair learning environment. An EFA was used to assess latent dimensionality since significant modifications were made to the original Fair Learning Environment Questionnaire (Lizzio, et al., 2007). Factors were extracted using Varimax rotation with Kaiser Normalization. The EFA on this data set revealed a two-factor structure: Systemic fairness ($\alpha = 0.50, CI_{95} = .44, .55$) and respectful partnership ($\alpha = 0.85, CI_{95} = .83, .86$). Since the calculated internal consistency for systemic fairness was below the acceptable level of $\alpha_0 > .70$ (Tabachnick & Fidell, 2006) this scale was removed from further analysis.

Learning strategies. SEM was used to assess latent dimensionality since validation data for the MSLQ was already available (see Pintrich, et al., 1993). In an initial test of the model, all hypothesized paths were significant. The model provided a

good fit to the data: $\chi^2(318, N = 850) = 969.7, p < .01, \chi^2/df = 3.04, CFI = .94, IFI = .94,$
RMSEA = .049.

Achievement goals. SEM was used to assess latent dimensionality since validation data for the AGQ-R was already available (see Elliot & Murayama, 2008). In an initial test of the model, all hypothesized paths were significant. The model provided a good fit to the data: $\chi^2(33, N = 850) = 16.5, p < .01, \chi^2/df = 3.22, CFI = .99, IFI = .99,$
RMSEA = .051.

Mediation Analysis

Tables 3 through 10 contain the full mediation analysis results. The bootstrap estimates presented are based on 5,000 bootstrap samples as recommended by Preacher and Hayes (2008). All reported confidence intervals are bias-corrected and accelerated (BCa); intervals including zero indicate a significant mediator. The results of each research question are discussed separately and are presented according to each multiple mediation model as follows: $IV \rightarrow M \rightarrow DV$.

Mediating effects of agency in the relation between goal-orientation and academic achievement.

Table 29

Mediation of Agency Variables between Goal-orientation and Academic Achievement

	Point Estimate	95% Confidence Interval	
		Lower	Upper
MAp → A → AA			
Total mediator set	.625*	.315	.959
Planfulness	.013	-.175	.202
Decision Confidence	.061	-.087	.210
Intrinsic Motivation	.005	-.285	.298
Extrinsic Motivation	-.053	-.235	.117
Self-Regulation	-.066	-.216	.061
Self-Efficacy	.665*	.399	.957
MAv → A → AA			
Total mediator set	.379*	.190	.588
Planfulness	.029	-.064	.132
Decision Confidence	.025	-.034	.112
Intrinsic Motivation	.070	-.054	.225
Extrinsic Motivation	-.025	-.164	.110
Self-Regulation	-.026	-.115	.010
Self-Efficacy	.307*	.162	.495
PAP → A → AA			
Total mediator set	.227*	.033	.439
Planfulness	.000	-.130	.125
Decision Confidence	-.002	-.124	.113
Intrinsic Motivation	.082	-.049	.234
Extrinsic Motivation	-.197	-.388	-.038
Self-Regulation	-.017	-.098	.037
Self-Efficacy	.362*	.224	.554
PAv → A → AA			
Total mediator set	.077	-.103	.259
Planfulness	.019	-.052	.102
Decision Confidence	.009	-.010	.071
Intrinsic Motivation	.035	-.014	.128
Extrinsic Motivation	-.054	-.211	.081
Self-Regulation	.009	-.010	.067
Self-Efficacy	.059	-.054	.189

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; A = agency; AA = achievement;

MAp = mastery approach; MAv = mastery avoidance; PAp = performance approach; PAv = performance avoidance

* Mediation is significant at $p < 0.05$

MAp → **A** → **AA**. When taken as a set of component variables (Table 29), agency mediated the effect of a student's mastery approach goal-orientation (MAp) on achievement (AA). The F statistic for this model was 12.39 with a p value of .00 and an R^2 of .11. The total and direct effects of MAp on AA are 1.781, $p < .01$ and 1.16, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .625 and a 95% BCa bootstrap CI of .315 to .959 (i.e. it can be claimed that the difference between the total and direct effect of MAp on AA is different from zero). An examination of the specific indirect effects indicates that only self-efficacy ($PE = .665$ $CI_{95} = .399, .957$; $p < .05$) was a mediator, since its 95% CI did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

MAv → **A** → **AA**. When taken as a set of component variables (Table 29), agency mediated the effect of a student's mastery-avoidance goal-orientation (MAv) on their achievement (AA). The F statistic for this model was 10.26 with a p value of .00 and an R^2 of .09. The total and direct effects of MAv on AA are .51, $p < .01$ and .13, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .379 and a 95% BCa bootstrap CI of .190 to .588 (i.e. it can be claimed that the difference between the total and direct effect of MAv on AA is different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .307$; $CI_{95} = .162, .495$; $p < .05$) was the only mediator,

since its 95% *CI* does not contain zero. None of the other agentic factors contributed to this mediation.

***PAP* → *A* → *AA*.** When taken as a set of component variables (Table 29), agency mediates the effect of a student's performance-approach goal-orientation (*PAP*) on their achievement (*AA*). The *F* statistic for this model was 18.43 with a *p* value of .00 and an *R*² of .15. The total and direct effects of *PAP* on *AA* are 2.01, *p* < .01 and 1.78, *p* < .01, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .227 and a 95% BCa bootstrap *CI* of .033 to .439 (i.e. it can be claimed that the difference between the total and direct effect of *PAP* and *AA* is different from zero). An examination of the specific indirect effects indicated that self-efficacy (*PE* = .362; *CI*₉₅ = .224, .554; *p* < .05) was the only mediator, since its 95% *CI* did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

***PAV* → *A* → *AA*.** When taken as a set of component variables (Table 29), agency does not mediate the effect of a student's performance-avoidance goal-orientation (*PAV*) on their achievement (*AA*). The *F* statistic for this model was 10.60 with a *p* value of .00 and an *R*² of .09. The total and direct effects of *PAV* on *AA* are .430, *p* < .01 and .353, *p* < .01, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .077 and a 95% BCa bootstrap *CI* of -.103 to .259 (i.e. it can be claimed that the difference between the total and direct effect of *PAV* and *AA* is NOT different from zero). An examination of the specific indirect effects indicated that there were no mediators, since their 95% *CI* contained zero.

Mediating effects of agency in the relation between the use of learning strategies and academic achievement.

Table 30

Mediation of Agency Variables between the use of Learning Strategies and Academic Achievement

	Point Estimate	95% Confidence Interval	
		Lower	Upper
R → A → AA			
Total mediator set	.525*	.373	.701
Planfulness	.024	-.030	.099
Decision Confidence	.012	-.032	.074
Intrinsic Motivation	.033	-.036	.123
Extrinsic Motivation	.013	-.083	.105
Self-Regulation	-.040	-.143	.057
Self-Efficacy	.483*	.339	.675
E → A → AA			
Total mediator set	.369*	.173	.568
Planfulness	.012	-.086	.111
Decision Confidence	.037	-.061	.143
Intrinsic Motivation	.022	-.124	.168
Extrinsic Motivation	-.014	-.096	.061
Self-Regulation	-.088	-.208	.026
Self-Efficacy	.399*	.236	.576
O → A → AA			
Total mediator set	.690*	.463	.929
Planfulness	.032	-.072	.153
Decision Confidence	.045	-.063	.163
Intrinsic Motivation	.076	-.060	.230
Extrinsic Motivation	-.017	-.124	.076
Self-Regulation	-.099	-.261	.062
Self-Efficacy	.654*	.422	.917
CT → A → AA			
Total mediator set	.342*	.183	.499
Planfulness	.017	-.034	.074
Decision Confidence	.034	-.061	.126
Intrinsic Motivation	.042	-.061	.156
Extrinsic Motivation	-.008	-.065	.045
Self-Regulation	-.110	-.245	.029

	Point Estimate	95% Confidence Interval	
		Lower	Upper
Self-Efficacy	.367*	.242	.506
SRS → A → AA			
Total mediator set	.159*	.018	.303
Planfulness	.006	-.052	.063
Decision Confidence	.030	-.035	.102
Intrinsic Motivation	.018	-.061	.110
Extrinsic Motivation	-.018	-.074	.032
Self-Regulation	-.101*	-.196	-.015
Self-Efficacy	.224*	.102	.355

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; A = agency; AA = achievement; R = rehearsal strategies; E = elaboration strategies; O = organization strategies; CT = critical thinking strategies; SRS = self-regulated study strategies

* Mediation is significant at $p < 0.05$

R → A → AA. When taken as a set of component variables (Table 30), agency mediates the effect of a student's use of rehearsal strategies (R) on their achievement (AA). The F statistic for this model was 11.49 with a p value of .00 and an R^2 of .10. The total and direct effects of R on AA are -.042, $p = .81$ and -.567, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .525 and a 95% BCa bootstrap CI of .373 to .701 (i.e. it can be claimed that the difference between the total and direct effect of R and AA is different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .483$; $CI_{95} = .339, .675$; $p < .05$) was the only mediator, since its 95% CI did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

E → A → AA. When taken as a set of component variables (Table 30), agency mediated the effect of a student's use of elaboration strategies (E) on their achievement (AA). The F statistic for this model was 11.88 with a p value of .00 and an R^2 of .10. The

total and direct effects of E on AA were .906, $p < .01$ and .538, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .369 and a 95% BCa bootstrap *CI* of .173 to .568 (i.e. it can be claimed that the difference between the total and direct effect of AA and R are different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .399$; $CI_{95} = .236, .576$; $p < .05$) was the only mediator, since its 95% *CI* did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

O → A → AA. When taken as a set of component variables (Table 30), agency mediated the effect of a student's use of organizational strategies (O) and their achievement (AA). The *F* statistic for this model was 10.28 with a *p* value of .00 and an R^2 of .09. The total and direct effects of O on AA were .828, $p < .01$ and .138, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .690 and a 95% BCa bootstrap *CI* of .463 to .929 (i.e. it can be claimed that the difference between the total and direct effect of AA and R are different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .654$; $CI_{95} = .422, .917$; $p < .05$) was the only mediator, since its 95% *CI* did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

CT → A → AA. When taken as a set of component variables (Table 30), agency mediated the effect of a student's use of critical thinking strategies (CT) and their achievement (AA). The *F* statistic for this model was 10.88 with a *p* value of .00 and an R^2 of .09. The total and direct effects of CT on AA were .661, $p < .01$ and .319, $p < .01$,

respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .342 and a 95% BCa bootstrap *CI* of .183 to .499 (i.e. it can be claimed that the difference between the total and direct effect of CT and AA are different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .367$; $CI_{95} = .242, .506$; $p < .05$) was a mediator, since its 95% *CI* did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

***SRS* → *A* → *AA*.** When taken as a set of component variables (Table 30), agency mediated the effect of a student's use of self-regulated study strategies (*SRS*) and achievement (*AA*). The *F* statistic for this model was 13.90 with a *p* value of .00 and an R^2 of .12. The total and direct effects of *SRS* on *AA* were .712, $p < .01$ and .554, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .159 and a 95% BCa bootstrap *CI* of .018 to .303 (i.e. it can be claimed that the difference between the total and direct effect of *SRS* and *AA* are different from zero). An examination of the specific indirect effects indicated self-efficacy ($PE = .224$; $CI_{95} = .102, .355$; $p < .05$) and self-regulation ($PE = -.101$; $CI_{95} = -.196, -.015$; $p < .05$) were the only mediators, since their 95% *CI* did not contain zero. Note that self-regulation had a negative effect on the use of self-regulated study strategies in this case. None of the other agentic factors contributes above and beyond self-efficacy and self-regulation.

Mediating effects of agency in the relation between social identification and academic achievement.

Table 31

Mediation of Agency Variables between Social Identification and Academic Achievement

	Point Estimate	95% Confidence Interval	
		Lower	Upper
SI → A → AA			
Total mediator set	.222*	.126	.320
Planfulness	.013	-.027	.060
Decision Confidence	.020	-.033	.077
Intrinsic Motivation	.037	-.031	.112
Extrinsic Motivation	-.015	-.083	.055
Self-Regulation	-.038	-.103	.024
Self-Efficacy	.204*	.135	.288

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; SI = social identification; A = agency; AA = achievement.

* Mediation is significant at $p < 0.05$

SI → A → AA. When taken as a set of component variables (Table 31), agency mediated the effect of a student’s identification with their student social group (SI) and their achievement (AA). The F statistic for this model was 10.29 with a p value of .00 and an R^2 of .09. The total and direct effects of SI on AA were .287, $p < .01$ and .065, $p = .49$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .222 and a 95% BCa bootstrap CI of .126 to .320 (i.e. it can be claimed that the difference between the total and direct effect of SI and AA are different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .201$; $CI_{95} = .135, .288$; $p < .05$) was the only mediator, since its 95% CI did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

Mediating effects of agency in the relation between student perceptions of the learning environment and academic achievement.

Table 32

Mediation of Agency Variables between the Learning Environment and Academic Achievement

	Point Estimate	95% Confidence Interval	
		Lower	Upper
LE → A → AA			
Total mediator set	.139*	.068	.222
Planfulness	.007	-.030	.046
Decision Confidence	.016	-.024	.064
Intrinsic Motivation	.021	-.032	.081
Extrinsic Motivation	-.010	-.053	.025
Self-Regulation	-.052	-.115	.007
Self-Efficacy	.157*	.098	.231

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; LE = respectful partnership in the learning environment; A = agency; AA = achievement.

* Mediation is significant at $p < 0.05$

LE → A → AA. When taken as a set of component variables (Table 32), agency mediated the effect of a student’s perception of their partnership with their instructor (LE) with their achievement (AA). The F statistic for this model was 12.14 with a p value of .00 and an R^2 of .17. The total and direct effects of LE on AA were .448, $p < .01$ and .310, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .139 and a 95% BCa bootstrap CI of .068 to .222 (i.e. it can be claimed that the difference between the total and direct effect of LE and AA are different from zero). An examination of the specific indirect effects indicated that self-efficacy ($PE = .157$; $CI_{95} = .098, .231$; $p < .05$) was the

only mediator, since its 95% *CI* did not contain zero. None of the other agentic factors contributes above and beyond self-efficacy.

Mediating effects of agency in the relation between social identification and goal-orientation.

Table 33

Mediation of Agency Variables between Social Identification and Goal-orientation

	Point Estimate	95% Confidence Interval	
		Lower	Upper
SI → A → MAP			
Total mediator set	.076*	.060	.095
Planfulness	.009*	.004	.017
Decision Confidence	-.002	-.008	.006
Intrinsic Motivation	.032*	.021	.045
Extrinsic Motivation	.008	-.001	.018
Self-Regulation	-.005	-.014	.001
Self-Efficacy	.003*	.024	.045
SI → A → MAV			
Total mediator set	.043*	.026	.060
Planfulness	.006	.000	.014
Decision Confidence	.001	-.008	.010
Intrinsic Motivation	.010	-.003	.024
Extrinsic Motivation	.022*	.010	.036
Self-Regulation	-.006	-.016	.003
Self-Efficacy	.011*	.001	.023
SI → A → PAV			
Total mediator set	.064*	.047	.082
Planfulness	.008*	.002	.016
Decision Confidence	.012*	.004	.022
Intrinsic Motivation	-.002	-.015	.010
Extrinsic Motivation	.036*	.023	.051
Self-Regulation	-.011*	-.021	-.003
Self-Efficacy	.021*	.011	.033
SI → A → PAV			
Total mediator set	.028*	.010	.049
Planfulness	.010*	.004	.019
Decision Confidence	.002	-.007	.011

	Point Estimate	95% Confidence Interval	
		Lower	Upper
Intrinsic Motivation	-.013	-.027	.002
Extrinsic Motivation	.045*	.030	.063
Self-Regulation	-.012*	-.024	-.003
Self-Efficacy	-.004	-.016	.008

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; A = agency; SI = social identification; MAp = mastery approach; MAv = mastery avoidance; PAp = performance approach; PAv = performance avoidance

* Mediation is significant at $p < 0.05$

SI → A → MAp. When taken as a set of component variables (Table 33), agency mediated the effect of a student's identification with their student social group (SI) and their mastery approach goal-orientation (MAp). The F statistic for this model was 47.34 with a p value of .00 and an R^2 of .31. The total and direct effects of SI on MAp were .085, $p < .01$ and .009, $p = .40$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .076 and a 95% BCa bootstrap CI of .060 to .095 (i.e. it can be claimed that the difference between the total and direct effect of SI and MAp are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .009$; $CI_{95} = .004, .017$; $p < .05$), intrinsic motivation ($PE = .032$; $CI_{95} = .021, .045$; $p < .05$), and self-efficacy ($PE = .003$; $CI_{95} = .024, .045$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Decision confidence, extrinsic motivation, and self-regulation did not contribute to this mediation above and beyond planfulness, intrinsic motivation, and self-efficacy.

SI → A → MAv. When taken as a set of component variables (Table 33), agency mediated the effect of a student's identification with their student social group (SI) and their mastery avoidance goal-orientation (MAv). The F statistic for this model was 11.53

with a p value of .00 and an R^2 of .10. The total and direct effects of SI on MAV were .062, $p < .01$ and .019, $p = .15$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .043 and a 95% BCa bootstrap CI of .026 to .060 (i.e. it can be claimed that the difference between the total and direct effect of SI and MAV are different from zero). An examination of the specific indirect effects indicated that extrinsic motivation ($PE = .022$; $CI_{95} = .010, .036$; $p < .05$) and self-efficacy ($PE = .011$; $CI_{95} = .001, .023$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Planfulness, decision confidence, intrinsic motivation, and self-regulation did not contribute to this mediation above and beyond extrinsic motivation and self-efficacy.

$SI \rightarrow A \rightarrow PAp$. When taken as a set of component variables (Table 33), agency mediated the effect of a student's identification with their student social group (SI) and their performance approach goal-orientation (PAp). The F statistic for this model was 24.64 with a p value of .00 and an R^2 of .19. The total and direct effects of SI on PAp were .083, $p < .01$ and .020, $p = .13$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .434 and a 95% BCa bootstrap CI of .327 to .552 (i.e. it can be claimed that the difference between the total and direct effect of SI and PAp are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .008$; $CI_{95} = .002, .016$; $p < .05$), decision confidence ($PE = .012$; $CI_{95} = .004, .022$; $p < .05$), extrinsic motivation ($PE = .036$; $CI_{95} = .023, .051$; $p < .05$), self-regulation ($PE = -.021$; $CI_{95} = -.021, -.003$; $p < .05$), and self-efficacy ($PE = .021$; $CI_{95} = .011, .033$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Note that self-regulation had a

significant negative influence on this model. Intrinsic motivation did not contribute to this mediation above and beyond planfulness, decision confidence, extrinsic motivation, self-regulation, and self-efficacy.

***SI* → *A* → *PAv*.** When taken as a set of component variables (Table 33), agency mediated the effect of a student's identification with their student social group (*SI*) and their performance avoidance goal-orientation (*PAv*). The *F* statistic for this model was 15.30 with a *p* value of .00 and an *R*² of .13. The total and direct effects of *SI* on *PAv* were .067, *p* < .01 and .038, *p* < .05, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .028 and a 95% BCa bootstrap *CI* of .010 to .049 (i.e. it can be claimed that the difference between the total and direct effect of *SI* and *PAv* are different from zero). An examination of the specific indirect effects indicated that planfulness (*PE* = .010; *CI*₉₅ = .004, .019; *p* < .05), extrinsic motivation (*PE* = .045; *CI*₉₅ = .030, .063; *p* < .05), and self-regulation (*PE* = -.004; *CI*₉₅ = -.024, -.003; *p* < .05) were mediators, since their 95% *CI* did not contain zero. Note that self-regulation had a significant negative influence on this model. Decision confidence, intrinsic motivation, and self-efficacy did not contribute to this mediation above and beyond planfulness, extrinsic motivation, and self-regulation.

Mediating effects of agency in the relation between student perceptions of the learning environment and goal-orientation.

Table 34

Mediation of Agency Variables between the Learning Environment and Goal-orientation

	Point Estimate	95% Confidence Interval	
		Lower	Upper
LE → A → M_{Ap}			
Total mediator set	.053*	.039	.071
Planfulness	.008*	.003	.015
Decision Confidence	-.001	-.007	.004
Intrinsic Motivation	.024*	.015	.035
Extrinsic Motivation	.004	.000	.010
Self-Regulation	-.007	-.015	.000
Self-Efficacy	.026*	.018	.036
LE → A → M_{Av}			
Total mediator set	.025*	.013	.041
Planfulness	.005	-.001	.012
Decision Confidence	.001	-.006	.007
Intrinsic Motivation	.007	-.003	.018
Extrinsic Motivation	.012*	.006	.023
Self-Regulation	-.007	-.018	.002
Self-Efficacy	.008*	.000	.019
LE → A → P_{Ap}			
Total mediator set	.038*	.024	.056
Planfulness	.006*	.001	.015
Decision Confidence	.010*	.003	.018
Intrinsic Motivation	-.003	-.012	.007
Extrinsic Motivation	.020*	.011	.033
Self-Regulation	-.012*	-.022	-.005
Self-Efficacy	.016*	.008	.027
LE → A → P_{Av}			
Total mediator set	.007	-.009	.023
Planfulness	.008	.002	.018
Decision Confidence	.002	-.005	.010
Intrinsic Motivation	-.011*	-.023	-.001
Extrinsic Motivation	.025	.015	.040
Self-Regulation	-.015*	-.027	-.005
Self-Efficacy	-.004	-.013	.006

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; A = agency; LE = respectful

partnership in the learning environment; MAp = mastery approach; MAv = mastery avoidance; PAp = performance approach; PAv = performance avoidance
* Mediation is significant at $p < 0.05$

$LE \rightarrow A \rightarrow MAp$. When taken as a set of component variables (Table 34), agency mediated the effect of a student's mastery approach goal-orientation (MAp) and their perception of their partnership with their instructor (LE). The F statistic for this model was 50.18 with a p value of .00 and an R^2 of .32. The total and direct effects of LE on MAp were .092, $p < .01$ and .039, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .053 and a 95% BCa bootstrap CI of .039 to .071 (i.e. it can be claimed that the difference between the total and direct effect of LE and MAp are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .008$; $CI_{95} = .003, .015$; $p < .05$), intrinsic motivation ($PE = .024$; $CI_{95} = .015, .035$; $p < .05$), and self-efficacy ($PE = .026$; $CI_{95} = .018, .036$; $p < .05$), were the only mediators, since their 95% CI did not contain zero. Decision confidence, extrinsic motivation, and self-regulation did not contribute to this mediation above and beyond planfulness, intrinsic motivation, and self-efficacy.

$LE \rightarrow A \rightarrow MAv$. When taken as a set of component variables (Table 34), agency mediated the effect of a student's perception of their partnership with their instructor (LE) and their mastery avoidance goal-orientation (MAv). The F statistic for this model was 12.74 with a p value of .00 and an R^2 of .11. The total and direct effects of LE on MAv were .065, $p < .01$ and .040, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .025 and a 95% BCa bootstrap CI of .013 to .041 (i.e. it can be claimed that the difference

between the total and direct effect of LE and MAv are different from zero). An examination of the specific indirect effects indicated that extrinsic motivation ($PE = .012$; $CI_{95} = .006, .023$; $p < .05$) and self-efficacy ($PE = .008$; $CI_{95} = .0004, .019$; $p < .05$), were the only mediators, since their 95% CI did not contain zero. Planfulness, decision confidence, intrinsic motivation, and self-regulation did not contribute to this mediation above and beyond extrinsic motivation and self-efficacy.

$LE \rightarrow A \rightarrow PAp$. When taken as a set of component variables (Table 34), agency mediated the effect of a student's perception of their partnership with their instructor (LE) and their performance approach goal-orientation (PAp). The F statistic for this model was 26.16 with a p value of .00 and an R^2 of .20. The total and direct effects of LE on PAp were .079, $p < .01$ and .042, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .038 and a 95% BCa bootstrap CI of .024 to .056 (i.e. it can be claimed that the difference between the total and direct effect of LE and PAp are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .006$; $CI_{95} = .001, .015$; $p < .05$), decision confidence ($PE = .010$; $CI_{95} = .003, .018$; $p < .05$), extrinsic motivation ($PE = .020$; $CI_{95} = .011, .033$; $p < .05$), self-regulation ($PE = -.012$; $CI_{95} = -.022, -.005$; $p < .05$), and self-efficacy ($PE = .016$; $CI_{95} = .008, .027$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Note that self-regulation was a negative influence in this model. Intrinsic motivation did not contribute to this mediation above and beyond planfulness, decision confidence, extrinsic motivation, self-regulation, and self-efficacy.

$LE \rightarrow A \rightarrow PAv$. When taken as a set of component variables (Table 34), agency did NOT mediate the effect of a student's perception of their partnership with their instructor (LE) and their performance avoidance goal-orientation (PAv). The F statistic for this model was 18.17 with a p value of .00 and an R^2 of .15. The total and direct effects of LE on PAV were .075, $p < .01$ and .069, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .007 and a 95% BCa bootstrap CI of -.009 to .023 (i.e. it can NOT be claimed that the difference between the total and direct effect of LE and PAV are different from zero). An examination of the specific indirect effects indicated that intrinsic motivation ($PE = -.011$; $CI_{95} = -.023, -.001$; $p < .05$) and self-regulation ($PE = -.015$; $CI_{95} = -.027, -.005$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Note that both intrinsic motivation and self-regulation were negative influences on this model. Planfulness, decision confidence, extrinsic motivation, and self-efficacy did not contribute to this mediation above and beyond intrinsic motivation and self-regulation.

Mediating effects of agency in the relation between social identification and learning strategies.

Table 35

Mediation of Agency Variables between Learning Strategies and Social Identification

	Point Estimate	95% Confidence Interval	
		Lower	Upper
SI → A → R			
Total mediator set	.082*	.059	.105
Planfulness	.005	-.002	.015
Decision Confidence	-.011	-.023	-.001
Intrinsic Motivation	-.013	-.030	.003
Extrinsic Motivation	.036*	.021	.053
Self-Regulation	.019*	.008	.033
Self-Efficacy	.046*	.031	.063
SI → A → E			
Total mediator set	.186*	.152	.223
Planfulness	.016*	.007	.030
Decision Confidence	.002	-.011	.016
Intrinsic Motivation	.051*	.031	.075
Extrinsic Motivation	.007	-.009	.023
Self-Regulation	.020*	.007	.037
Self-Efficacy	.090*	.067	.116
SI → A → O			
Total mediator set	.114*	.092	.138
Planfulness	.010	.004	.019
Decision Confidence	-.006	-.017	.003
Intrinsic Motivation	.008	-.007	.024
Extrinsic Motivation	.016*	.004	.030
Self-Regulation	.022*	.012	.036
Self-Efficacy	.064*	.047	.083
SI → A → CT			
Total mediator set	.162*	.129	.194
Planfulness	.001	-.009	.011
Decision Confidence	.004	-.010	.019
Intrinsic Motivation	.038*	.019	.061
Extrinsic Motivation	.010	-.007	.028
Self-Regulation	.051*	.033	.072
Self-Efficacy	.057*	.039	.079

	Point Estimate	95% Confidence Interval	
		Lower	Upper
SI → A → SRS			
Total mediator set	.291*	.237	.346
Planfulness	.017*	.004	.035
Decision Confidence	-.005	-.025	.015
Intrinsic Motivation	.044*	.018	.075
Extrinsic Motivation	.026*	.003	.051
Self-Regulation	.056*	.035	.084
Self-Efficacy	.153*	.117	.195

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; A = agency; SI = social identification; R = rehearsal strategies; E = elaboration strategies; O = organization strategies; CT = critical thinking strategies; SRS = self-regulated study strategies

* Mediation is significant at $p < 0.05$

SI → A → R. When taken as a set of component variables (Table 35), agency mediated the effect of a student's identification with their student social group (SI) and their use of rehearsal learning strategies (R). The F statistic for this model was 18.92 with a p value of .00 and an R^2 of .15. The total and direct effects of SI on R were .048, $p < .01$ and -.034, $p < .05$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .082 and a 95% BCa bootstrap CI of .059 to .105 (i.e. it can be claimed that the difference between the total and direct effect of SI and R are different from zero). An examination of the specific indirect effects indicated that extrinsic motivation ($PE = .036$; $CI_{95} = .021, .053$; $p < .05$), self-regulation ($PE = .019$; $CI_{95} = .008, .033$; $p < .05$) and self-efficacy ($PE = .046$; $CI_{95} = .031, .063$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Planfulness, decision confidence, and intrinsic motivation did not contribute to this mediation above and beyond extrinsic motivation, self-regulation, and self-efficacy.

SI → A → E. When taken as a set of component variables (Table 35), agency mediated the effect of a student's identification with their student social group (SI) and

their use of elaboration learning strategies (E). The F statistic for this model was 70.27 with a p value of .00 and an R^2 of .40. The total and direct effects of SI on E were .159, $p < .01$ and -.027, $p = .20$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .186 and a 95% BCa bootstrap CI of .152 to .223 (i.e. it can be claimed that the difference between the total and direct effect of E and SI are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .016$; $CI_{95} = .007, .030$; $p < .05$), intrinsic motivation ($PE = .051$; $CI_{95} = .031, .075$; $p < .05$), self-regulation ($PE = .020$; $CI_{95} = .007, .037$; $p < .05$) and self-efficacy ($PE = .090$; $CI_{95} = .067, .116$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Decision confidence and extrinsic motivation did not contribute to this mediation above and beyond planfulness, intrinsic motivation, self-regulation, and self-efficacy.

$SI \rightarrow A \rightarrow O$. When taken as a set of component variables (Table 35), agency mediated the effect of a student's identification with their student social group (SI) and their use of organizational learning strategies (O). The F statistic for this model was 48.79 with a p value of .00 and an R^2 of .32. The total and direct effects of SI on O were .102, $p < .01$ and -.012, $p = .44$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .114 and a 95% BCa bootstrap CI of .092 to .138 (i.e. it can be claimed that the difference between the total and direct effect of SI and O are different from zero). An examination of the specific indirect effects indicated that extrinsic motivation ($PE = .016$; $CI_{95} = .004, .030$; $p < .05$), self-regulation ($PE = .022$; $CI_{95} = .012, .036$; $p < .05$) and self-efficacy ($PE = .064$; $CI_{95} = .047, .083$; $p < .05$) were the only mediators, since their 95% CI did not

contain zero. Planfulness, decision confidence, and intrinsic motivation did not contribute to this mediation above and beyond extrinsic motivation, self-regulation, and self-efficacy.

***SI* → *A* → *CT*.** When taken as a set of component variables (Table 35), agency mediated the effect of a student's identification with their student social group (*SI*) and their use of critical thinking learning strategies (*CT*). The *F* statistic for this model was 45.06 with a *p* value of .00 and an *R*² of .30. The total and direct effects of *SI* on *CT* were .044, *p* = .051 and -.117, *p* < .01, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .162 and a 95% BCa bootstrap *CI* of .129 to .194 (i.e. it can be claimed that the difference between the total and direct effect of *SI* and *CT* are different from zero). An examination of the specific indirect effects indicated that intrinsic motivation (*PE* = .038; *CI*₉₅ = .019, .061; *p* < .05), self-regulation (*PE* = .051; *CI*₉₅ = .033, .072; *p* < .05) and self-efficacy (*PE* = .057; *CI*₉₅ = .039, .079; *p* < .05) were the only mediators, since their 95% *CI* did not contain zero. Planfulness, decision confidence, and extrinsic motivation did not contribute to this mediation above and beyond intrinsic motivation, self-regulation, and self-efficacy.

***SI* → *A* → *SRS*.** When taken as a set of component variables (Table 35), agency mediated the effect of a student's identification with their student social group (*SI*) and their use of self-regulated study strategies (*SRS*). The *F* statistic for this model was 86.41 with a *p* value of .00 and an *R*² of .45. The total and direct effects of *SI* on *SRS* were .271, *p* < .01 and -.021, *p* = .49, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .291

and a 95% BCa bootstrap *CI* of .237 to .346 (i.e. it can be claimed that the difference between the total and direct effect of SI and SRS are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .017$; $CI_{95} = .004, .035$; $p < .05$), intrinsic motivation ($PE = .044$; $CI_{95} = .018, .075$; $p < .05$), extrinsic motivation ($PE = .026$; $CI_{95} = .003, .051$; $p < .05$), self-regulation ($PE = .056$; $CI_{95} = .035, .084$; $p < .05$) and self-efficacy ($PE = .153$; $CI_{95} = .117, .195$; $p < .05$) were the only mediators, since their 95% *CI* did not contain zero. Decision confidence did not contribute to this mediation above and beyond planfulness, intrinsic motivation, extrinsic motivation, self-regulation, and self-efficacy.

Mediating effects of agency in the relation between student perceptions of the learning environment on the use of learning strategies.

Table 36

Mediation of Agency Variables between Learning Strategies and Learning Environment

	Point Estimate	95% Confidence Interval	
		Lower	Upper
LE → A → R			
Total mediator set	.049*	.032	.068
Planfulness	.004	-.002	.012
Decision Confidence	-.009*	-.020	-.002
Intrinsic Motivation	-.011	-.026	.000
Extrinsic Motivation	.018*	.009	.030
Self-Regulation	.015*	.004	.028
Self-Efficacy	.034*	.021	.049
LE → A → E			
Total mediator set	.134*	.101	.169
Planfulness	.013*	.005	.026
Decision Confidence	.001	-.010	.012
Intrinsic Motivation	.036*	.020	.056
Extrinsic Motivation	.001	-.008	.010
Self-Regulation	.014*	.001	.030
Self-Efficacy	.068*	.045	.090
LE → A → O			
Total mediator set	.081*	.060	.104
Planfulness	.008*	.002	.017
Decision Confidence	-.005	-.014	.002
Intrinsic Motivation	.005	-.007	.017
Extrinsic Motivation	.008*	.001	.016
Self-Regulation	.018*	.007	.030
Self-Efficacy	.049*	.033	.067
LE → A → CT			
Total mediator set	.114*	.084	.146
Planfulness	.000	-.009	.010
Decision Confidence	.002	-.010	.014
Intrinsic Motivation	.026*	.012	.046
Extrinsic Motivation	.000	-.010	.010
Self-Regulation	.045*	.028	.067
Self-Efficacy	.041*	.025	.060

	Point Estimate	95% Confidence Interval	
		Lower	Upper
LE → A → SRS			
Total mediator set	.215*	.163	.271
Planfulness	.013*	.001	.030
Decision Confidence	-.004	-.022	.010
Intrinsic Motivation	.030*	.011	.055
Extrinsic Motivation	.011	.000	.027
Self-Regulation	.047*	.026	.072
Self-Efficacy	.118*	.082	.157

Note: Confidence intervals are bias corrected and accelerated; intervals not including 0 indicate a significant mediator; Estimation was done with 5000 bootstrap re-samples; A = agency; LE = respectful partnership in the learning environment; R = rehearsal strategies; E = elaboration strategies; O = organization strategies; CT = critical thinking strategies; SRS = self-regulated study strategies
* Mediation is significant at $p < 0.05$

LE → A → R. When taken as a set of component variables (Table 36), agency mediated the effect of a student's perception of their partnership with their instructor (LE) and their use of rehearsal learning strategies (R). The F statistic for this model was 19.73 with a p value of .00 and an R^2 of .16. The total and direct effects of LE on R were .096, $p < .01$ and .047, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .246 and a 95% BCa bootstrap CI of .157 to .359 (i.e. it can be claimed that the difference between the total and direct effect of R and LE are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .026$; $CI_{95} = .002, .068$; $p < .05$), intrinsic motivation ($PE = .042$; $CI_{95} = .008, .091$; $p < .05$), self-regulation ($PE = .087$; $CI_{95} = .046, .146$; $p < .05$) and self-efficacy ($PE = .061$; $CI_{95} = .001, .128$; $p < .05$) were the only mediators, since their 95% CI did not contain zero. Decision confidence and extrinsic motivation did not contribute to this mediation above and beyond planfulness, intrinsic motivation, self-regulation, and self-efficacy. The F statistic for this model was 19.73 with a p value of .00 and an R^2 of .16.

$LE \rightarrow A \rightarrow E$. When taken as a set of component variables (Table 36), agency mediated the effect of a student's perception of their partnership with their instructor (LE) and their use of elaboration learning strategies (E). The F statistic for this model was 74.33 with a p value of .00 and an R^2 of .41. The total and direct effects of LE on R were .218, $p < .01$ and .084, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .134 and a 95% BCa bootstrap CI of .101 to .169 (i.e. it can be claimed that the difference between the total and direct effect of LE and E are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .013$; $CI_{95} = .005, .026$; $p < .05$), intrinsic motivation ($PE = .036$; $CI_{95} = .020, .056$; $p < .05$), self-regulation ($PE = .014$; $CI_{95} = .001, .030$; $p < .05$), and self-efficacy ($PE = .068$; $CI_{95} = .045, .090$; $p < .05$) were mediators, since their 95% CI did not contain zero. Decision confidence and extrinsic motivation did not contribute to this mediation above planfulness, intrinsic motivation, self-regulation, and self-efficacy.

$LE \rightarrow A \rightarrow O$. When taken as a set of component variables (Table 36), agency mediated the effect of a student's perception of their partnership with their instructor (LE) and their use of organizational learning strategies (O). The F statistic for this model was 51.94 with a p value of .00 and an R^2 of .33. The total and direct effects of LE on O were .139, $p < .01$ and .058, $p < .01$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .081 and a 95% BCa bootstrap CI of .060 to .104 (i.e. it can be claimed that the difference between the total and direct effect of LE and O are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .008$; $CI_{95} = .002, .017$; $p < .05$), intrinsic motivation ($PE = .036$; $CI_{95} = .020, .056$; $p < .05$), self-regulation ($PE = .014$; $CI_{95} = .001, .030$; $p < .05$), and self-efficacy ($PE = .068$; $CI_{95} = .045, .090$; $p < .05$) were mediators, since their 95% CI did not contain zero. Decision confidence and extrinsic motivation did not contribute to this mediation above planfulness, intrinsic motivation, self-regulation, and self-efficacy.

.05), extrinsic motivation ($PE = .008$; $CI_{95} = .001, .016$; $p < .05$), self-regulation ($PE = .018$; $CI_{95} = .007, .030$; $p < .05$), and self-efficacy ($PE = .049$; $CI_{95} = .033, .067$; $p < .05$) were mediators, since their 95% *CI* did not contain zero. Decision confidence and intrinsic motivation did not contribute to this mediation above planfulness, extrinsic motivation, self-regulation, and self-efficacy.

***LE* → *A* → *CT*.** When taken as a set of component variables (Table 36), agency mediated the effect of a student's perception of their partnership with their instructor (*LE*) and their use of critical thinking learning strategies (*CT*). The *F* statistic for this model was 40.17 with a *p* value of .00 and an R^2 of .28. The total and direct effects of *LE* on *CT* were .129, $p < .01$ and .016, $p = .43$, respectively. The difference between the total and direct effects is the total indirect effect through the six mediators, with a point estimate of .114 and a 95% BCa bootstrap *CI* of .084 to .146 (i.e. it can be claimed that the difference between the total and direct effect of *LE* and *CT* are different from zero). An examination of the specific indirect effects indicated that intrinsic motivation ($PE = .026$; $CI_{95} = .012, .046$; $p < .05$), self-regulation ($PE = .045$; $CI_{95} = .028, .067$; $p < .05$), and self-efficacy ($PE = .041$; $CI_{95} = .025, .060$; $p < .05$) were mediators, since their 95% *CI* did not contain zero. Planfulness, decision confidence, and extrinsic motivation did not contribute to this mediation above intrinsic motivation, self-regulation, and self-efficacy.

***LE* → *A* → *SRS*.** When taken as a set of component variables (Table 36), agency mediated the effect of a student's perception of their partnership with their instructor (*LE*) and their use of self-regulated study strategies (*SRS*). The *F* statistic for this model was 91.32 with a *p* value of .00 and an R^2 of .47. The total and direct effects of *SRS* on *LE* were .338, $p < .01$ and .123, $p < .01$, respectively. The difference between the total and

direct effects is the total indirect effect through the six mediators, with a point estimate of .215 and a 95% BCa bootstrap *CI* of .163 to .271 (i.e. it can be claimed that the difference between the total and direct effect of LE and SRS are different from zero). An examination of the specific indirect effects indicated that planfulness ($PE = .013$; $CI_{95} = .001, .030$; $p < .05$), intrinsic motivation ($PE = .030$; $CI_{95} = .011, .055$; $p < .05$), self-regulation ($PE = .047$; $CI_{95} = .026, .072$; $p < .05$), and self-efficacy ($PE = .118$; $CI_{95} = .082, .157$; $p < .05$) were mediators, since their 95% *CI* did not contain zero. Decision confidence and extrinsic motivation did not contribute to this mediation above planfulness, intrinsic motivation, self-regulation, and self-efficacy.

General Findings

Each research question investigated the mediating relationship of agentic processes relative to academic achievement, goal-orientation, self-regulated study strategy use, social identification, and student perceptions of the fairness of the learning environment. An overview of the general findings of this research is presented below.

- 1) When interpreted as a set of variables, agency mediates the effects of a students' goal orientation on their academic achievement specifically through self-efficacy.
- 2) When interpreted as a set of variables, agency mediates the use of learning strategies and effects of academic achievement specifically self-efficacy.
- 3) When interpreted as a set of variables, agency mediates the effects of social identification on academic achievement specifically through self-efficacy.

- 4) When interpreted as a set of variables, agency mediates the effects of student perceptions of the learning environment on academic achievement specifically through planfulness, intrinsic motivation, self-regulation, and self-efficacy.
- 5) When interpreted as a set of variables, agency mediates the effects of social identification on goal orientation specifically through planfulness, decision confidence, extrinsic motivation, intrinsic motivation, self-regulation, and self-efficacy.
- 6) When interpreted as a set of variables, agency mediates the effects of student perceptions of the learning environment on goal orientation specifically through planfulness, decision confidence, intrinsic motivation, extrinsic motivation, self-regulation, and self-efficacy.
- 7) When interpreted as a set of variables, agency mediates the effects of social identification on the use of learning strategies specifically through planfulness, intrinsic motivation, extrinsic motivation, self-regulation, and self-efficacy.
- 8) When interpreted as a set of variables, agency mediates the effects of student perceptions of the learning environment on the use of learning strategies specifically through planfulness, intrinsic motivation, extrinsic motivation, self-regulation, and self-efficacy.

Upon closer examination, these findings further suggest that agentic processes mediate the influence of social-environmental factors (social identification and learning environment) on personal variables (goal orientation, learning strategy use) and academic achievement. While this research does not provide conclusive results, it does support the suggestion that there is a need to further explore the combined effects of social and

environmental factors on the cognitive aspects of learning (Zimmerman & Cleary, 2006). This research also supports claims in AFL and SCT that emphasize the role of the environment and social factors on learning (e.g. Cameron, 1999; Jakubowski, 2003).

However, the findings of this research are limited. Both AFL and SCT posit that interactions between agentic processes and personal, behavioural, and social-environmental influences occur through reciprocal causation. In order to examine reciprocal causation, two conditions must be met: (1) a theoretically causal relationship must be established; and (2) this relationship must be examined using longitudinal data (Cole & Maxwell, 2003; Collins & Flaherty, 2006; Maxwell & Cole, 2007). A reciprocal analysis is not appropriate with these data since this research uses correlational data measured in a cross-sectional design. However, since a theoretically causal relationship has been proposed, the mediation analysis presented in this study enables a *preliminary* examination of the relationship between the proposed agentic processes and personal, behavioural, and social-environmental factors. The mediational relationship suggested by the results of this study and the causal nature of the effect of agentic processes and their reciprocal relationships should be examined further using longitudinal data and structural equation modeling (SEM).

Concluding Discussion

Agency concerns students' abilities to regulate, control, and monitor their own learning. Results of this study indicate that with the exception of performance-avoidance goal-orientation, agentic processes are significant mediators. Within each mediational model, the role of specific agentic processes was found to vary in strength (significance)

depending on the context. For example, this research suggests that self-efficacy is a significant mediator of goal orientation on academic achievement and learning strategy use on academic achievement. These findings are supported in the literature (e.g. Caprara, et al., 2008; Pajares & Miller, 1994; Pajares, et al., 1999; Thijs & Verkuyten, 2008). Whereas, the findings of this research also suggest that agentic processes (intentionality, forethought, self-regulation and self-efficacy) also mediate the effects of social-environmental influences (social identification and learning environment) on personal factors (goal-orientation and learning strategy use). It is recommended that future research explore these assumptions further. These findings are consistent with social cognitive theory as described by Bandura (1986) and emphasized in AFL (Code, 2010a).

There are several implications of these findings for current research and practice. First, this research provides a clear theoretical context in which to study multidimensional aspects of agency including aspects of intentionality (planfulness, decision confidence), forethought (intrinsic and extrinsic motivation), self-regulation, and self-efficacy. Since, aspects of intentionality, forethought, self-regulation, and self-reflectiveness are often studied independently in the literature (e.g. Gestsdottir & Lerner, 2007; Kitsantas, 2008; Little, 1998; Loedewyk & Winne, 2005; Wolters & Yu, 1996) this research provides an empirical framework in which to study these processes collectively. Second, this research provides an empirical foundation for the theoretical framework in which it is based. Using the AFLQ and mediation analysis this research was able to suggest that agentic processes are significant mediators of various personal, behavioural, and social-environmental processes providing supporting evidence for AFL theory. Third, this

research opens the door for further exploration of the role of agentic processes, how they operate collectively over time, function as mediators of academic achievement, and how they interact with personal, behavioural, and social-environmental factors. Although it has been argued that agency is difficult to theorize and study within traditional psychological science (Martin, et al., 2003), this research provides an alternative perspective to the study of agency processes and a framework that in which to re-interpret of existing theory.

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Appendix A

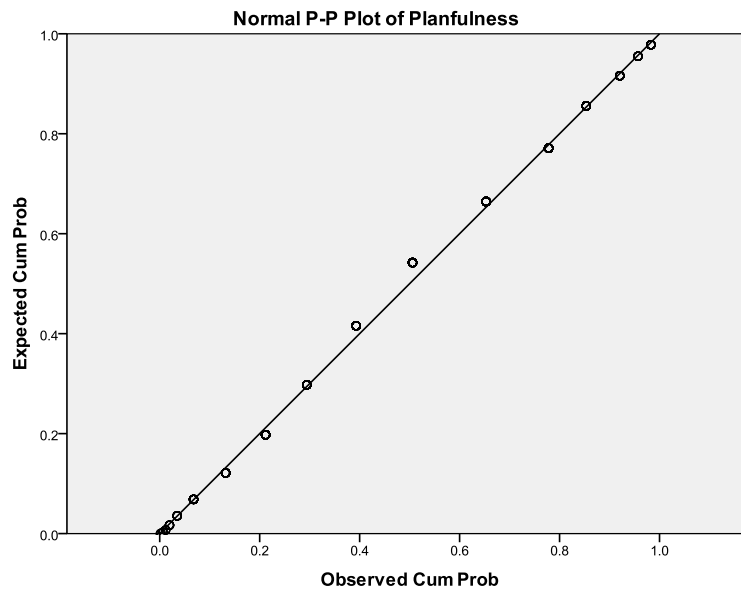


Figure 14. Normal P-P Plot of Planfulness.

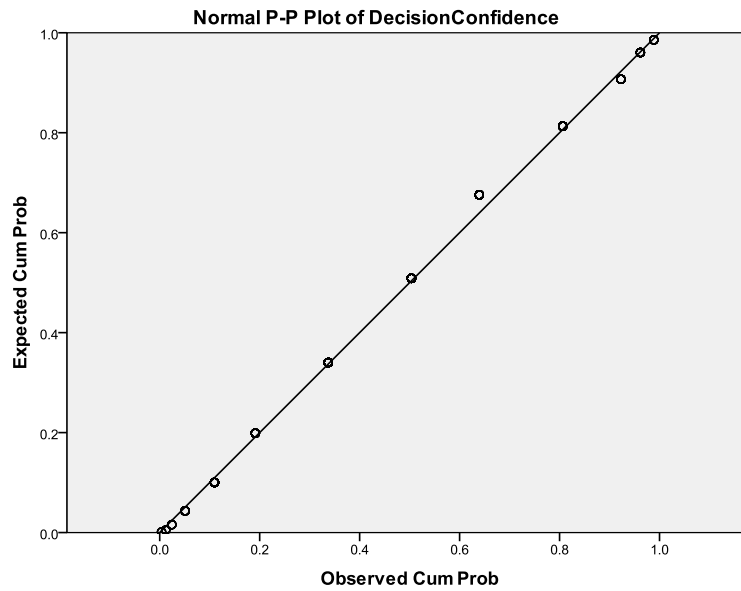


Figure 15. Normal P-P Plot of Decision Confidence

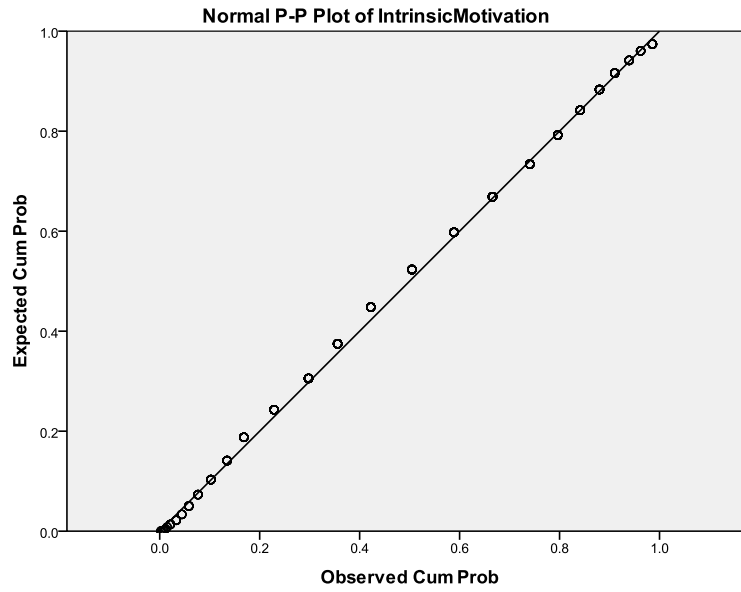


Figure 16. Normal P-P Plot of Intrinsic Motivation

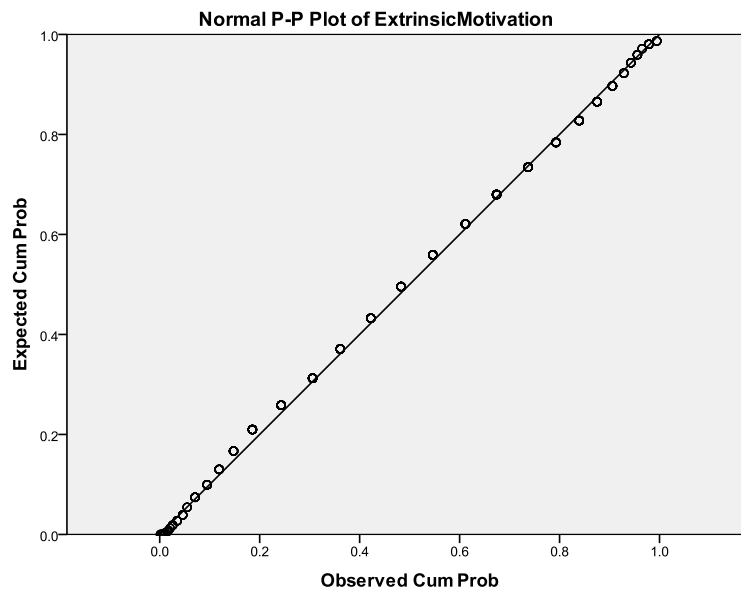


Figure 17. Normal P-P Plot of Extrinsic Motivation

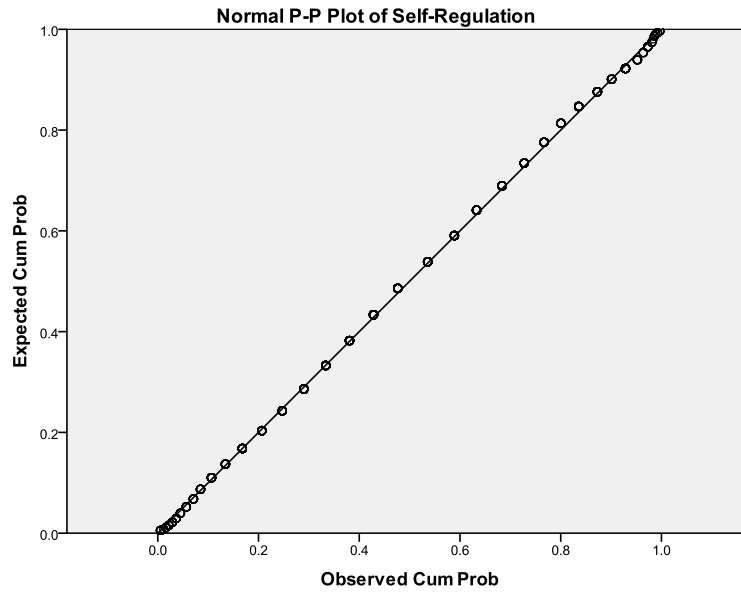


Figure 18. Normal P-P Plot of Self-Regulation

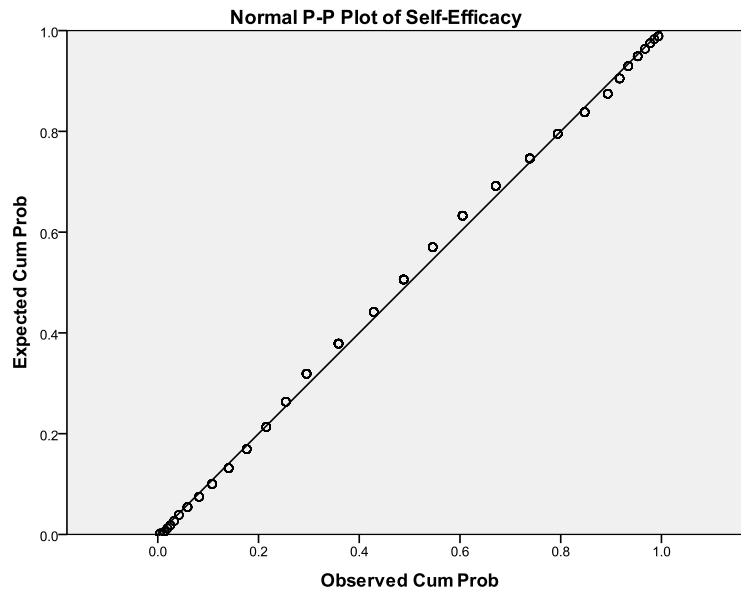


Figure 19. Normal P-P Plot of Self-Efficacy

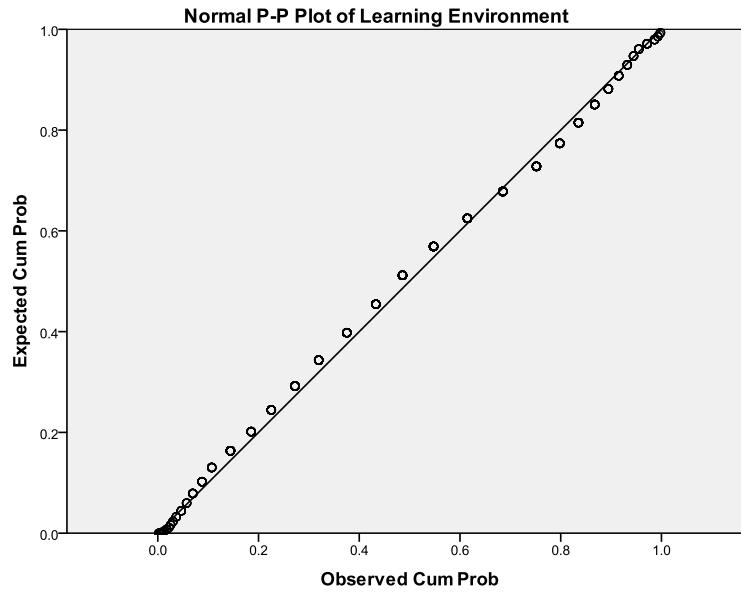


Figure 20. Normal P-P Plot of Learning Environment

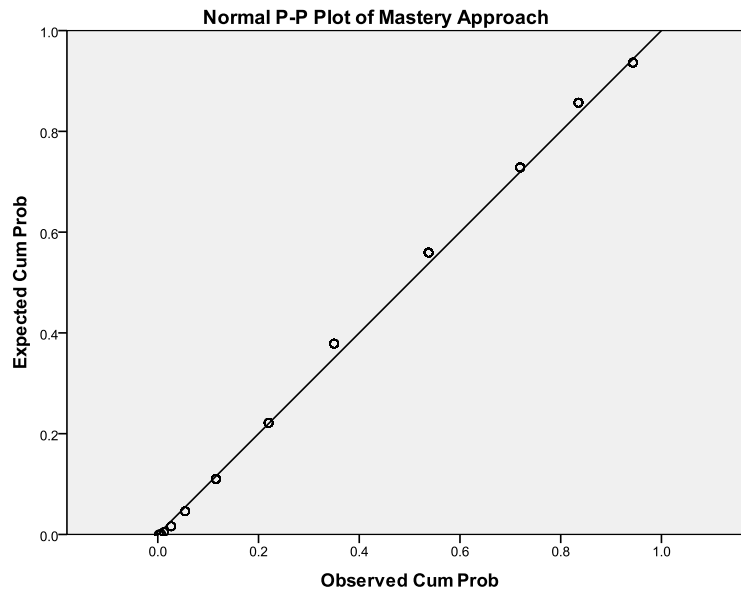


Figure 21. Normal P-P Plot of Mastery Approach

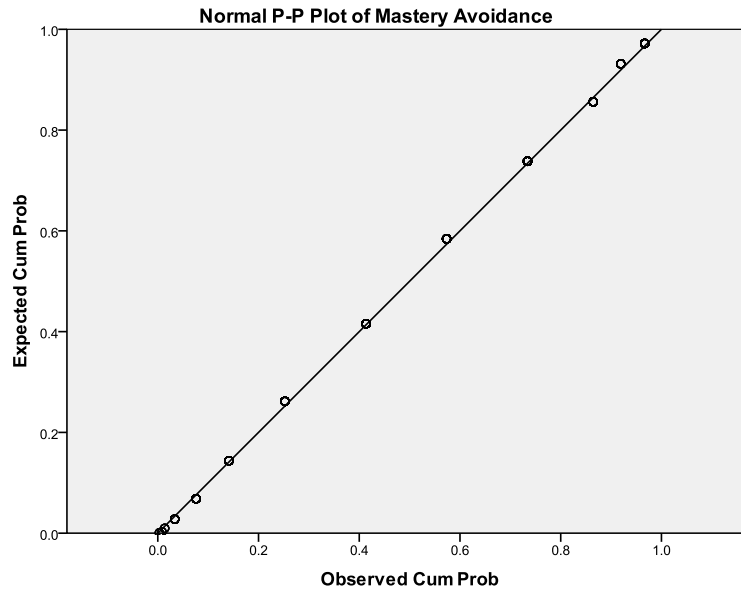


Figure 22. Normal P-P Plot of Mastery Avoidance

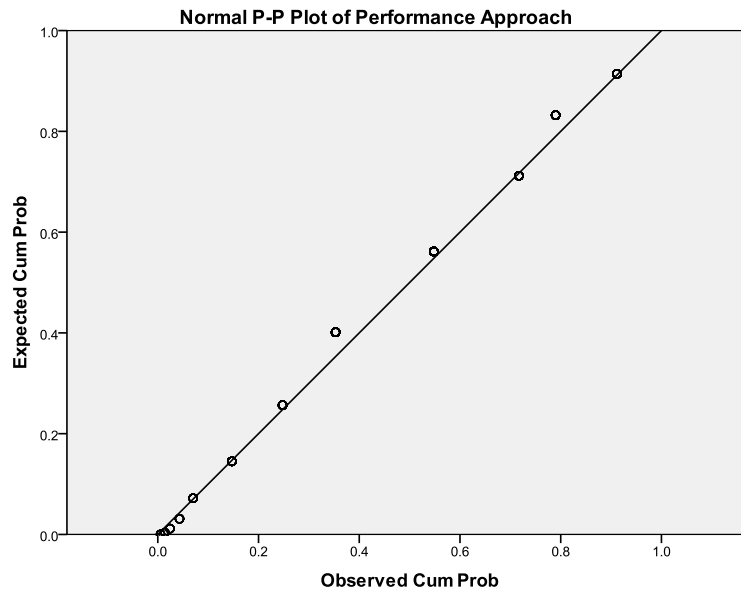


Figure 23. Normal P-P Plot of Performance Approach

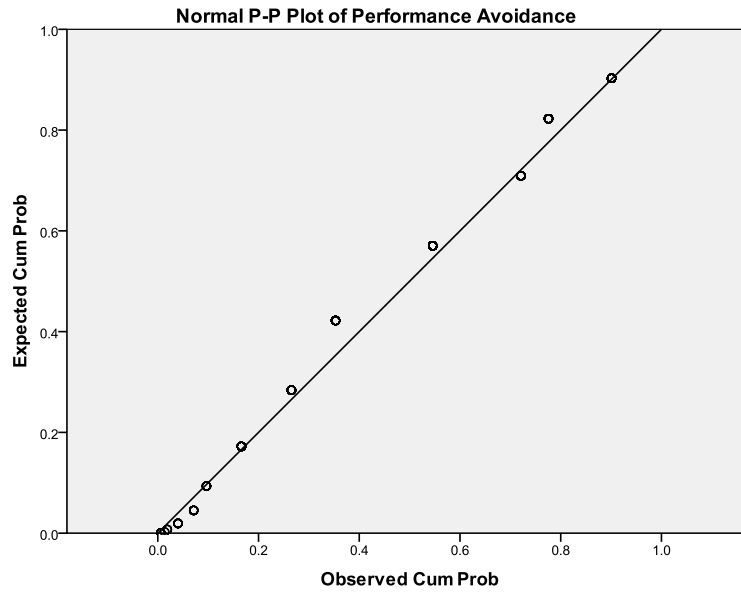


Figure 24. Normal P-P Plot of Performance Avoidance

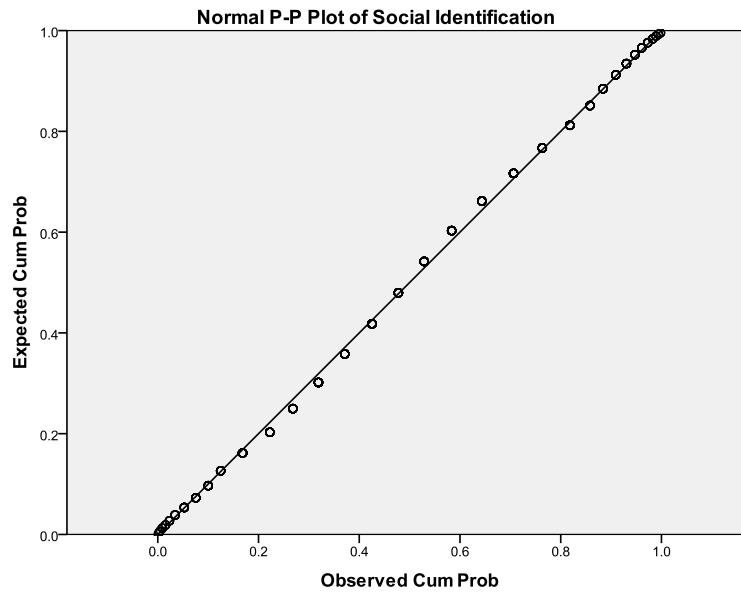


Figure 25. Normal P-P Plot of Social Identification

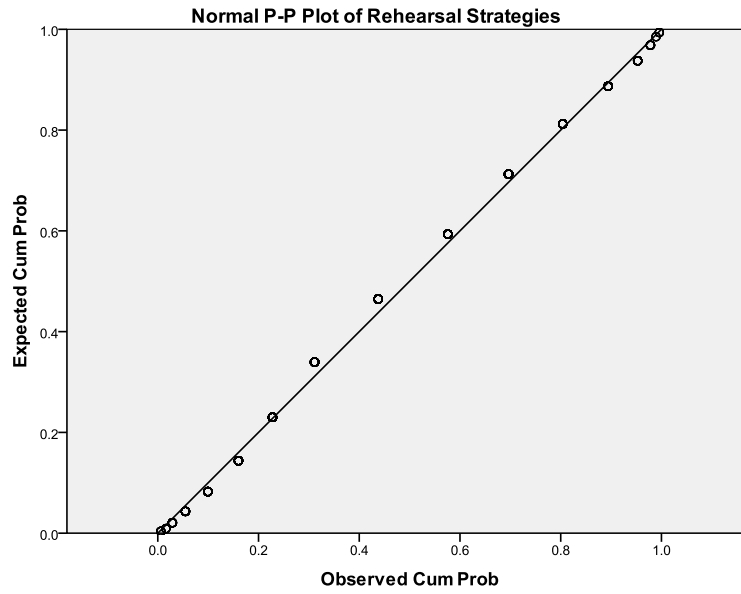


Figure 26. Normal P-P Plot of Rehearsal Strategies

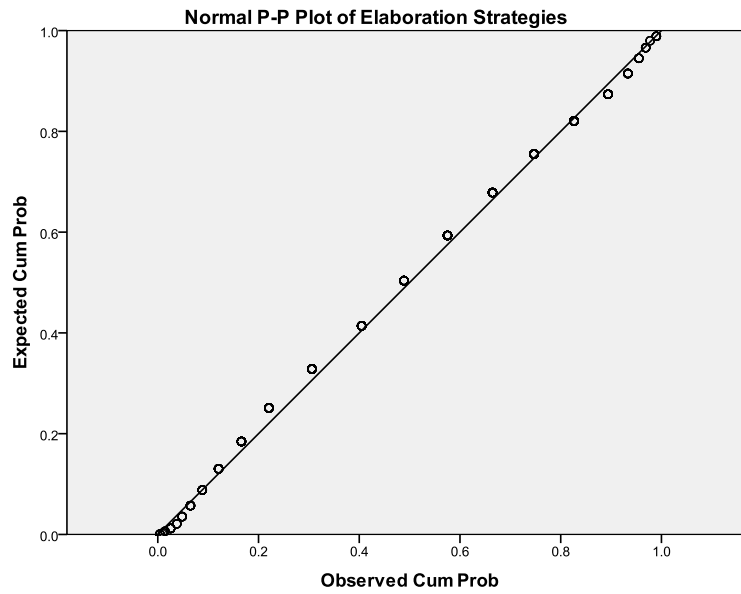


Figure 27. Normal P-P Plot of Elaboration Strategies

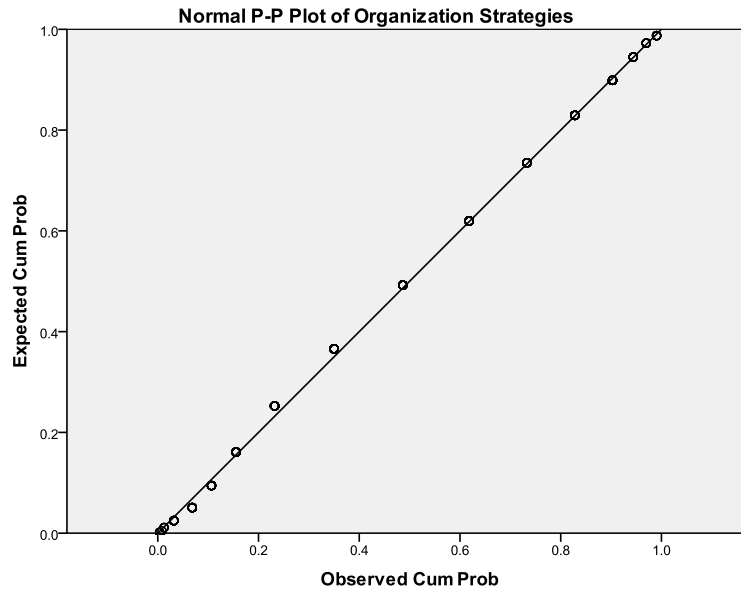


Figure 28. Normal P-P Plot of Organization Strategies

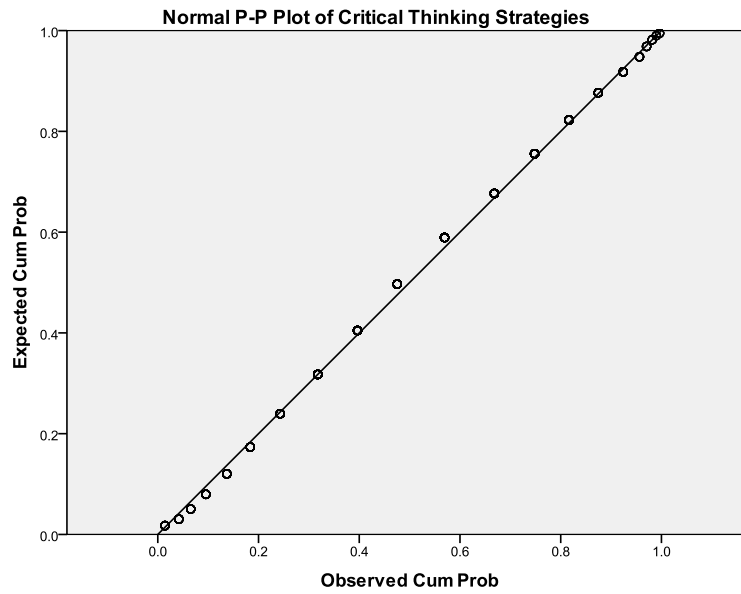


Figure 29. Normal P-P Plot of Critical Thinking Strategies

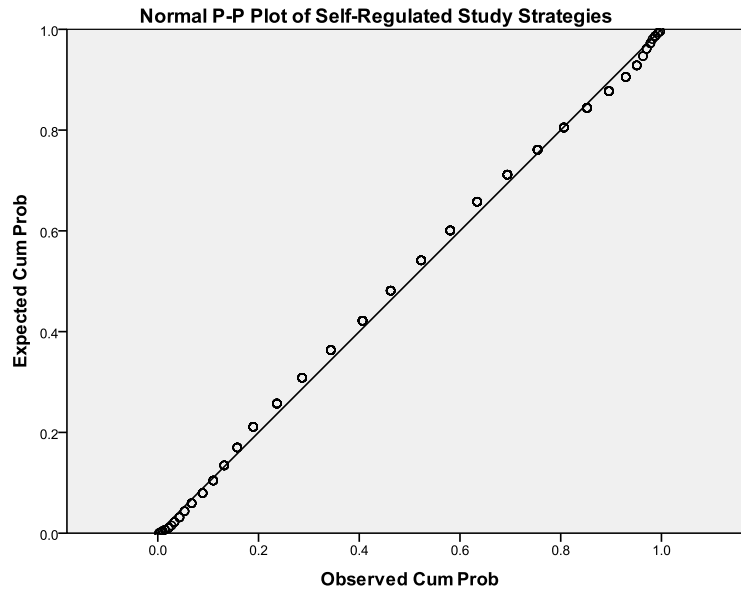


Figure 30. Normal P-P Plot of Self-Regulated Study Strategies.

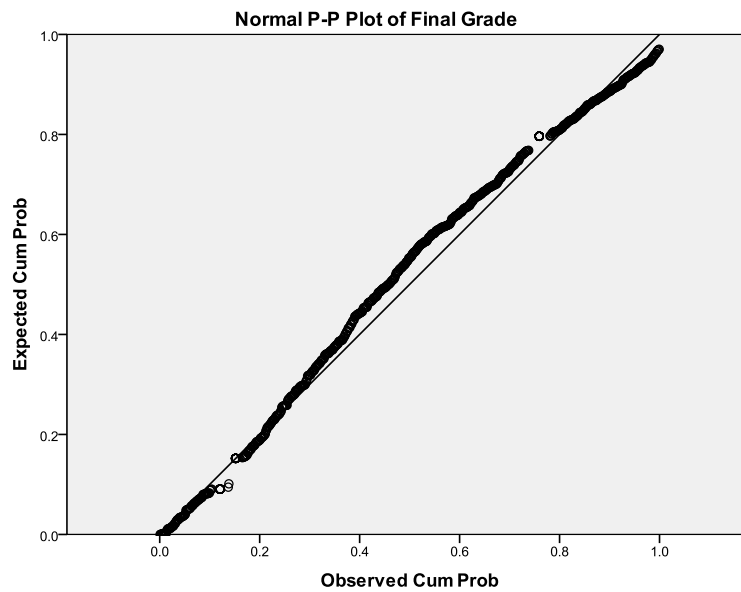


Figure 31. Normal P-P Plot of Academic Achievement

CHAPTER 5: CONCLUSION

Understanding how agency develops and emerges within learning environments is a key factor in identifying why learning occurs. The focus of this dissertation research was not specifically on what agency is but on exploring how agentic processes potentially operate within the learning context. The theoretical model of agency for learning (AFL) presented in Chapter 2 built upon a social cognitive view and extended this view by incorporating aspects of developmental, historical, and sociocultural theorizing that emphasized the integral nature of agency on the regulating processes necessary for learning. This model presented agentic processes as mediating factors between other personal, environmental, and behavioural processes. It was proposed that AFL presented a more complete picture of how individuals regulate and use their influence to meet personal and collective goals and provided a framework that enables the further study of learning in the classroom context. Chapter 3 traced the development of the Agency for Learning Questionnaire (AFLQ) and examined the internal consistency, predictive validity, and psychometric properties of this new instrument using classical test theory and item response analysis. Results indicated that the scales on the AFLQ developed with university students had excellent internal consistency, significant predictive validity, and strong psychometric properties. Building upon the AFL framework, the AFLQ provided a means to empirically investigate self-processes within the learning context. Using the AFL framework and the newly developed AFLQ, Chapter 4 examined the mediating relationship of agentic process (intentionality, forethought, self-regulation, and self-efficacy) relative to academic achievement, goal-orientation, self-regulated study strategy use, social identification, and student perceptions of the fairness of the learning

environment. Results of this study indicate that with the exception of performance-avoidance goal-orientation, agentic processes act as significant mediators and the role of specific agency processes was found to vary in strength depending on the context. The results of the research presented in this thesis, encompass the following themes consistent with a theory of agency for learning.

- 1) Students show evidence of agentic capabilities through intentionality (planfulness and decision confidence), forethought (intrinsic motivation and extrinsic motivation), self-reactiveness (self-regulation), and self-reflection (self-efficacy).
- 2) Agentic processes can be studied empirically using existing measures, enabling the re-interpretation of existing learning theory.
- 3) Agentic processes play a mediating role between the effects of student goal orientation, learning strategy use, social identification, perceptions of the learning environment, and academic achievement.

Limitations

Some of the limitations of this research include threats to external validity and generalizability. The results of this research are more suggestive of a causal relationship between agentic processes and the variables studied because this research used a cross-sectional survey based design. Given the limitations of the existing statistical analysis and the theoretical nature of agency as established in the extant literature, the causal relationship between agentic factors and other personal, behavioural, and social-environmental influences cannot be concluded with the existing results.

Threats to external validity are found in the extraneous subject characteristics that influenced who participated in this research. Students were recruited from a convenience sample of second-year organic chemistry students and given course credit for participation. Although this contributed to the increased response rate, this specific group of students is not necessarily representative of the general undergraduate university population.

Implications and Recommendations for Future Research

There are wide ranging implications for future research using the AFL framework described in this study. This conceptual framework helps clarify confusion about terminology and will enable researchers, especially in the area of self-regulated learning, to use terms interchangeably. Using AFL to provide conceptual clarification will help guide future SRL assessment and instrument development, link learning processes with academic outcomes, enable more theoretically rigorous and comprehensive educational developmental research, and tie agentic processes firmly with instructional methods (Schunk, 2008).

The results of this research, and the current lack of conceptual clarity in the educational psychology literature (see Dinsmore, et al., 2008; Martin & McLellan, 2008; Schunk, 2008), implores researchers to identify relevant theories in which to guide their research. As an example of how AFL can be applied in existing research, two lines of inquiry are outlined based on the findings of this research. One line of inquiry describes how learning environments can promote agency development. A second line of inquiry describes how the use of social networks as cultural tools encourages agency emergence.

Design of Learning Environments

Designing effective environments for learning requires a critical analysis of approaches to instructional design. AFL theory integrates aspects of student decision making, motivation, self-regulation, and self-efficacy by providing a theoretical framework that enables the empirical exploration of agency within a learning context. Agency development is of the utmost importance for students to be successful in school and throughout their lifespan. For example, to encourage agency development in the learning context (face to face or virtual settings), teachers can encourage student risk-taking and active, self-directed experimentation (Martin, 2004a). Learning environments that are designed to promote agency development would encourage students to pursue tasks that challenge their existing understandings in ways that require them to access resources through a variety of classroom and extracurricular sources. These tasks help students become comfortable with risk-taking while being encouraged by teachers and working with peers to focus on the issues, concerns, and challenges (Martin, 2004a). As Martin suggests, in this environment students are encouraged to evaluate the results of their experimentation and risk-taking and reflect upon their new understanding relative to the challenges they faced in the learning activity.

Agency in Social Networks

Learning within communities evolves from expressions of human agency. Learning communities, such as those within social networks, are a result of mediated expressions of agency that challenge the existing authority structure of classroom discourse. Social software provides students with opportunities to manipulate contexts

and strategically interact with other students (agents) to achieve a desired outcome. Social experience involves the interactions between individuals, and involves the tools, symbols, and values that influence the action (Gauvain, 2001). Vygotsky's sociocultural theory of development posits that the transformation and development of cognitive and social skills occurs within social interactions. Vygotsky (1962, 1978) believed that children (and individuals) learn using *cultural tools* which mediate higher-order mental processes such as reasoning and problem solving. Cultural tools include both *technical tools* such as books, media, and computers, and *psychological tools* such as language, signs, writing, and symbols.

Cultural tools mediate communication within social settings. Online social networks and social software changes the way we perceive and act within social settings. As social software is both a social and psychological tool, it provides a computing environment in which actions are mediated through the appropriation of language, writing, signs, and symbols. As a result, online social networks and social software are cultural tools, and are carriers of social, cultural, and historical formations that amplify certain social actions (Jones & Norris, 2005). The enactment of social software as a cultural tool promotes the development of a unique and particular social language that mediates agentic expression.

Expressions of agency through online social networks promote the idea that an individual has authority over their virtual cultural space. There is potential to develop a research program that explores the emergence of agency as a social construction that develops through mediation, the appropriation of cultural tools, and facilitates a novel means of community formation.

Conclusion

Agency for learning extends current views of agency and self-regulated learning by enabling educational psychologists to identify, measure, and study agentic processes in the context of learning. The research presented in this dissertation provides evidence that agentic capabilities mediate the effects of various personal, environmental, and behavioural processes on academic achievement. This research is significant because it provides a theoretically grounded empirical framework in which to examine agentic processes enabling practitioners, teachers, and instructional designers to explore how learning environments can be designed to promote agency. Further, the model and instrument presented in this dissertation align self-regulated learning with developments in the field of agency and provides a starting point for further study of the interaction between personal, environmental, and behavioural processes in learning. Although it has been argued that agency is difficult to theorize and study within traditional psychological science (Martin, et al., 2003), this research provides an alternative perspective to the study of agentic processes and a framework that enables the re-interpretation of existing theory.

A Final Thought

“Our research agenda as educational psychologists is not to prove that the self or spirit of being, agency, and will exists. Our job, rather, is to study and define its operation and in so doing, discover how best to tap the resources of that inner spirit, and rekindle goals for positive growth that motivate learning and self-development. As we work in this direction, we

will discover how to promote that will, to free up positive affect, and to develop the belief systems and skills that contribute to self-regulated learning. In so doing, we will take a major step toward improving students' development and the quality of schooling and learning outcomes”

(McCombs & Marzano, 1990, p. 67).

It has been 20 years since Barbara McCoombs and Robert Marzano, in their article *Putting the Self in Self-Regulated Learning: The Self as Agent in Integrating Will and Skill* (1990), implored educational psychologists to look upon the past 100 years of philosophy to inform their research and practice. Many have yet to receive this message.

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