Mindsets, Mastery, and Inquiry: Classroom Impact on Students' Achievement Goals

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Contributions of Authors

This thesis is based on two manuscripts; one submitted for publication and one in preparation (Gyles & Shore, 2015; Gyles, Shore, & Hoover, 2015). The first manuscript is a review article, *Mindsets, Mastery, and Inquiry: A Framework for Examining Mindset Development in Educational Contexts*, whereas the second article, *Mindsets, Mastery, and Inquiry: Classroom Impact on Students' Achievement Goals*, is an empirical study based on the relationship proposed in the review article. The literature review for the empirical article is summarized more briefly. My role in the development of this article involved conceptualizing the proposed relations among variables, determining the research questions, reviewing the literature, proposing and refining data collection methods and tools, recruiting participants, leading a small team in data collection, proposing and conducting statistical analyses, interpreting the data, and writing the manuscripts. My supervisor (second author), Professor Emeritus Bruce M. Shore, at the early stages of my doctorate sponsored my attendance at a conference where I first heard Carol Dweck speak and had the initial inspiration for my thesis, and then provided guidance and consultation on the methodology, analyses, and interpretation of the findings, and assisted with numerous iterations in editing the manuscripts. Professor Michael L. Hoover, third author on the second manuscript, gave substantial contributions through consultations on the methodology, statistical analyses, data interpretation.

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Abstract

Implicit theories, also known as mindsets, and achievement goals are motivational constructs that describe the reasons that we engage in or disengage from learning scenarios. These theories provide accounts of how likely we are to approach or avoid tasks, the extent to which we persist in the face of challenge, the cognitive strategies we apply, how well we perform, and the emotional reactions and underlying beliefs about ourselves. Ames (1992) proposed classroom structures to support incremental theories (the belief that one's abilities can grow) and mastery goals (goals aimed at learning and growth); these classroom qualities largely overlap with inquiry-based methods (Gyles & Shore, 2016). This study investigated the impact of guided-inquiry-classrooms versus comparison teacher-structured classrooms as contexts to promote mastery goals in a sample of 81 grade-12 English students from seven classes. Binomial logistic regression analyses revealed that inquiry-based classes (regardless of implicit theory) and incremental theories of ability (in either instructional setting) each predicted the likelihood of reporting mastery goals in response to questions about student motivation in class. These students reported a desire to learn for the sake of learning, wanting to build and develop a skillset or knowledge base, and later application to life outside of academic contexts. Students in more teacher-structured classes and those holding entity theories of ability were more likely to report performance goals (e.g., grade emphasis, planning for university admission, outperforming peers) as their motivation. There was an additive effect of guided inquiry and incremental theories on students' learning goals. It is well established in previous research that students with incremental theories are more likely to adopt mastery goals. This study further demonstrated that students in inquiry-based classes reported mastery goals over and above the level predicted by students' mindset or implicit theory alone.

Résumé

Les théories implicites de l'intelligence, appelées également mentalités [« mindsets »], ainsi que les buts d'accomplissement, sont des concepts motivationnels qui aident à élucider les raisons pour lesquelles on s'intéresse ou se désintéresse à des scénarios d'apprentissage. Ces théories nous informent sur les probabilités que l'on accepte ou repousse certaines tâches, la mesure dans laquelle on persévère face à l'adversité, les stratégies cognitives que l'on applique, notre niveau de rendement, ainsi que les réactions émotives et croyances sous-jacentes à notre propre égard. Ames (1992) a proposé des structures de salles de classe qui mettent l'accent sur les théories incrémentielles (la croyance q'on a le potentiel d'augmenter ses habiletés) et les buts de maîtrise (objectifs d'apprentissage ou de développement); ces propriétés chevauchent grandement les démarches (ou approches) par investigation raisonnée [« inquiry »] (Gyles & Shore, 2016). Cette étude a examiné, auprès d'un échantillon de 81 étudiants suivants le cours d'anglais de douzième année et provenant de sept salles de classe, l'incidence des salles de classe fonctionnant par démarche d'investigation guidée et qui tendent à favoriser la promotion des buts de maîtrise, versus les classes structurées et dirigées par les enseignants. Analyses de régression logistique binomiale ont révélé que les étudiants dans des classes où se trouve la démarche d'investigation (sans égard à la théorie implicite), ainsi que les étudiants ayant des théories incrémentielles (dans l'un ou l'autre des cadres éducatifs) avaient des buts de maîtrise en réponse aux questions sur leur motivation. Ces étudiants ont rapporté le désir d'apprendre par pur intérêt d'apprentissage, désirant développer soit des compétences soit une base de connaissances, pour ensuite en faire usage dans des situations de vie à l'extérieur du contexte scolaire. Les étudiants dans les classes plus structurées par professeurs et adhérant à des théories de l'entité avaient une plus grande tendance à rapporter des buts de performance (accent sur les notes, planification pour

l'admission universitaire, le désir de surpasser les pairs) comme étant leurs motivations. Un effet additif du modèle d'investigation guidée et de la croyance aux théories incrémentielles peut influencer les buts d'apprentissage des étudiants. Dans plusieurs recherches antérieures, il a été bien établi que les étudiants ayant des théories incrémentielles sont plus portés à adopter des buts de maîtrise. Cette étude démontre davantage que les étudiants apprenant dans un environnement de démarche d'investigation guidée ont rapporté avoir des buts de maîtrise bien au-dessus des niveaux prédits en observant seuls les mentalités ou théories implicites de ces derniers.

Chapter 1

Introduction to the Manuscripts

This dissertation is composed of two manuscripts investigating the role of implicit theories of ability, achievement goals, and style of instruction. Broadly, the current research aimed to investigate the theoretical possibility that inquiry-based learning environments may contribute to different learning goals and underlying beliefs about one's abilities. In classroom settings, not all students are equally motivated to learn. Furthermore, when faced with obstacles, students of similar levels of achievement may have drastically varied responses in the face of challenge. Rather than considering motivation in quantitative terms, such as high or low motivation in students, the present research examined student motivation varying by quality and the role instructional characteristics may play in this.

The first manuscript, by Gyles and Shore (2016), *Mindsets, Mastery, and Inquiry: A Framework for Examining Development of Implicit Theories in Educational Contexts*, is a literature review proposing inquiry-based classrooms as instructional settings that may promote the adoption of mastery-goal orientations and incremental implicit theories. Dweck (1986) classified two types of implicit theories of ability or mindsets: *entity* or *fixed* and *incremental* or *growth*. Learners with incremental theories tend to adopt mastery goals and believe their abilities can be learned and developed by employing effortful learning and persisting in the face of challenge. Learners with entity theories are prone to holding performance goal-orientations in which the belief that one's abilities are fixed propels individuals to approach situations in which they can demonstrate their competence, but avoid scenarios in which they do not believe they will succeed (Dweck, Chiu, & Hong, 1995). Ames (1992) suggested three fundamental classroom structures that may encourage mastery orientation and relatedly incremental theories

in learners. Gyles and Shore (2016) argued that these classroom-goal structures of task, authority, and evaluation and recognition practices, overlap with key features of inquiry-based instruction. Guided-inquiry education is a student-centered, interest-driven, collaborative, project-based form of learning, in which students have opportunities to pursue in-depth investigations of questions of interest with scaffolded autonomy (Aulls & Shore, 2008; Llewellyn, 2013; Saunders-Stewart, Gyles, & Shore, 2012; Saunders-Stewart, Gyles, Shore & Bracewell, 2015). Inquiry-based teaching and learning practices in general are highly in line with the classroom structures suggested by Ames (1992). The first paper in the thesis provides a review, bridging the literatures among implicit theories, achievement goals, and inquiry learning and posited that inquiry-based educational settings might be a context to foster incremental theories of ability and mastery goals.

The second manuscript, by Gyles, Shore, and Hoover (2016), *Mindsets, Mastery, and Inquiry: Classroom Impact on Students' Achievement Goals*, tested the hypothesis proposed from the review of the literature that inquiry-based classrooms may be a context in which to promote the adoption of mastery goals and incremental theories. Specifically, the following questions were addressed: (a) Do students' implicit theories differ in guided-inquiry versus teacher-structured learning environments? Are implicit theory and instructional setting correlated to one another? (b) Are students in inquiry settings more likely to hold mastery-goal orientations? Is there an additive or interactive effect of instructional style and implicit theory on achievement goals? (c) How are instruction and implicit theory related to learning strategies and achievement emotions and behaviors? High-school students sampled from highly inquiry-based classrooms and comparison teacher-structured classes with lower inquiry use were given questionnaires assessing their implicit theories and related variables. Students were interviewed

about what motivated them in their classes to determine if there were significant differences in reported achievement goals or measured implicit theories between the instructional groups. As hypothesized based on theory and past research, inquiry instruction and incremental theories of ability predicted student motivation and reports of mastery goals. These findings have wide application to the fields of education and educational psychology, as well as many indirect implications.

Chapter 2

Mindsets, Mastery, and Inquiry: A Framework for Examining Development of Implicit Theories in Educational Contexts

In today's classrooms, not all children equally share a passion for knowledge or learning. What makes some students more eager to learn than others? Further, what makes some students intrinsically driven to learn, in the absence of external praise or recognition?

Implicit theories and achievement goals both offer explanations of individual differences in intrinsic motivation for learning and achieving. Students with incremental theories (growth mindsets) believe that their traits and abilities, including intelligence and academic abilities, are not static and can develop through their efforts (Dweck, 1986; Dweck & Elliott, 1983). This makes students more likely to adopt mastery goals aimed at personal improvement and seeking opportunities to learn (Dweck & Leggett, 1988). With numerous cognitive, affective, and achievement benefits for students, many educational psychologists have shifted their focus to explore which classroom features might encourage incremental theories and mastery-orientations (e.g., Davis, Burnette, Allison, & Stone, 2011; Grant & Dweck, 2003; Harackiewicz, Barron, & Elliot, 1998). Many proposed strategies and elements of classroom environments overlap with elements of inquiry-based teaching and learning (e.g., Law, 2011; Singh, 2011; Shimoda, White, & Frederikson, 2002). These include interesting and engaging tasks, increased autonomy and collaboration, as well as and process- and effort-based recognition and authentic evaluation (Ames, 1992). Inquiry education is a student-centered, collaborative, project-based form of learning, in which students have opportunities to pursue in-depth investigations of questions of interest (Aulls & Shore, 2008). To date, no review has bridged the education literature in inquiry-based teaching and learning with that of the motivational literature on achievement goals

and implicit theories. Specifically, no review has examined guided inquiry as a framework to examine educational conditions that foster incremental theories of ability and mastery-goal orientation.

We review theory and research surrounding implicit theories of ability and achievement goals. Inquiry-based learning is described in relation to other educational methods including discovery, problem-based, and collaborative learning. Theoretical and empirical studies proposing classroom features that encourage incremental theories and mastery goals are then synthesized and tied to elements of inquiry. Guided inquiry is proposed as a framework to examine mindset development in educational settings. Further, we propose that inquiry-based education is not only a supportive context to encourage adoption of incremental theories and mastery goals, but that children holding these motivational styles may especially benefit in inquiry environments.

Motivation

Implicit Theories

Implicit theories, also referred to as mindsets, are a framework for understanding differences in motivation to learn (Dweck, 1986; Dweck & Elliott, 1983; Dweck & Leggett, 1988). These are the underlying personal theories or beliefs in the source of one's abilities, and reflect either the belief that one's abilities are innate and stable or the belief that abilities are changeable and developed over time and through effort. Individuals with entity theories or fixed mindsets believe they have unchangeable, fixed levels of their abilities. The perception of stability in these personal qualities is associated with an external locus of control (Dweck, Chiu, & Hong, 1995) and makes one less inclined to value effort and face challenge in order to learn. Thus, one would want to display areas of strength, appearing achieved or highly able, and avoid

areas of weakness. In contrast, individuals with incremental theories or growth mindsets believe their abilities can develop through effort, persistence, and strategy use (Dweck, 1986; Dweck & Elliott, 1983; Dweck & Leggett, 1988). Individuals with this mindset hold a more internal locus of control and are eager to face challenges in order to learn and grow; believing that abilities are malleable and learnable makes an individual more prone to directing efforts toward improvement (Dweck et al., 1995).

When faced with obstacles, some children tend to avoid challenging tasks and show marked impairments in performance, whereas others seek challenge and effectively persevere through (Dweck & Leggett, 1988). These two different patterns of responding occur even when controlling for ability levels. Continued encounters with perceived failure may habituate a learned helplessness response (Abramson, Seligman, & Teasdale, 1978; Dweck & Reppucci, 1973); however, without histories of failure, what makes some children adopt helpless, maladaptive response patterns, whereas others do not? When individuals believe their abilities are fixed entities, these abilities are perceived as uncontrollable, and it is more adaptive to try to assess one's abilities and give up if the task seems to surpass their abilities (Dweck & Leggett, 1988). Unfortunately, many abilities and personal attributes are complex constructs and are difficult to gauge (Dweck et al., 1995). These individuals then rely on approximations, such as compliments or achievement successes as reassurance. Feedback indicating poor performance, however, may signal an individual to avoid the task. In contrast, when individuals believe their abilities to be incremental, they believe that their abilities are malleable and controllable, and are more likely to face and persist through challenging activities that promote the growth of those abilities or skills. Feedback indicating poor performance can be used as information for future improvement. These two competing implicit theories reflect different attributions of the origins

of one's abilities. Adopting one implicit theory over another places a differential emphasis on different achievement goals, leading to different paths of cognitive, affective, and behavioral patterns of responding.

Achievement Goals

Achievement-goal theory is concerned with the reasons and purposes that individuals engage in learning tasks--the different reasons relating to adaptive or maladaptive responses to achievement challenges (Ames & Archer, 1988; Dweck, 1986; Nicholls, 1984). Two types of achievement goals were initially conceptualized: mastery goals, also described as learning or task goals, and performance goals, also described as ego or others-referenced goals. Mastery goals aim an individual toward improving one's competence through effortful learning. Performance goals focus on a desire to demonstrate competence (Ames & Archer, 1988; Dweck, 1986; Elliott & Dweck, 1988; Nicholls, 1984). Performance goals have further been categorized into approach-avoidance dimensions (Elliot, 1999). Performance-approach goals correspond to the aim of achieving by outperforming others, whereas performance-avoidance goals correspond to the aim of avoiding the demonstration of incompetence relative to others. A 2 × 2 model of achievement goals was proposed, in which the approach-avoidance dimension was applied to mastery goals (Elliot & McGregor, 2001). Those with mastery-approach goals strive to learn or improve, while those with mastery-avoidance goals strive to avoid learning failures (e.g., not knowing as much as one can, skill decline). Examples of perfectionists highlight this latter category. Although mastery-avoidance goals are theoretically interesting and empirically supported, this paper focuses on mastery-approach goals. Recently, a 3 × 2 model was proposed (Elliot, Murayama, & Pekrun, 2011), separating mastery into two distinct competence-based domains: (a) task, using the standards of the task itself as a referent, and (b) self, one's past or

expected level is used as the referent. Since the 3 × 2 model was proposed, however, much research in the area has retained more parsimonious models of achievement goals (e.g., Hamilton, Nolen, & Abbott, 2013; Senko, Hama, & Belmonte, 2013). Particularly relevant to many educational contexts, this paper focuses on the trichotomous model examining mastery, performance-approach, and performance-avoidance goals.

Perceived competence, value ascribed to the task, sense of control, and achievement emotions all influence the likelihood that an individual will choose to approach or avoid a task. All individuals have a basic need for competence and this is a driving force for seeking stimulation and challenging activities (Deci & Ryan, 1985). The different types of achievement goals are based upon the different standards or referents that individuals use to define competence (Elliot & McGregor, 2001). Individuals with mastery goals are prone to use intrapersonal (e.g., one's past learning or maximum potential) or absolute standards (e.g., the objective requirements of the task itself). Individuals with performance goals are more likely to use normative indices (e.g., the performance of others). Wigfield and Eccles (2000) posited that one's expectations for success on the task pair with the perceived value to determine whether or not an individual will choose to approach a task, and the intensity and persistence that they will pursue the task with. Achievement values are grouped into three components: (a) attainment value--the importance of doing well, (b) intrinsic value--the enjoyment in engaging in the task, and (c) utility value--usefulness of the task for future plans.

Domain Specificity

Although an entity theory and incremental theory should not logically coexist simultaneously in an individual's belief system (believing that something cannot change is the logical opposite of believing something can change), they likely do coexist to differing degrees

in many individuals (Dweck et al., 1995). For instance, a female student might work hard in mathematics and look at her test results to determine how to better study for the next test--demonstrating an incremental theory, while also agreeing that females are genetically worse at mathematics and that certain people are "just not good" at mathematics--endorsing an entity theory. Further, these competing and coexisting beliefs may be held in one or more domains, and are not necessarily pervasive throughout all arenas of one's life (Wigfield & Eccles, 2000). The same student might believe she is naturally athletic and hold a fixed mindset in this domain, while in school she acknowledges that if she is not doing well in a subject she probably needs to work harder--reflecting a growth mindset. The belief in innateness of qualities has been examined for more general abilities, such as intelligence (Mueller & Dweck, 1998), specific abilities such as aptitude for mathematics or physics (Davis et al., 2011; Lerdpornkulrat, Koul, & Sujivorakul, 2012), as well as personality traits (e.g., shyness--Valentiner, Mounts, Durik, & Gier-Lonsway, 2011, and leadership--Hoyt, Burnette, & Innella, 2012). Like implicit theories, more recent conceptualizations of mastery and performance goals hold that individuals can adopt more than one type of goal at the same time (Pintrich, Conley, & Kempler, 2003). Several researchers have argued that domain-specific, rather than domain-general, research is necessary for obtaining accurate findings, given the variable nature of mindsets and achievement goals across different areas (e.g., Eccles, Wigfield, Harold, & Blumenfeld, 1993; Lerdpomkulrat et al., 2012). Different levels of various goals can be assessed within an individual and within domains (Meece & Holt, 1993).

Implicit Theories as Antecedents to Achievement Goals

Individuals with entity theories tend to adopt performance goals, whereas those holding incremental theories are more likely to set mastery goals (Dweck, Mangels, & Good, 2004). In

situations of perceived competence, individuals with performance goals will approach the task in order to perform or demonstrate competence (Elliot & Church, 1997). Thus, for example, the belief of being "gifted," having a "science brain," or being a "natural leader" would make one more likely to engage in related academic or vocational pursuits. However, a performance goal paired with low levels of perceived competence or situations that challenge one's sense of competence, leads to avoidance or to giving up an endeavor (Elliot & Church, 1997). Individuals with mastery goals approach learning situations with a focus on improving and working toward a personal best. An area of weakness is seen as a target to work on and develop, rather than something to hide or avoid.

Implicit theories predict achievement outcomes through the mediated effects of goal orientation (Dweck & Leggett, 1988). This relationship is further mediated by the presence of achievement-related emotions (Daniels, Stupnisky, Pekrun, Haynes, Perry, & Newall, 2009). Individuals desire to explain events and outcomes in their lives, and these explanations drive future choices and behaviors (Weiner, 1985). Incremental theories, or growth mindsets, are causal attributions of one's abilities that are personally controllable (Dweck et al., 1995). Entity theories, or fixed mindsets, are causal attributions of one's abilities that are uncontrollable by the individual. Attributions or beliefs about the level of one's control are related to emotion responses that, in turn, affect motivation and behavior (Pekrun, 2006; Weiner, 1985; 2010). Experiencing salient emotions provides feedback to the individual and this influences approach or avoidance behaviors in similar situations in the future. Attributions of failure that are stable, internal, and uncontrollable can lead to a hopeless emotional response (e.g., Hareli & Weiner, 2002). This stable, internal, and uncontrollable attribution of failure is linked to the goal of wanting to avoid demonstrating incompetence. Performance-avoidance goals have been

empirically linked to negative emotions such as anxiety or helplessness, and thus can lead to increased avoidance behaviors in the future, including self-handicapping (Midgley & Urdan, 2001; Pekrun, Elliot, & Maier, 2006). In contrast, mastery-approach goals have been linked to positive emotions such as enjoyment, and performance-approach goals have been linked to pride (Pekrun et al., 2006). These positive emotions make the individual more likely to approach similar situations in the future. These achievement emotions are largely domain-specific, indicating that prevalent and influential emotions in one subject area may not transcend to another (Goetz, Frenzel, Pekrun, & Hall, 2006).

Individuals with entity theories of ability have a tendency to adopt performance goals, whereas individuals holding incremental theories are more likely to adopt mastery goals (Dweck et al., 2004). This specific model has been repeatedly empirically validated (e.g., Haimovitz, Wormington, & Corpus, 2011; Lerdpomkulrat et al., 2012; Mueller & Dweck, 1998; Stipek & Gralinski, 1996).

Some research relating implicit theories and goal orientation, however, has found mixed evidence for the model (Donohoe, Topping, & Hannah, 2012; Dupeyrat & Mariné, 2005; Roedel & Schraw, 1995). Issues in measurement may account for a lack of correlation or weak correlations found in some studies. For example, many studies treat implicit theories and achievement goals as continuous variables when, in fact, individuals may hold more than one implicit theory or achievement goal simultaneously (Pintrich, 2000). An individual might be high in one and low in the other, or high in both. More recent research has overcome this through cluster analysis (e.g., Isoard-Gautheur, Guillet-Descas, & Duda, 2013; Jang & Liu, 2012). As well, much research has been conducted using global measures of implicit theories and achievement goals, as opposed to domain-specific measures that would allow for higher

resolution of these variables (e.g., Donohoe et al., 2012; Duperyrat & Mariné, 2005; Eccles et al., 1993). Moreover, mastery goals have not been further classified into approach and avoidance dimensions until relatively recently, and much achievement-goal research has not accounted for this potential added variable. This may be problematic because mastery-avoidance goals are thought to positively correlate to entity theories of ability (Elliot & McGregor, 2001). Although anticipated correlations in some studies may be absent or weak, the relations found largely may not invalidate Dweck's theory, but they may not directly support it (e.g., Dupeyrat & Mariné, 2005).

Outcomes of Implicit Theories and Achievement Goals

Benefits of Incremental Theories and Mastery Goals

Many highly desirable learning outcomes have been shown to come overwhelmingly from holding mastery goals and, relatedly, incremental theories of ability. There is a high overlap of positive outcomes for mastery goals and incremental theories including persistence, planning, strategy use, deeper processing of material, improved performance, greater rates of improvement over time, increased interest, and intrinsic motivation (e.g., Grant & Dweck, 2003; Harackiewicz et al., 1998). Affective outcomes such as resilience and decreased sense of helplessness (Davis et al., 2011; Yeager & Dweck, 2011), and fewer anxious or depressed feelings have also been linked to mastery orientations and incremental theories (Hoyt et al., 2012). Individuals with learning goals are more likely to use negative feedback in a proactive manner, using this as information to shape their efforts and improve their learning (Grant & Dweck, 2003). The wealth of protective factors allows learners to overcome barriers and find ways to continue to learn and grow. Rather than meeting defeat with acceptance and avoidance, students may plan, problem solve, and strategize to surmount potential learning obstacles. They

approach learning situations with interest, intrigue, empowerment, and positive affect. The learning is deep and meaningful.

Resilience is an increasingly popular construct in positive psychology, shifting focus from impairment and pathology to how individuals may rise above potentially negative circumstances (Seligman, Ernst, Gillham, Reivich, & Linkins, 2009). Davis and colleagues (2011) investigated resiliency in individuals holding domain-specific incremental theories. A sample of 165 college students was grouped based on endorsements of incremental- versus entity-theory statements of mathematical ability and then randomly assigned to a "topdog" or an "underdog" competition status in a mathematics competition--members of the topdog group were told that they would compete against less academically-able community college students and students in the underdog group were told that they would compete against more academically-able MIT students. For students in the disadvantaged competitive position, incremental theories rendered them resilient by heightening their mathematical self-efficacy through lessened experiences of helplessness. Holding incremental theories of one's abilities may further buffer students against the potentially toxic effects of negative stereotypes. In a study by Good, Aronson, and Inzlicht (2003), randomly-assigned seventh-grade students were sent weekly emails either explaining the academic benefits of an incremental theory or attributing seventh-grade difficulties to the novelty of middle school. Students in the incremental group had significantly higher achievement test scores at the end of the year in mathematics and verbal abilities. This effect was even more pronounced for females in mathematics as well as ethnic minorities and low-income students in reading, demonstrating resilience against stereotype threat for at-risk students.

In common wisdom we acknowledge the role of hard work, but this is often secondary to the strong belief in the limiting or delineating nature of our genes or inborn qualities. Can a nonmusical person become musical? Can a "right-brained" individual become an artist, or a "left-brained" individual become an engineer? Can we actually increase our intellectual capacities? In a longitudinal study with 33 healthy adolescents, Ramsden and her colleagues (2011) demonstrated that across adolescence significant changes occur in measured intelligence. The ranges of individual change, either decreasing or increasing, were on the order of approximately 20 standard-score units for the verbal composite, perceptual composite, and the Full Scale IQ. Nearly one quarter of the sample shifted at least one standard deviation on the verbal or perceptual composite within four years after the initial measurement point. These changes in IQ scores were related to structural changes as well as respective heightened or decreased activity levels in the associated areas of the brain, thus triangulating the results and indicating that cognitive abilities are, in fact, much less static than were commonly thought.

Mueller and Dweck (1998) experimentally created changes in IQ scores by manipulating achievement goals and implicit theories. In a series of six studies with fifth-grade samples, children completed questions from IQ measures and all participants were given some praise ("You did very well. You got [over 80%] right!"). The two experimental groups then received either praise for ability ("You must be smart at these problems!"), or praise for effort ("You must have worked hard at these problems!"), and the control group received no additional praise or received praise without any attributional suggestions ("That's a really high score!"). Children praised for effort selected to work on future problem-solving tasks that promised increased learning and the provision of strategy-related information, above that of their ability-praised counterparts. These students also took accountability for their performance when told they did

poorly, as compared with the ability-praise group, who tended to over-represent their test scores concerned that a lower score vulnerably reflected a lack of ability. Children praised for effort adopted a more incremental theory of intelligence and mastery orientation which not only buffered them from the drop in IQ scores seen after ability praise and perceived failure, but these children actually performed better on the IQ measures compared to their initial scores.

Mastery-approach goals are met with myriad positive outcomes. In contrast, those who adopt mastery-avoidance goals may experience some negative consequences. Although there is less existing research on mastery-avoidance goals, empirical articles suggest that mastery-avoidance goals are present from the early elementary level to the undergraduate level (Carr & Marzouq, 2012; Elliot & McGregor, 2001). These goals are associated with interest and engagement in course material, but also with fear of failure, low self-determination, disorganized studying, and test anxiety (Elliot & McGregor, 2001).

Risks of Entity Theories and Performance Goals

Entity theories, or fixed mindsets, and associated performance goals have largely been associated with choosing activities that allow one to perform well (potentially at the cost of learning), preoccupation with how others performed on the same task, and lower levels of task persistence, task enjoyment, and performance after experiencing perceived failure as compared to those with incremental theories (Mueller & Dweck, 1998). For individuals with entity theories, negative feedback on a cognitive or academic task can result in low-ability attributions to account for poor performance--believing they are "not smart" (Mueller & Dweck, 1998). Having an entity belief of personality can make one more prone to making negative self-attributions when faced with social rejection and more likely to make negative judgments about

others--viewing others as either “good” or “bad” rather than considering their intentions (Heyman & Dweck, 1998).

Negative consequences for holding performance-avoidance goals have been replicated repeatedly. These consistent findings are largely mediated by maladaptive patterns of emotions, positively predicting anger, hopelessness, shame, and anxiety and negatively predicting pride and hope (Pekrun, Elliot, & Maier, 2009). Conversely, performance-approach goals have received empirically mixed results or positive associated outcomes, such as high grades, persistence, effort, pride, and strategy use (e.g., Elliot & Church, 1997; Elliot, McGregor, & Gable, 1999; Harackiewicz et al., 1998).

Accounting for some discrepancies in the findings for performance goals, Grant and Dweck (2003) tested the notion that outcomes of performance goals may differ depending on how they are operationalized. Through a series of five studies, Grant and Dweck revealed the different effects of performance goals by classifying them into three types: ability-linked goals, normative goals, and outcome goals. After real or hypothetical setbacks, ability goals aimed at validating an aspect of oneself were linked to increases in helplessness and rumination, and decreases in self-worth, intrinsic motivation, and performance. Interestingly, when no setbacks are present and one’s sense of competence is intact, ability goals may boost one’s performance. Goals that were explicitly normative and aimed at outcompeting others were not associated with the same negative cognitive, affective, and achievement outcomes as ability-linked goals. They were, however, related to denial after setbacks. Goals that were focused on obtaining certain outcomes, such as doing well in a course, had no significant unique effects. Effects were related to the reason one wanted to do well (e.g., to demonstrate ability vs. to learn). This has been further validated based on the findings of a meta-analysis by Hulleman, Schrager, Bodmann, and

Harackiewicz (2010). Within a single label (e.g., performance goals), they examined varying conceptual and operational definitions (e.g., normative social comparison, appearance and validation of ability). The varying definitions were associated with different achievement outcomes. For example, performance goals measured by normatively-referenced criteria were positively correlated to performance outcomes, whereas performance goals with emphases on appearance and evaluative criteria were negatively correlated to performance outcomes.

Other researchers have focused on the conditions that bring about positive effects of performance goals and the possibility of multiple-goal adoption influencing findings (Harackiewicz et al., 1998; Pintrich, 2000; Senko, Hulleman, & Harackiewicz, 2011). In the multiple-goal perspective the unique contributions of mastery and performance goals are acknowledged as well as the potential additive, interactive, or specialized effects on motivation by holding both goals simultaneously.

Pintrich (2000) tested the multiple-goal model with a sample of 150 middle school students and determined that, when comparing the high-mastery/low-performance group to the high-mastery/high-performance group, the group high in both mastery and performance goals showed higher levels of task value than the other group and did not show any less positive or more negative affect, with no significant differences in achievement levels. However, the measure of task value included utility value, indicating the measure might not be assessing what is inherently interesting for the students, but rather something that may be useful, or seen as a means to another end (e.g., admission into a program). Although not directly investigating multiple-goal theory, Senko and colleagues (2013) provided insight into why performance-approach goals alongside mastery goals may be adaptive in school. Two studies conducted with undergraduate students showed that mastery-oriented students spent a disproportionate amount

of time studying personally interesting material, as compared to performance-oriented students who focused their efforts on material they believed was most important to their instructors. This differential learning agenda was then linked to their academic achievement, showing how performance-approach goals may improve achievement in school. The above studies both indicate comparable or increased academic performance for individuals holding high levels of mastery and performance goals. However, these studies also demonstrated potential extrinsic qualities driving performance (e.g., doing well to please the teacher).

Studies showing positive outcomes linked to performance goals often failed to challenge the learner's sense of competence or track the outcomes over extended periods of time (e.g., Elliot & Church, 1997; Elliot et al., 1999). In the aforementioned study by Grant and Dweck (2003), ability-linked performance goals boosted students' performance, until exposed to adversity. Brophy (2005) argued that performance-approach goals readily turn into performance-avoidance goals over longer periods time or in the face of perceived obstacles. Change, challenge, and obstacles are inevitable in school and throughout life, therefore the benefits associated with performance-approach goals should be taken with caution. Middleton, Kaplan, and Midgley (2004) observed this in students transitioning from Grades 6 to 7. Performance-approach goals in sixth-grade students positively predicted performance-avoidance goals in seventh-grade students. The authors suggested this may be due to change and challenge in the novel junior-high-school environment. This relation, however, only occurred in students who reported high academic self-efficacy before the transition, highlighting the vulnerability of performance-based confidence in conjunction with change in circumstances.

In addition, the learning outcomes and task value associated with performance goals might be lower-level and more extrinsically-driven, respectively, compared to those associated

with a mastery orientation (Elliot et al., 1999; Pintrich, 2000; Senko et al., 2013). For example, Meece and Holt (1993) established that students reporting high levels of mastery and performance-approach goals in science used more superficial learning strategies compared to students who indicated high levels of mastery and low performance-goal levels.

Holding multiple goals might in fact be beneficial in many of today's classrooms. Performance-approach goals help students stay focused and persist through a task, even when it is not inherently interesting or when it is a means to another end. Holding this orientation might help students use cognitive strategies, such as memorization, necessary to perform well on many common assessment forms, such as multiple-choice. As well, performance goals might help to encourage students to study for the test and not waste time investigating other, related things of interest (Senko & Miles, 2008). Despite the student benefits, students who endorse the multiple-goal perspective do not necessarily encourage educators to begin adopting practices to gear their classes toward encouraging performance orientations (see Pintrich, 2000).

Fostering Incremental Theories and Mastery Goals

How can we foster incremental theories and mastery models of learning? Classroom practices can influence adoption of achievement goals (see Meece et al., 2003). Work has also been done on direct teaching of the importance of a growth mindset. *Brainology* (Mindset Works, 2012) is an educational program aimed at teaching children the metaphor of the brain as a muscle and how through effort, strategies, and persistence we can improve our abilities. Short-term interventions aimed at changing goal orientation in a specific context have been implemented (see Linnenbrink, 2005), however, changing the underlying mindset beliefs and associated behavior may take more time and practice (Liu, 2012). Other efforts have focused on de-emphasizing grades, performance, or ability in learning environments, in favor of

encouraging effort. These strategies include specific use of praise, alternative grading techniques, or ability-grouping practices, shifting classroom culture away from normative comparison (Bråten, Samuelstuen, & Strømsø, 2004; Kaplan, Middleton, Urdan, & Midgley, 2002; Mueller & Dweck, 1998). Based in the work of Epstein (1988), the acronym TARGET captures the six classroom structures influencing student learning and motivation: task, authority, recognition, grouping, evaluation, and time. A prominent paper by Ames (1992) focused on three primary elements of educational contexts that augment the development of mastery-oriented learners. She argued that (a) task, (b) authority dimensions, and (c) evaluation and recognition are key classroom structures that influence achievement goals. Interesting and engaging tasks, the interplay between autonomy and collaboration with increased responsibility in learning, and meaningful and formative evaluation are all integral features of inquiry instruction. The following sections aim to connect two somewhat distinct literatures--one in the psychological domain and the other much more educationally-based with psychology underpinnings.

Inquiry-Based Learning

Curricular reform is increasingly grounded in inquiry-based practices and is currently mandated pedagogy nation-wide across the United States (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). Inquiry is a fundamental aspect of science education (National Research Council, 2000), although their terminology has recently changed (National Research Council, 2012). The *National Science Education Standards* (NSES) described inquiry as:

> A multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning

> investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (National Research Council, 1996, p. 23)

The NSES described practices for student engagement through in-depth and authentic investigation. Aulls and Shore (2008) furthered this definition by describing three additional core qualities of inquiry-based learning environments across disciplines: (a) student interest or curiosity, (b) collaboration and co-construction of the curriculum, and (c) role shift or diversification of roles (see Walker & Shore, 2015; Walker, Shore, & Tabatabai, 2016). Student interest is a fundamental aspect of many student-centered forms of learning. In inquiry, students are encouraged to seek out questions of interest and given the opportunity to quench their curiosity through guided investigations using problem-solving skills and methods. In doing this, project-based inquiry shifts the focus from the products to the process of learning (Dewey, 1910, 1933). Problem-based and project-based methods require student engagement in real-world problems with a strong focus on problem-solving and metacognitive strategies (Downing, Kwong, Chan, Lam, & Downing, 2009). However, inquiry augments problem-based methods in that it involves problem solving and also problem finding.

Based in social-constructivist theory (Vygotsky, 1978), in inquiry individuals must construct their own understandings by engaging in and mentally manipulating the material, and through discussion and collaboration with teachers and other knowledgeable peers. Dialog, argumentation, and collaboration are fundamental to effective inquiry (Llewelyn, 2013). Rather than being handed facts to memorize, inquiry learners must create their own unique

understanding. The curriculum is co-constructed among students and teachers, in that it focuses on learning process skills and, at least some, learning of specific information is incidental and based uniquely in students' interests (Aulls & Shore, 2008).

In inquiry, a role shift occurs between the teacher and the students placing increased responsibility in the hands of the learners (Aulls & Shore, 2008). In focusing on learning how to learn, students are gradually equipped with the skills needed to learn autonomously. The teacher scaffolds this process and autonomy is granted in stages based on a student's needs. Models of open, guided, or structured inquiry have been proposed and that differ in the level of teacher support and student responsibility (Bell, Smetana, & Binns, 2005; Keegan, 1993). Open inquiry or discovery are highly student-centered and predicated on learner autonomy, and are largely what the Montessori school philosophy is based upon (Montessori, 1964). In this model, learning is achieved through unstructured, exploratory, trial-and-error processes. Guided inquiry is a more scaffolded and collaborative process based upon expertise from teachers and peers (Keegan, 1993; Mayer, 2004). Teachers offer support in the process, for example, teaching steps for students to self-monitor reading comprehension, but may offer less direct teaching of content. As well, different levels of support may be offered to students ready for different levels of autonomy. Much research supports the use of guided inquiry over open discovery, based upon optimizing cognitive load in learners (Brunstein, Betts, & Anderson, 2009; de Jong, 2010; Mayer, 2004). Moreover, discovery is often an independent exploration, whereas in inquiry a significant emphasis is placed on the social and collaborative elements of learning (Aulls & Shore, 2008). Structured inquiry may include some project-based, interest-based, and collaborative qualities, however, it will generally resemble more traditional forms of instruction (Bell et al., 2005). An example of a structured-inquiry project may be a laboratory exercise with

step-by-step instructions for students to follow and arrive at a specified product. In contrast, a guided-inquiry project may involve exposure to a topic, developing a research question, collaborating with other students to develop a procedure to investigate it, conducting the investigation or experiment, then sharing the findings, and self-reflecting and getting feedback on what could be done differently for a future investigation--all with teacher support and guidance.

An overarching goal of education is future transfer to out-of-class situations. In inquiry, authenticity in problems solved and products created helps to address issues of transfer and generalizability of learning (Saunders-Stewart, Gyles, & Shore, 2012). Rather than question-answer format, students can create authentic products as practicing professionals to demonstrate their learning (Renzulli & Reis, 1985, 2000). These products could include holding a science fair, an art exhibition, creating a documentary and sharing it at a community event, or submitting written work for publication. Sharing and communicating learning outcomes are key components of inquiry (National Research Council, 1996). At times, teachers may feel restricted by time and limited resources and resort to more simplistic, multiple-choice and short-answer assessments. In these instances, inquiry assessment methods still aim to capture interconnecting ideas and increasing levels of sophistication in reasoning (e.g., Linn, Lee, Tinker, Husic, & Chiu, 2006). A strong focus on process, authenticity, and sharing of knowledge is reflected in inquiry assessments.

Diverse benefits have been found for students engaging in inquiry, including knowledge acquisition, process skills, intrinsic motivation, and autonomy (Saunders-Stewart, Gyles, Shore, & Bracewell, 2014; Saunders-Stewart et al., 2012). However, some obstacles to classroom implementation have been noted and a range of inquiry practices may be seen in different classes

and programs (Shore, Aulls, & Delcourt, 2008). The obstacles include teacher or student resistance to teaching and learning formats that are novel to them (Bramwell-Rejskind, Halliday, & McBride, 2008; Brickman, Gormally, Armstrong, & Hallar, 2009). Also, within the guided inquiry model, some direct instruction and extra support may be necessary. In a qualitative study that brought experts into the class to guide secondary-science teachers toward increased levels of inquiry, the experts acknowledged one of the biggest obstacles to overcome was students' background knowledge or motivation. These students needed additional support and more frequent "checking in" (Gengarelly & Abrams, 2009).

Guided inquiry is a form of teaching and learning employing meaningful, interesting, and engaging, problem-based tasks. It involves collaborative practices, yet facilitates individual autonomy. Recognition and assessment are authentic, process-based, and involve sharing knowledge. These educational qualities are highly in line with classroom structures proposed by Ames (1992) as influential to achievement goals, namely, (a) task, (b) authority, and (c) evaluation and recognition dimensions. Guided inquiry may be an adaptive educational environment to foster incremental theories and mastery goal-orientation.

Task: Interest and engagement. The nature of classroom tasks communicates to students the salience and value of different achievement goals and implicit theories. Relevant, interesting, and engaging tasks may encourage incremental theories and mastery-orientation (Ames, 1992; Dweck, 2009). Interest, importance, and utility all play a role in determining the likelihood of students choosing to approach a task and the level of effort and persistence they will put towards it (Wigfield & Eccles, 2000). Student interest is a driving force in inquiry-based learning (Aulls & Shore, 2008). Students often incorporate interests and experiences and make projects personally relevant; as well, projects largely have direct application to real-world

questions, also enhancing relevance. Rathunde and Csikszentimihalyi (2005) studied five Montessori schools with a philosophy encouraging student interest and engagement, with substantial amounts of free time to investigate material of interest freely. These students showed more positive affect and intrinsic motivation, as compared to students from comparison schools exemplifying "traditional" instructional approaches who reported higher utility value in school.

Senko and colleagues (2013) and Senko and Miles (2008) found that mastery-oriented students in "traditional" classrooms were being penalized for excessive studying of material they found personally interesting. In contrast, in inquiry student interests are reflected directly in the curriculum (Aulls & Shore, 2008). Inquiry environments provide flexibility for studying material of interest, and much of the "required" material is learned incidentally. Guided inquiry however, does not leave students with full freedom to choose what they learn, as is seen in discovery learning (Hmelo-Silver, Duncan, & Chinn, 2007). At times, direct teaching is appropriate, but inquiry differs from more "traditional" forms of instruction in that the exercises can still be personally relevant (e.g., tied to interests and experiences), tied to authentic and realistic learning situations (e.g., students know why they need to learn the information or skills and relate it to work in the field), and still be engaging (e.g., students can learn knowledge in much more engaging and varied ways than rote memorization) (Linn et al., 2006). Encouraging students to be driven by their interests reflects how inquiry may promote mastery-orientation and, moreover, mastery-oriented students might especially thrive in inquiry.

Classroom environments high in mastery-orientation have teachers who describe active engagement in learning as a key classroom feature (Patrick, Anderman, Ryan, Edelin, & Midgley, 2001). Belenky and Nokes-Malach (2012) echoed the social-constructivist notion that students need to create their own understandings rather than be handed facts. Undergraduate

students in a statistics course were randomly assigned into one of two groups. The "invention" condition provided students with background on the topic then asked them to come up with a procedure for solving a problem, whereas students in the "tell-and-practice" group were also given an example of the procedure for solving the problem. Students in the "invention" group had higher levels of mastery-orientation, deeper and more process-based knowledge, and greater ability for knowledge transfer. A case study by Singh (2011) described implementing inquiry-based practices into the classroom in order to encourage growth mindsets in students by incorporating relevant NASA articles into the curriculum. Singh described a qualitative difference in student internalization of the information and understanding of the scientific process, including the realization that scientists revise their hypotheses and that getting it "wrong" is part of the scientific process. Focusing on the learning process and problem-solving strategies shifts away from an emphasis on performance goals in that students learn that for many real-world questions there are no "right" or "wrong" answers. The scientific method requires investigators to formulate hypotheses, gather and evaluate evidence, draw conclusions, and either accept or revise their initial hypotheses (National Research Council, 2000).

Shimoda et al. (2002) looked at how mastery- and performance-oriented students learn process skills. Grade 6 students completed online inquiry projects using the steps: hypothesize, investigate, analyze, model, evaluate, and question. Mastery-oriented students scored higher on the post-test inquiry-process skills (e.g., creating competing hypotheses and research investigations). However, the project was completed over approximately one hour, and there were no significant differences within groups from pre- to post-test scores, indicating that students might require more time to engage and work through inquiry processes to reap the full benefits. Patrick and Yoon (2004) observed a sample of four students engaging in a series of

hands-on, inquiry-based science investigations over six weeks. Highly mastery-oriented students showed the greatest levels of conceptual and applied understanding after the investigations.

In order to effectively engage in deeper learning and reflect on the learning process, students must develop problem-solving and self-regulatory strategies. As one progresses from lower-level learning objectives, such as memorizing and understanding, to higher-level learning objectives, such as application, analysis, evaluation, and creation (Anderson & Krathwohl, 2001; Bloom, 1956), different and more complex metacognitive strategies are needed. These include planning, monitoring, regulation, and resource-management strategies. Mastery goals are strongly and positively related to use of cognitive and metacognitive, self-regulation strategies (Pintrich, 1999). In the *Brainology* program (Mindset Works, 2012), students are explicitly taught metacognitive strategies, helping students realize that thinking skills are not all inborn and many of these can be worked on and developed. Direct teaching of these skills is related to changing mindsets, in which students adopt more incremental theories of intelligence (Donohoe et al., 2012). In inquiry, these cognitive and metacognitive skills are taught, practiced, and supported. Salovaara (2005) found that inquiry-based instruction resulted in the use of deeper-level cognitive strategies, such as monitoring, creating representations of knowledge such as summarizing, synthesizing, and transferring ideas, and sharing information collaboratively. Thus, mastery-oriented students may especially benefit from inquiry environments, and relatedly, inquiry environments may promote mastery-orientation.

Project-based learning involves an open-ended, in-depth, realistic, and contextualized approach to solving problems (Blumenfeld, 1991). This approach bridges the gap between classroom learning and real-life application. Through investigating problems that are deemed interesting and valuable, appropriately challenging, project-based learning allows students to use

high-level cognitive strategies and hold learning goals (Blumenfeld, 1991). A potential challenge to successfully implementing inquiry-based learning in classrooms is to provide students with the opportunity to gain adequate background knowledge to develop meaningful, open-ended questions to investigate (Edelson, Gordin, & Pea, 1999). Two, large-scale urban literacy projects for academically at-risk, middle-school students looked at the role of inquiry projects in motivation (Owens, Hester, & Teale, 2002). In one five-week program, students worked with experts and specialized institutions (e.g., museums, cultural centers, businesses), along with technology-based resources (e.g., data gathering, data management, and presentation tools) to explore topics of interest. In-depth learning opportunities with expert mentors created interest, excitement, and prolonged engagement in the project.

In sum, guided inquiry offers interesting, meaningful, engaging, and process-driven tasks. Several empirical studies have effectively linked these elements of inquiry-based educational environments to promoting mastery goals and incremental theories. Further, students with incremental theories and mastery orientation might have an advantage in inquiry-based classes.

Authority: Autonomy, facilitation, and collaboration. In classes that encourage autonomous learning and shift the locus of control toward the students, learners have heightened feelings of self-competence and intrinsic motivation (Deci, Schwartz, Sheinman, & Ryan, 1981). Guiding students to be a part of decision-making in the classroom allocates more control to the students and fosters an environment for incremental beliefs in ability and mastery learning (Ames, 1992; Brooks, Brooks, & Goldstein, 2012). Rather than a narrow focus on attaining specific competencies, teachers facilitate students' self-guided explorations and this may further mastery orientations or incremental theories (Flum & Kaplan, 2006). In inquiry-based classrooms, students are given increasing authority over their learning (Aulls & Shore, 2008).

However, rather than full independence, students are supported by teachers, experts, and other students (Bell et al., 2005). Curricular decisions, such as topics and formats, are made collaboratively with the teacher and other students. Large projects require planning, organization, and monitoring. Traditionally in education, students are not responsible for these elements of the process. However, in inquiry, students take active roles in self-regulating and self-monitoring, including prioritizing and establishing guidelines for pace of learning (Edelson et al., 1999). Students develop self-regulated learning skills through deep cognitive engagement in a project and autonomy support. The child's increasing agency is shaped through reflective, guided inquiry, scaffolded support, reciprocal teaching, and collaborative learning (Paris & Paris, 2001).

The skills required for self-regulated learning are strongly related to mastery-goal orientation (Pintrich, 1999). Schmidt and Ford (2003) examined a sample of 79 undergraduates who completed a web-based metacognitive-skills training program over approximately one hour. Mastery-goal orientation was robustly related to metacognitive skill use. Only students who were low in performance-avoidance orientation benefitted from the training, whereas students who were high in performance-avoidance reported decreased metacognitive activity. These results indicated that mastery-oriented students have the requisite skills to engage in autonomous, self-regulated, inquiry environments, but performance-avoidance students may have difficulty engaging in some aspects of inquiry learning without added support.

In guided inquiry, more or less support and structure can be used, so as to match the students' needs (Hmelo-Silver et al., 2007). Challenge and support are set appropriately; students are not set up to fail, but rather are supported along the way. Early stages of autonomy support may consist of a teacher offering three choices of topics to a student, whereas later stages

of autonomy support may involve choice in topic, resources, format for conveying learning, and even timelines for learning, thus matching the level of autonomy to the students' needs. Mäkitalo-Sieglc, Kohnle, and Fischer (2011) suggested that in classrooms giving students too much freedom can result in a loss in student learning. Shore, Delcourt, Syer, and Schapiro (2008) examined students' perceptions of support and cheating in school. Reasons for engaging in academic dishonesty were based on perceptions of high stakes, expectations, or competitive-level, paired with lack of time, resources, and support. Interestingly, parallels were drawn to plagiarism and falsification of data by professionals and scientists.

Teachers who create highly mastery-oriented environments support students' autonomy. Opposed to applying a "one-fits-all" approach, these teachers adapt instruction to students' level of understanding (Meece, 1991). In mastery-oriented classrooms, teachers ensure students grasp concepts and procedures before engaging in an activity, and monitor the students' learning so as to transfer responsibility gradually (Turner et al., 2002). Furthermore, in mastery-oriented classrooms, students are more open to accepting teacher support and more likely to engage in help-seeking behavior (Ryan, Gheen, & Midgley, 1998).

In constructivist theory, it has been argued that learners must mentally manipulate and process information to create their own understandings. Social-constructivism posits that, in part, this is done by engaging in dialog with others, including teachers, experts, and more knowledgeable peers (Phillips, 1995; Vygotsky, 1978). Students may reach one level of understanding or a specific set of skills by engaging in an activity independently, however, effective collaborative-group strategies might allow students to attain different understandings or skills. Collaborative group work results in important skills necessary to work in many careers, including communication, problem-solving, and conflict-management skills (Colbeck, Campbell,

& Bjorklund, 2000). Gabbert, Johnson, and Johnson (1986) looked at the effects of collaborative learning in a sample of 52 first-grade students. Students who worked in cooperative-learning groups achieved higher-level learning outcomes than students who only worked independently. These outcomes mapped onto the upper levels of Bloom's (1956) original taxonomy, and included the ability to apply learning, analyze information, and also to produce creative products. Further, many of these advanced cognitive skills were retained and transferred to individual tasks. A qualitative, classroom-based study encountered flexible problem solving when mathematics was taught in small groups and students were encouraged to engage in argumentation with reasoning and proofs, as mathematicians do (Suh, Graham, Ferrarone, Kopeinig, & Bertholet, 2011). These students also endorsed growth-mindset oriented statements at the end of the academic year.

Classroom cultures emphasizing social comparison promote performance goal-orientation (Ames, 1992), whereas highly mastery-oriented classrooms encourage collaboration (Meece, 1991). These classes give students opportunities to work together on shared objectives. Students make their own unique contributions and each contribution is valued as it relates to the overall project. Hijzen, Boekkarts, and Vedder (2007) conducted a mixed-methods investigation of 57 secondary students in cooperative learning groups. Effective groups, high in task-relevant behavior and socially-oriented task engagement (e.g., helping and supporting), were also higher in mastery-orientation. These groups displayed higher levels of social responsibility, with noted concern for the well-being of the group.

However, mere participation in collaborative groups is not sufficient for achieving higher-level cognitive outcomes, interpersonal outcomes, or motivational outcomes. Teacher supervision and facilitation in helping choose an appropriate level of task, structuring group

interactions and discussions, monitoring the collaborative process, and providing feedback is needed. Effective "jigsaw" group work, in which participants bring different necessary contributions to the outcome, overseen by teachers employing these scaffolding and facilitation strategies, was related to higher-order reading achievement outcomes, compared to drama groups or whole-class work. Reading achievement was related to autonomous motivation (Law, 2011).

In sum, guided inquiry supports students' development as autonomous learners, employing critical-thinking and self-regulation strategies. Students learn collaborative skills and work together to attain higher than they could individually, and the teacher scaffolds these processes. Critical-thinking, self-regulation, and collaboration skills are all elements of effective, autonomy-promoting, mastery-oriented and growth-mindset oriented classrooms. As well, individuals with incremental theories and mastery goals hold many of these qualities and skills.

Recognition and evaluation: Sharing knowledge, and authentic, formative assessment. Recognition and evaluation focusing on effort and skills and away from normative comparisons are believed to encourage mastery-goal orientation and incremental theories of ability (Ames, 1992; Mueller & Dweck, 1998). Recognition and evaluation differ in inquiry from traditional methods of instruction in that there is a greater focus on the learning process, rather than excessive attention to final products (Dewey, 1910; 1933). Priority is placed on problem-solving, comprehension, and collaborative skills as learning outcomes over that of specific content knowledge; these are skills that allow students to continue learning with increased autonomy in the future (Aulls & Shore, 2008). Recognition and assessment practices aim to reflect this emphasis. Cummins, Green, and Elliott (2004) implemented college-level, inquiry-based chemistry labs, in which the research ideas were prompted by the teachers, but the

research questions and methods were designed collaboratively by students. In many cases the projects went beyond that of what the instructors had anticipated; the products and outcomes were unknown, thus formal feedback was necessary at each stage of the process. Because assessment practices can often be time consuming, students regularly submitted their progress online and received feedback from peers and the instructor to help revise and refine their work. Feedback at each step of learning shifts students to focus on the process and this feedback can be strategy-based rather than outcome-based (Fyfe, Rittle-Johnson, & DeCaro, 2012). Having students give each other feedback creates a community of learners (Brown & Campioni, 1994)--rather than holding a competitive mentality, students work together to achieve their highest potential. In inquiry, as with many self-regulated forms of learning, self-assessment is a salient feature (Aulls & Shore, 2008; Paris & Paris, 2001). Students shift their focus from what others think, to what they think about their work, and employ self-monitoring strategies to improve.

Recognition and assessment in inquiry aims to be formative and authentic, and to encourage sharing of knowledge (Aulls & Shore, 2008). Having an authentic, meaningful product intended for a real audience empowers learners to act like practicing professionals. Students can host a classroom-based laboratory demonstration, create a school-wide periodical, or make pamphlets for a local museum. These types of activities are aimed at producing higher-level learning outcomes such as creative productivity (Renzulli & Reis, 2000). Shore et al. (2008) described the adverse effects of not having an audience to share project-based work; one quarter of science fair students openly admitted to making up data in order to expedite their projects, half of whom also said their project was intended for no particular audience. Sharing knowledge with others empowers students to take on the role of the teacher and expert (Walker & Shore, 2015; Walker et al., 2016). This naturally de-emphasizes normative comparison and,

rather, focuses on everyone's unique contribution.

Classrooms that are highly product-oriented and centered around normative comparisons are detrimental to encouraging incremental theories and mastery goals (Ames, 1992; Brophy, 1983; Mueller & Dweck, 1998). An emphasis on grading distributions can cause students to create and focus on fixed perceptions of their own ability and that of their peers. In contrast, formative-assessment practices that provide feedback *and* allow students opportunities to improve, reduce this preoccupation (Ames, 1992; Covington & Omelich, 1984). Rather than setting expectations for polished products, feedback provided in stages guides learners in how to improve. Further, students engaging in self-assessment practices may develop an internal dialog with self-improvement. Self-assessment has been posited to link with mindset development (Hopper, 2012). Process-oriented recognition can create incremental theories and mastery goals. Mueller and Dweck (1998) concluded that praise based on effort and strategy use has powerful, immediate, and lasting effects in children's development of implicit theories.

Thus, guided inquiry involves process-based, formative, and reflective assessment and recognition practices emphasizing sharing and communicating learning, producing a community rather than competitive environment. Assessment aimed at process and improvement, and away from normative comparisons, encourages incremental theories and mastery goals.

Conclusions

Guided inquiry-based education involves tasks that are meaningful, interesting, and engaging (Aulls & Shore, 2008). These tasks are often project-based, offering in-depth investigations, and problem-based, focusing on problem-solving strategies. Guided inquiry encourages student authority. Teachers scaffold students in increasing levels of autonomy in learning and promote peer collaboration. Recognition and assessment emphasize formative,

rather than summative, practices in and tend to focus on process feedback. Peer- and self-assessments help create communities of reflective learners, and veer away from normative comparisons. Creating authentic products and sharing knowledge empowers students.

These elements of inquiry-based learning map onto the three classroom structures of task, authority, and recognition and evaluation, proposed to influence adoption of mastery goals (e.g., Ames, 1992; Flum & Kaplan, 2006; Patrick et al., 2001; Pintrich, 1999). Many of these qualities are also supported in the literature on the development of incremental theories of ability (e.g., Brooks et al., 2012; Dweck, 2009; Mueller & Dweck, 1998). The elements of inquiry involving interest-driven, engaging tasks that focus on learning processes, have received much empirical attention and show strong positive relations with mastery-orientation and incremental theories. Some support has also been found in the areas of supported autonomy and collaboration and in inquiry-based assessments. The pedagogy and specific activities implemented in guided inquiry may help students develop growth mindsets and adopt mastery goals. Students holding growth mindsets and who are mastery-oriented may be especially suited to learn and achieve in inquiry learning environments. Previously, no review has bridged the inquiry literature with that of achievement goals and implicit theories. Guided inquiry appears to be a supportive framework for the development of incremental theories and mastery-goal orientation.

Implications

This overview of the literature offers several important implications for teachers and educational psychologists. Broader indices of academic success may be needed. Incremental theories and mastery goals are associated with numerous long-term, positive cognitive-affective outcomes and assessments of these could be implemented alongside other standardized testing. For school and classroom consultations, inquiry-based strategies can be recommended as a

means to foster growth mindsets through emphasizing and supporting the learning process, effort, and strategies. For gifted learners, or students already at the top of their class, implications are extremely salient, because inquiry paired with a growth mindset might help them excel beyond the "big fish, small pond" phenomenon. Assessment practices might also reflect students' efforts and the aspects of issues that are within their control, in contrast to diagnostic labels placing constructs within the child.

Chapter 3

Linking Text

As described in the previous manuscript, numerous empirical studies have revealed evidence that classroom context and instructional strategies influence achievement goals and related implicit theories of ability. In addition, strong theoretical evidence exists for inquiry-based classes specifically for promoting mastery goals and growth mindsets. Given how inquiry-based practices are well aligned with current curricular reform, and given the documented numerous long-term, resilient outcomes of mastery-goal orientations and incremental theories of ability, determining the specific relationship between inquiry, implicit theories, and achievement goals could be highly valuable for the fields of education generally and educational psychology, and for professionals who help assure student success, such as school psychologists. The previous manuscript was a review article providing an in-depth analysis of previous research on the topics of implicit theories of ability, or mindsets, achievement goals, and inquiry. The following manuscript*, Mindsets, Mastery, and Inquiry: Classroom Impact on Students' Achievement Goals* (Gyles, Shore, & Hoover, 2016), tested the primary hypothesis that being a student in an inquiry-based classrooms might predict an increased likelihood to voice mastery-oriented motivations in learning. This chapter contains an abbreviated literature review suitable for an empirical journal article, and presents qualitative and quantitative analyses to address the research question. The methodology section is somewhat more detailed than typical journal articles in the description of the study and statistical analyses. This thoroughness is for the purposes of the thesis and will be reduced prior to submission to a journal.

Chapter 4

Mindsets, Mastery, and Inquiry: Classroom Impact on Students' Achievement Goals

Student motivation has long been of interest within the educational system. However over the past few decades, researchers have increasingly shifted away from asking questions centered on how to increase motivation and achievement in students to focus on what kinds of motivation to promote and how to encourage sustained achievement in the face of barriers.

Implicit theories, also referred to as mindsets, and achievement goals are motivational constructs that explain why we engage in or disengage from learning scenarios (Ames & Archer, 1988; Dweck, 1986; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliot, 1999; Nicholls, 1984). These theories provide accounts of how likely we are to approach or avoid particular learning tasks, the cognitive strategies we apply, the extent to which we persist in the face of challenge, how well we perform, and the emotional reactions and underlying beliefs about ourselves during this. Incremental theories and mastery goals (defined below) have been associated with numerous positive outcomes (e.g., Grant & Dweck, 2003; Harackiewicz, Barron, & Elliot, 1998; Hoyt, Burnette, & Innella, 2012; Pekrun, Elliot, & Maier, 2006), thus much research has investigated how to promote incremental theories and mastery goals. Ames (1992) described three fundamental classroom structures suggested to promote mastery goals. Gyles and Shore (2016) related these classroom structures to key features of inquiry-based learning environments, and proposed that guided inquiry-based settings might promote both mastery goals and incremental theories. Guided inquiry involves engaging tasks, increased student authority, and emphasis on authentic recognition and evaluation practices acknowledging the complexities and grey areas in real-world phenomena, which might influence achievement goals and implicit theories. The present study sought to test this theory, by assessing the relation

between guided inquiry, implicit theories, and achievement goals.

Implicit Theories and Achievement Goals

Implicit theories of ability, or mindsets, offer a framework for understanding differences in motivation to learn by examining underlying personal theories about one's abilities, namely incremental versus entity theories (Dweck, 1986; Dweck & Elliott, 1983; Dweck & Leggett, 1988). Individuals with incremental theories, or growth mindsets, believe their abilities can develop through effort, persistence, and strategy use (Dweck, 1986; Dweck & Elliott, 1983; Dweck & Leggett, 1988). Belief in an incremental theory of one's abilities creates a tendency to direct effort toward improvement. When individuals believe their abilities are incremental, they are more likely to persist through challenging activities in efforts to develop their abilities; feedback can be valuable and used for future improvement. In contrast, individuals with entity theories, or fixed mindsets, believe they have unchangeable, fixed levels of their abilities and this perceived innateness makes one less inclined to value effort and challenge in learning. Entity theorists want to display areas of strength, appear high achieving or highly able, and avoid areas of weakness. If one believes that an ability is fixed, then it is more adaptive to try to assess one's abilities and approach areas of perceived competence and give up if the task seems to surpass those abilities (Dweck & Leggett, 1988). Holding an incremental versus entity theory leads to placing different emphases on different achievement goals, leading to unique paths of cognitive, affective, and behavioral patterns of responding.

Incremental theories have been associated with a tendency to adopt mastery goals (Dweck, Mangels, & Good, 2004). Mastery goals, also referred to as learning or task goals, are aimed at improving one's competence through effortful learning (Ames & Archer, 1988; Dweck, 1986; Elliott & Dweck, 1988; Nicholls, 1984). People with mastery-goal orientations tend to

focus on developing abilities, mastering new skills, and understanding learning materials, even when challenging. Students find more intrinsic value in learning and derive satisfaction from the inherent qualities of the task, such as its interest and challenge (Wigfield & Eccles, 2000). With mastery-goal orientations, success is often evaluated in terms of self-improvement or absolute standards (Elliot & McGregor, 2001).

Entity theories, by contrast, make one more likely to hold performance-goal orientations (Dweck et al., 2004). Performance goals, also termed ego- or others-referenced goals, are based upon a desire to demonstrate rather than develop one's competence (Ames & Archer, 1988; Dweck, 1986; Elliott & Dweck, 1988; Nicholls, 1984). Students with performance-goal orientations tend to focus on achieving academically to demonstrate ability, outperforming other students, attaining certain grades, or achieving for some external utility associated with performance. These individuals use social comparison standards to make judgments of ability and performance (Elliot & McGregor, 2001). A sense of accomplishment is derived from doing as well as or better than others and in relation to normative performance standards.

Achievement goals have been further categorized into approach and avoidance dimensions. Performance-approach goals relate to approaching a learning task to achieve by outperforming others, whereas performance-avoidance goals correspond to the aim of avoiding the demonstration of incompetence relative to others (Elliot, 1999). Those with mastery-approach goals strive to learn or improve. On the other hand, those with mastery-avoidance goals strive to avoid failures in learning (e.g., not knowing as much as one can, skill decline, perfectionism; Elliot & McGregor, 2001). Rather than being mutually exclusive, competing implicit theories and achievement goals can coexist simultaneously (Dweck et al., 1995; Wigfield & Eccles, 2000).

Performance-avoidance goals have been linked to many negative outcomes including anxiety, feelings of helplessness, self-handicapping behaviors (Midgley & Urdan, 2001; Pekrun et al., 2006), whereas performance-approach goals are associated with more diverse outcomes, some positive, such as pride or high achievement, and others potentially harmful, such as lower levels of enjoyment, use of shallow learning strategies, and reduced persistence in the face of challenge (Elliot, McGregor, & Gable, 1999; Meece & Holt, 1993; Mueller & Dweck, 1998). Mastery goals and, relatedly, incremental theories have been associated with numerous positive outcomes including enjoyment and interest in learning, reduced anxiety in learning, deeper processing of material, and a tendency to seek feedback and use it proactively (Grant & Dweck, 2003; Harackiewicz et al.,1998; Hoyt et al., 2012; Pekrun et al., 2006). Incremental theories have also been linked to resilience in the face of challenge or obstacles (e.g., Blackwell, Trzesniewski, & Dweck, 2007; Davis, Burnette, Allison & Stone, 2011).

Promoting Incremental Theories and Mastery Goals in Schools

With numerous cognitive, affective, and achievement benefits for students, many educational psychologists have focused their investigations on exploring which classroom features might encourage growth mindsets and mastery-orientations (e.g., Davis et al., 2011; Grant & Dweck, 2003; Harackiewicz et al., 1998). The TARGET (Epstein, 1988) model proposed six classroom structures as influential features for student learning and motivation: task, authority, recognition, grouping, evaluation, and time. Based on this model, Ames (1992) focused on three primary elements of educational contexts that augment the development of mastery-oriented learners. Ames argued that (a) task, (b) authority dimensions, and (c) evaluation and recognition are key classroom structures that influence achievement goals. Gyles and Shore (2015) suggested that, relatedly, these features could promote incremental theories of

ability. Interesting and engaging tasks, increased student authority in the classroom, and authentic, meaningful, formative recognition and evaluation practices that acknowledge more than one right answer or approach are all integral features of inquiry-based teaching and learning.

Inquiry-based teaching and learning are the basis of widespread curricular reform. Inquiry education is a social-constructivist, student-centered, goal-driven, collaborative, project-based form of learning, in which student interest and strengths inform curriculum. In guided inquiry specifically, students are scaffolded and supported through problem-finding and in-depth investigations of questions of interest (Aulls & Shore, 2008; Llewellyn, 2013; Saunders-Stewart, Gyles, & Shore, 2012; Saunders-Stewart, Gyles, Shore & Bracewell, 2015). The term inquiry will therefore be used to refer to guided-inquiry teaching and learning for the purposes of this paper. Inquiry-based instruction has been associated with a number of positive outcomes for students because it provides a context to drive learners to seek out complex and challenging learning scenarios, and enables them with the necessary skills for a sense of autonomy to do so. Key components of inquiry include interesting, engaging, authentic tasks, scaffolded autonomy with high levels of collaboration, as well as and process- and effort-based recognition and authentic evaluation (e.g., Law, 2011; Singh, 2011; Shimoda, White, & Frederikson, 2002). Based on these qualities of inquiry-learning settings, inquiry might be a context in which to promote incremental theories of ability and mastery learning goals (Gyles & Shore, 2015). Given the alignment of inquiry and the classroom structures proposed by Ames (1992), are inquiry-based educational contexts related to incremental theories of ability, mastery goals, and related achievement emotions and behaviors in learners?

Research Questions

Three specific research questions were addressed:

1. Do students' implicit theories differ in inquiry versus teacher-structured learning environments? Are implicit theory and instructional setting related to one another?
2. Are students in inquiry settings more likely to hold mastery-goal orientations? Is there an additive or interactive effect of instructional style and implicit theory on achievement goals?
3. How are instruction and implicit theory related to learning strategies and achievement emotions and behaviors?

The first question addresses whether there are observed differences in mean scores of implicit theory (level of entity-theory endorsement) in inquiry versus teacher-structured classes and if there are correlations between the variables. The second research question is the principal topic of interest in this study, and explores whether or not students with incremental implicit theories and students in inquiry classes are more likely to set mastery-based goals in their classes. The second research question explores whether or not students with incremental theories are more likely to hold mastery goals, and if inquiry-based instructional settings augment this relation over and above the extent predicted by their implicit theory. Relatedly, it probes whether or not students with entity theories are more likely to hold performance goals and if teacher-structured settings add to this relation. The third research question addresses whether or not students in inquiry classes show increased use of deep learning strategies, reduced use of shallow learning strategies, more feedback seeking, and lower levels of maladaptive achievement emotions, compared to students in teacher-structured classes.

Hypotheses

Past interventions aimed at changing implicit theories through direct growth-mindset

training or praise have shown positive results (e.g., Blackwell et al., 2007; Good, Aronson, & Inzlicht, 2003; Mueller & Dweck, 1998); however, there is some evidence that changing implicit theories may take more time than brief interventions or may not override longstanding habits of thinking (e.g., Donohoe, Topping, & Hannah, 2012; Liu, 2012). Taking a single inquiry-based high-school class may not be influential enough to alter students' beliefs about their abilities, but it might be enough to influence the adoption of specific goals and associated goal-directed behavior and cognitions. Classroom influence on achievement goals and goal-directed behavior has been suggested by Ames (1992). It was therefore hypothesized that there might not be group differences in implicit theories between inquiry and teacher-structured classes, but students holding incremental theories of ability will be more likely to report mastery goals and this relation might be bolstered in inquiry classes (over and above that of incremental theories alone), whereas students with entity theories of ability and students in teacher-structured settings will be less likely to report mastery goals (and more likely to report performance goals).

A third and exploratory hypothesis was that students in inquiry classes might have higher levels of mastery-related goal-directed behavior and emotions (e.g., deep learning strategies, higher levels of feedback seeking, less achievement-related fear and anxiety), whereas students in teacher-structured classes might show higher levels of shallow cognitive strategies, maladaptive failure appraisals, and achievement anxiety.

Methodology

Instruments

Data were obtained through questionnaires, interviews, and classroom observations. The following section outlines the instruments used to collect student data to address the aforementioned hypotheses, as well as teacher and classroom data to accurately classify

instructional groups as either Inquiry or Teacher-Structured.

Implicit Theory Scale (ITS). This questionnaire included six Likert-scale items on a six-point scale that ranged from "Fully Disagree" to "Fully Agree," along with one dichotomous item asking, "If I had to choose between getting a good grade and being challenged in class, I would choose . . . (a) good grade or (b) being challenged" (statements were taken from Dweck, Chiu, & Hong, 1995, and Muller & Dweck, 1998). Three additional open-response follow-up items asked students to provide brief explanations for their responses. The ITS showed high reliability (over 90%) with other measures assessing implicit theories (see Dweck et al., 1995, for a discussion of reliability and validity).

Motivational Strategies for Learning Questionnaire (MLSQ). The full questionnaire is a 44-item instrument on a six-point scale that assesses various learning strategies including elaborating and organizing information, relating material to new information, and shallow strategy use (Pintrich & DeGroot, 1990). The Cognitive Strategy Use (Deep and Shallow Learning Strategies) and Test Anxiety subscales were administered (14 items total). Internal consistency estimates for the Cognitive Strategy Use and Test Anxiety subscales ranged from .64 to .80 (Pintrich, Smith, García, & McKeachie, 1993). Deep Learning Strategies were significantly related to Intrinsic value, which includes many mastery-goal qualities (Pintrich & DeGroot, 1990).

Performance Failure Appraisal Inventory--Short Form (PFAI). This five-item questionnaire assesses fear of failure, a hypothesized antecedent of performance-approach goals, performance-avoidance goals and entity theories of ability (Conroy, 2001; Mueller & Dweck, 1998). Items are presented on a five-point scale ranging from "do not believe at all" to "believe 100% of the time." Items with the highest factor loadings from each section of the long form of

the PFAI comprised the items for the short form (Conroy, Willow, & Metzler, 2002). The five-item instrument demonstrated good fit of cross-validity with each scale and had good predictive validity, in that it was highly correlated with several variables related to the original PFAI (e.g., worrying, cognitive disruption; Conroy et al., 2002).

Feedback-Seeking Frequency. This is a two-item questionnaire with reliability estimates of .70 or higher (VanderWalle & Cummings, 1997). The first question assesses the number of times during the semester that the participant contacted the teacher to seek feedback on his or her performance, and the second question assesses the number of times during the semester that the participant contacted a classmate about the participant's performance or feedback. Feedback-seeking behavior positively relates to mastery or learning goals, and this relationship is mediated by perceived cost or value (VanderWalle & Cummings, 1997).

Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI-II). The WASI-II was used as a brief IQ measure to provide a general estimate of cognitive abilities based on verbal and nonverbal reasoning skills (Wechsler, 2011). The Full Scale IQ Two-Subtest Form (FSIQ-2) consists of the Matrix Reasoning and Vocabulary subtests. It takes approximately 15 minutes to administer and is normed for use in populations from ages 6 to 90 years.

Brief Demographics Questionnaire. This instrument was developed by the first author and was used to obtain information on age, sex, ethnicity, parental education level, grade averages for the current and previous academic year, and any previous enrolment in a selective admission program. The form was originally intended to be completed by students' parents; however, based on concerns with response rate of returned forms, the students were asked to complete the forms themselves.

Semistructured student interview. Grade-12 students were asked a series of questions

assessing enjoyment and motivation in their current learning environments. These questions were: "What do you like best about ___ class?" "What do you like least?" "What motivates you in this class?" "What are your top three academic goals this year?" Students were then asked to rate their self-perceptions of ability and academic achievement. The primary questions of interest for the present study addressed students' motivation and potential for adoption of achievement goals in their specified English class. Three questions assessing similar motivational outcomes were asked in different ways. The questions asked were as follows:

Question 1. "What is motivating about <<SPECIFIED>> class? What pushes you in the class? What gets you to do the work?"

Question 2. "In this class, if you had to pick would you say you are mostly motivated by:

a. Wanting to understand the material or learn new skills [coded as mastery]
b. Wanting to do well in comparison to others or get good grades [coded as performance-approach]
c. To avoid bad grades or failing [coded as performance-avoidance]"

Question 3. "What do you hope to achieve at the end of <<SPECIFIED>> class? What do you want to get out of it?"

Semistructured teacher interview. Information was gathered on instructional style and teaching background. Four questions that assessed instructional style were posed (from Oppong-Nuako, Shore, Saunders-Stewart, & Gyles, 2015): (a) What are the methods of teaching and learning most often used in the class? (b) What does the classroom look like on a typical day? (c) What are the most important outcomes that the students learn in the class? (d) What are the most important outcomes of inquiry-based teaching and learning? Background information including highest level of education obtained (e.g., BEd, MEd, EdD), the number of years as a

teacher, experience teaching Grade-12 English, experience teaching English and high school generally, and the number of years worked as a teacher, was also gathered.

Reformed Teaching Observation Protocol (RTOP). This is a classroom-observation protocol designed to assess classroom qualities related to inquiry and student-centered approaches (Piburn et al., 2000). Documented inter-rater reliability estimates are .90 or higher for the entire instrument and there are high estimates of internal consistency: Cronbach's alpha levels of .97 for the full protocol and .80 or higher for individual subscales. Face validity, criterion validity, and predictive validity have been established through criterion-referencing of items and scales, through factor analysis, resulting in the three-factor model of the instrument: Lesson Design and Implementation, Content, and Classroom Culture, and through studies of predicted achievement outcomes (Sawada et al., 2002).

Participants

Teachers. Three Grade-12 English teachers were recruited from New York state and the province of Ontario, Canada to provide classes of students exposed to either inquiry-based or limited-inquiry instruction. Inquiry teachers were recruited through purposive sampling to target teachers employing highly inquiry-based methods of teaching. Inquiry teachers, located in New York state, were identified through referral of the program director of an EdD in Instructional Leadership program designed for educators to develop innovative learning environments and respond to reform (Western Connecticut State University, 2013). Recruitment emails were sent to current students and recent EdD graduates based on recommendations of high use of inquiry approaches. The emails described qualities of inquiry-based teaching and requested teachers who self-identified as inquiry-based teachers, as defined below, to respond if interested in participating (see Table 2 and Appendix A). Two teachers expressed interest in participating in

the study, however, one of them was offered an administrative position at another school just before the onset of data collection and thus was removed from the study. Teacher A (Inquiry) taught a total of four grade-12 English classes that consisted of two Advanced English classes (Advanced Placement--AP) and two General English classes (see Table 1). Teacher A and the Inquiry classes were at a school located in a semirural, semi-urban area, a town of approximately 5,000 people that is a distant suburb of New York City, with a spread of socio-economic levels, ranging from extreme wealth to significant poverty (US Census Bureau, 2010).

Comparison, Teacher-Structured teachers were recruited through a school board in Ontario. The research director of the school board provided referrals for teachers likely to be interested in participating in research, although the research director was unable to inform the Principal Investigator about teachers' instructional style. Emails were sent to referred teachers describing either "inquiry" or "teacher-structured" teaching characteristics. Teachers were asked to self-identify based on the listed qualities and to respond if interested in participating, indicating with which category they self-identified (see Table 2 for the list of qualities and Appendices A and B for the complete email scripts). Two grade-12 English teachers from a single school responded to the recruitment email and participated in the study. Teacher B taught two sections of an Advanced English class (referred to by the school board as University Stream) and Teacher C taught one section of a General English class (referred to as College Stream). The school was located in a semi-urban, semirural area, in a town of approximately 24,000 residents, surrounded by farmland but serving also as a distant suburb of Toronto.

Both schools in the study were in semirural, semi-urban, distant suburbs of major cities, and had comparable levels of visible minorities (approximately 6.4% and 6.5% for the New York and Ontario towns, respectively; Central LHIN, 2006; US Census Bureau, 2010).

The data collection was time- and labor-intensive, thus convenience sampling was used for the comparison group. The sample of Teacher-Structured teachers and their students, however, was

Table 1

Teacher Background and Class Information

Teachers	Teacher A (Inquiry)	Teacher B (Teacher-Structured)	Teacher C (Teacher-Structured)
Highest Degree Obtained	EdD	MEd	BEd
Number of Years Teaching	27 years	26 years	11 years
Subjects Taught	English	English, History, Religion, Math, Media Studies	English, Religion, Drama
Grade Levels Taught	6 to 12	9 to 13	9 to 12
Years Teaching English	27 years	26 years	11 years

Classes	Class A-1 "AP" (Advanced)	Class A-2 "AP" (Advanced)	Class A-3 (General)	Class A-4 (General)	Class B-1 "University Stream" (Advanced)	Class B-2 "University Stream" (Advanced)	Class C-1 "College Stream" (General)
Total # of Students in Class	26	26	13	13	30	14	22
# of Student Participants by Class	9	19	8	7	13	11	14
Total Student Participants by Group	28		15		24		14
	n(inquiry) = 43				*n*(teacher-structured) = 38		

as closely matched as possible with the Inquiry group for teaching background, academic level of classes taught (e.g., Advanced vs. General), characteristics of the town, and timing within the term or semester. With regard to teaching background, both Advanced teachers (Teacher A and

Teacher B) had similar numbers of years teaching English (27 and 26 years) and both held graduate degrees in education. The Teacher-Structured General teacher (Teacher C) reported fewer years as a teacher, however he was by no means a new educator (11 years experience). Although this was not intentionally matched, all three participating teachers were male. The specific curricula across geographical regions varied, as it does across provinces and states. However, the focus of this study was on instructional style and self-reported motivation rather than specific academic learning outcomes or skills, thus the different topics should not have influenced the presence of reported mastery or performance goals. For example, if a student reported being motivated to learn theme analysis in literature whereas another student reported motivation to learn how to effectively use transitions in writing, these would both be categorized as mastery goals within the subcategory of Skill Development. Although these students learned different topics and skills in their courses, the motivational themes of these responses were the topic of study and different curricula at this level should not affect students' reported achievement goals.

Determining level of inquiry instruction. Level of inquiry was assessed through four methods: referral, self-identification, semistructured interviews with an inquiry-coding system, and classroom observations using a validated observational protocol.

Referral. Inquiry-based teachers were recommended as employing highly inquiry-based methods and were referred based on known instructional style through the program director of an EdD program promoting inquiry-based methods and instructional leadership for teachers and administrators. Teachers in the Teacher-Structured group were sought as excellent, highly-regarded teachers using evidence-based teaching strategies (e.g., distributed learning), but not strategies that are specifically inquiry-oriented (e.g., student problem-finding).

Recommendations of the school-board research director provided suggestions for excellent, highly regarded teachers, but did not provide information about specific teaching approaches.

Self-identification. Teachers interested in participating then self-identified as teaching

Table 2

Recruitment Script Characteristics of Inquiry and Teacher-Structured Instruction

Inquiry: Teachers self-identified as Inquiry if they felt that many of these qualities were characteristic of their classrooms.	Teacher-Structured: Teachers self-identified as Teacher-Structured if they felt that many of these qualities were characteristic of their classrooms.
Are there multiple examples of project-based work?	As a teacher, would you consider your main roles in the class to convey the material to the students in a clear and organized manner, and to evaluate student learning?
Are the projects centered around real-world problems and student interest?	
Do students have the opportunity to choose questions to investigate?	Is information presented, students get the opportunity to practice it, then the material is tested?
Do students use many different types of learning resources beyond the teacher and a textbook, for example, they may go to a museum, watch a documentary, read a newspaper or magazine article, listen to an invited speaker, search company websites, etc.?	Does the practice often involve worksheets or a number of opportunities for the students to apply the material?
Is student-student dialog an important part of the learning process?	Do the students have a textbook upon which they rely heavily?
Is assessment centered around the learning process as much as specific content knowledge?	Do you feel you create well-designed tests to capture the knowledge students learn in your lessons?
Is creativity or critical thinking encouraged, instructed, or assessed?	Do you consider yourself fairly structured; do you find it quite important to follow the structure you had planned for the course, unit, lesson, etc.?
Is your role as the teacher less directive and structured, giving your students more room to explore?	

with either primarily Inquiry or Teacher-Structured styles based on lists of characteristics. The classroom features identified on the recruitment emails are listed in Table 2. Teachers were asked if they used some or many of the listed features in their classrooms and if they felt the listed qualities were characteristic of their teaching style. The full email recruitment materials are included in Appendices A and B.

Interviews with inquiry coding system. Semistructured teacher interviews were conducted to further assess instructional approach. Responses were rated based on a 25-item table of inquiry characteristics (Oppong-Nuako et al., 2015). In the interviews, teachers were asked to describe: (a) the methods of teaching and learning most often used in the class, (b) what the classroom looks like on a typical day, (c) the most important outcomes that the students learn in the class, and (d) the most important outcomes of inquiry-based teaching and learning. Teachers were also asked for background information about their education and teaching career (see Table 1). Interviews were audiorecorded and transcribed. Two researchers who were blind to the teachers' self-identified teaching styles independently coded the transcriptions. The 25 inquiry characteristics were nonorthogonal and not mutually exclusive, thus, the overall proportion of agreement between raters was acceptable (85%), although the item-by-item agreement level was lower (68%; $\kappa = .40$, 95% CI [. 29 - .51], $p < .01$, a "fair" strength of agreement; Landis & Koch, 1977). The object of assessment was, however, the global level of inquiry instruction. Following independent coding, the researchers discussed items on which there were inconsistent ratings and consensus was reached. After consensus, Teacher A (Inquiry) was rated as having 21 of the 25 inquiry characteristics, consistent with a high level of inquiry use as described by Oppong-Nuako et al. (2015), and Teacher B and Teacher C (Teacher-Structured) were rated to exhibit 14 and 16 inquiry characteristics, respectively, falling

between low and moderate inquiry levels, as described by Oppong-Nuako et al.

Classroom observation. Finally, the *Reformed Teaching Observation Protocol* (RTOP; Piburn et al., 2000; Sawada et al., 2002) was used to quantify classroom observations based on student-centered, inquiry-based instructional characteristics. The instrument is a 25-item observational protocol assessing three areas composed of five subscales in total (Lesson Design and Implementation, Content--Propositional and Procedural, and Classroom Culture—Communicative Interactions and Student-Teacher Relationships). The instrument generates a maximum score of 100 points, with scores over 50 reflecting inquiry-based, reform-related instruction, whereas scores under 50 are indicative of a low level of inquiry (MacIsaac & Falconer, 2002). Two Teacher-A classes were observed with the RTOP, namely an Advanced Placement (AP) class and a general English class (designated as Inquiry: A2-Advanced and A4-General). One class was observed for Teacher B (Teacher-Structured: B1-Advanced) and one for Teacher C (Teacher-Structured: C1-General). Observations were coded independently by two researchers and inter-rater reliability was calculated. Agreement between raters ranged from 93% to 97% for total RTOP scores, with subscale agreement ranging from 80% to 100%. Inter-rater consistency of coding was examined by correlating the raters' scores ($r = .89$, $p < .001$), indicating high consistency between raters. Nearly all discrepant items differed by just one-point variations on the 1- to 4-point scale. Out of the four RTOP observations (a total of 100 coded items), only three items were rated with more than a one-point discrepancy. As discussed in Adamson et al. (2003) and Blanchard et al. (2010), after independent coding the observers discussed their ratings and adjusted some ratings not to reach consensus but primarily to inform future classroom observations. The Inquiry Advanced class (Teacher A) received a total score ranging from 80 to 83 ($M = 81.5$) and the total scores for Inquiry General English class (Teacher

A) ranged from 74 to 79 (M = 76.5). The Teacher-Structured Advanced class (University Stream--Teacher B) was rated with an overall score ranging from 19 to 21 (M = 20.0), and the Teacher-Structured General English class (College Stream--Teacher C) was rated within a range of 15 to 19 (M = 17.0). Based on classroom observations by two independent observers, the Inquiry classes fell well within the range of inquiry-based, student-centered classes compared to the Teacher-Structured classes, which fell well below the cutoff of 50 (MacIsaac & Falconer, 2002).

Teacher A's (self-identified Inquiry) classroom observations revealed many inquiry-based and other good pedagogical strategies. There were high levels of discussion and dialog throughout the classes. When Teacher A presented new information, it was constantly framed in questioning form to prompt students to engage and to model curiosity and question asking. Teacher A acted as a director of the conversation, with a range of directedness (notably more directed in the General English class as compared to the Advanced class). When students asked questions, the questions were often redirected back to the class (e.g., "Why do you think . . . ?). The discussion was guided to relate to the students (e.g., "Who's a middle child?") and engage them in philosophical and metacognitive thought exercises (e.g., relating concepts to how they thought when they were in Grade 7, and how they would view the same thing "now" in Grade 12), with cross-disciplinary concepts introduced (e.g., legal system). An interesting and unexpected feature of Teacher A's teaching style was that, although highly inquiry-driven, he engaged in reinforcement practices that have been specifically noted as contrary to classroom qualities promoting mastery goals and incremental theories. For example, students received stickers for participating, which they collected and could use to get a prize at the end of the term and, when students made comments, he frequently responded saying, "You're so smart!" or

"You're geniuses!" This form of praise is also in contrast to what has been proposed to promote growth mindsets and learning-based mastery goals (Mueller & Dweck, 1998).

Teacher B's (self-identified Teacher-Structured) classroom revealed many strong pedagogical strategies. At the onset of the class, an outline was presented so students could orient their learning in context. Prior to discussing the book, Teacher B provided a biography of the author that contextualized the character development in the story. A thorough description of the era and setting of the story was presented to the students, again contextualizing the story as well as scaffolding weaker students. The teacher related themes to previous texts read in the class. A PowerPoint was used with many visuals, key points were written on a chalkboard, and short videos were shown for multimodal learning. Some questions were posed to the class by the teacher and some jokes were made to elicit participation and engagement. At the end of the class, upcoming assignments were reviewed.

Teacher C's (self-identified Teacher-Structured) classroom was also characterized by many positive pedagogical strategies as well as an evident personal connection with the students. Jokes and humor were present throughout the observation, made by both the teacher and the students. The class was multimodal and formats included lecture, independent work, video, and some class discussion, although many student questions were centered on clarification. During independent work, Teacher C walked around the class to provide scaffolding and more individualized support for students who required it. Additional support was provided while watching the video; Teacher C paused the video on several occasions to check understanding and relate it back to the topic.

Students. Grade-12 secondary students ($N = 81$) in English classes representing two styles of learning contexts (Inquiry--n(inquiry) = 43; and Teacher-Structured--n(teacher-

structured) = 38) participated in the study. Teachers who agreed to participate were asked to read a recruitment script to their students to solicit interest in participation and parental consent was obtained for interested students. Several students in the sample were 18 years of age or older and thus were additionally provided a student consent form to sign, whereas students under 18 were given student assent forms before participating. The Inquiry classes had a response rate of 55%, with 43 students participating in total: 28 Advanced students (AP English) and 15 General students (General English). The Teacher-Structured classes had a response rate of 58%, with 38 participating students: 24 Advanced students (University Stream English) and 14 General students (College Stream English). Students in the Inquiry classes were aged 16 to 18 years (M = 17.07 years, SD = 0.40). Students in the Teacher-Structured classes ranged from 16 to 19 years of age (M = 17.18, SD = 0.51). Both groups had a median age of 17. In Inquiry classes the male to female ratio was 19 to 24, whereas in Teacher-Structured classes the make up of participants included a larger proportion of males (26) to females (12).

There was a significant difference between means of grade-point averages (GPA) in which Inquiry students reported stronger grades (M = 93.86) compared to those in the Teacher-Structured classes (M = 79.66) for the current school year $t(79) = 8.87$, $p < .01$), as well as the previous school year (Inquiry M = 92.26, Teacher-Structured M = 79.29; $t(79) = 7.14$, $p < .01$). The difference in the number of students who had been enrolled in a selective-admission program between the instructional groups (Inquiry: 80%, Teacher-Structured: 27%; $\chi^2(1, N = 78) = 22.47$, $p < .01$) was also significant. However, there was no significant difference in IQ estimates between the groups (Inquiry M = 104.93, Teacher-Structured M = 101.39; $t(79) = 1.32$, $p > .05$). Although the Inquiry group was composed of high achieving students, the underlying ability level (as reflected by IQ) between the groups of students was comparable.

Inquiry students reported significantly higher parental education levels, which was used as an index of socio-economic status, $\chi^2(3, N = 79) = 34.70, p < .01$. Please see Table 3 for detailed student demographic information.

Table 3

Student Demographic Information

	Inquiry (Advanced)	Inquiry (General)	Teacher-Structured (Advanced)	Teacher-Structured (General)
n	28	15	24	14
Mean Age of Students	17.07 (*SD* = 0.38)	17.07 (*SD* = 0.46)	17.13 (*SD* = 0.54)	17.29 (*SD* = 0.47)
% Self-Identified as a Visible Minority	11.1%	13.3%	16.7%	28.6%
Median Level of Parental Education	Graduate School	Bachelor's Degree /Graduate School	College Diploma/Certificate	College Diploma/Certificate
Mean Parental Education 1 = High School 2 = College 3 = Bachelor's 4 = Graduate School	3.48 (*SD* = 0.85)	3.14 (*SD* = 1.10)	2.04 (*SD* = 0.77)	1.85 (*SD* = 0.86)
Mean Grades 2014-2015	95.64 (*SD* = 2.38)	90.53 (*SD* = 5.96)	84.25 (*SD* = 6.65)	71.79 (*SD* = 7.77)
Mean Grades 2013-2014	95.36 (*SD* = 3.25)	86.47 (*SD* = 6.85)	84.50 (*SD* = 7.67)	70.36 (*SD* = 5.69)
Mean Brief IQ (Standard Score)	108.00 (*SD* = 11.23)	99.20 (*SD* = 10.13)	105.67 (*SD* = 11.88)	94.07 (*SD* = 10.53)

Procedure

Data were collected in fall term of the 2014 to 2015 academic year, from late November to mid-December. Participating teachers were recruited through email requests. Teachers who

agreed to participate then made an announcement to students in their Grade-12 English classes describing the study and that students would have the opportunity to win one of two $30 gift certificates (a random draw for each participating school). Four researchers were trained to administer the assessment battery (student interview, brief IQ, questionnaires); up to three researchers were at a school at one time. At the schools, private offices were provided for the researchers, which included unused teachers' lounges, empty classrooms, conference rooms, computer rooms, and empty guidance offices. As well, some quiet public spaces were used while administering portions of the battery that did not require privacy (e.g., library or a desk set up at a quiet end of a hallway). Upon obtaining consent and student assent, students were individually taken out of their English class or agreed to meet the researchers during a spare period within the school day. Students completed a brief demographic information form. Interviews and brief IQ assessments both involved sensitive information and thus were administered individually in a private setting. A battery of questionnaires was then given to the students to complete. This was often completed in the library or other space where they could work quietly although, because this was not sensitive information, it was not required that they were completed in a private space. Students were administered the battery in a fixed order, beginning with the interview, then the IQ test, then the questionnaires in a specified order, starting with the *Implicit Theory Scale*, then assessing other achievement-related variables (*Motivational Strategies for Learning*, *Performance Failure Appraisal*, *Feedback Seeking Frequency Questionnaire*). Administration of the interview, brief IQ, and questionnaire battery together took approximately one hour per student.

Analysis

Content analysis. Interview transcripts from the semistructured student interview were

analyzed through both inductive and deductive content analysis (Ericcson & Simon, 1984; Krippendorf, 1980; Patton & Westby, 1992), using both open coding to find emerging themes and an a priori design for content analysis to detect predetermined themes of performance goals-approach goals (e.g., wanting good grades, wanting to get into a good university), performance-avoidance goals (e.g., not wanting to fail), mastery-approach goals (e.g., seeking challenge and learning), and mastery-avoidance goals (e.g., avoid learning less than last semester). Student responses were interpreted statement-by-statement, and then were verified in context vertically and horizontally in the context of the entire response to the question and, at times, in reference to other statements made in the interview. The units of analyses were student responses to each question from the student interview for Question 1 (What is motivating about the class?) and Question 3 (What do you hope to achieve at the end of the class?) and coding was completed using MAXQDA qualitative software (VERBI Software, 2014). Question 2 was not open coded as it was framed as multiple-choice--In this class, if you had to pick would you say you are mostly motivated by: (a) Wanting to understand the material or learn new skills, (b) Wanting to do well in comparison to others or get good grades, or (c) To avoid bad grades or failing? Thus, students' selection indicated (a) mastery goals, (b) performance-approach goals, or (c) performance-avoidance goals.

Students' responses to interview Questions 1 and 3 were initially coded based on the 2 × 2 framework for achievement goals (Performance, Mastery; Approach, Avoidance). However, very few avoidance-dimension goals were expressed in the transcripts. Out of the 162 units of transcript analyzed, three Mastery-Avoidance and seven Performance-Avoidance goals were reported. The finding of Mastery-Avoidance goals occurring at a very low frequency is consistent with findings from Ciana and Sheldon (2010). In contrast, with Performance-

Avoidance goals, several variables may have influenced the infrequent reporting of these goals. One prominent influence might have been the largely high-achieving sample, for which average grades were approximately 80 and 94 for the instructional groups. Thus, for the majority of these students, high academic expectations that are often met would not trigger an avoidance response. In addition, and related to the high achievement status of the sample, several responses were somewhat ambiguous as to whether the student was referring to certain marks as a "bare minimum" for their or others' expectations (e.g., S72: "I'm really just looking for an 80."). If not clearly indicating wanting to avoid a perceived failure, the response was interpreted within the category of Performance-Approach. There were six of these ambiguous responses coded as Performance-Approach goals. Thus, due to the low frequency of reporting Avoidance-dimension achievement goals, these were not used in further analyses. Statements of Performance-Avoidance goals were collapsed with Performance-Approach goals and are referred to as Performance goals for the remainder of the manuscript. In contrast, Elliot and McGregor (2001) suggested that Mastery-Avoidance goals may correlate more strongly with Entity Theories over Incremental Theories, thus, Mastery-Avoidance goals were excluded from the ensuing analyses.

Based on students' responses to interview Question 1, students were ultimately coded as voicing Mastery goals, Performance goals, or both Mastery and Performance goals simultaneously (e.g., S33: "There's like a dual thing where you try hard to get a good grade to get into college in your senior year. I also like getting better at analyzing literature and style. I really like that style of expression."). Themes of positive teacher or classroom qualities emerged as an unanticipated variable in students' responses to this question. Several students did not indicate achievement goals in regard to their reported motivation as assessed by this question,

but, rather, noted positive characteristics of their teacher or the classroom culture that motivated them (e.g., S49: "(Teacher) loves teaching it. And I think when you have a teacher that . . . is really engaging and loves what he's doing, it kind of just makes doing the work and participating in class a lot easier."). Many students reported both achievement goals and teacher or classroom qualities as motivators. Question 3 responses were coded into expressing Mastery goals, Performance goals, or a combination of mastery and performance goals. Only six of the 81 Question 3 transcript responses mentioned positive teacher or classroom qualities so, although the Teacher Qualities/Classroom Culture category was initially coded for Question 3, no further analyses of it were conducted; no other themes emerged in the analysis of this item. Responses to Question 2 were indicated in a multiple-choice style based on the way the question was presented, therefore field notes indicating the response and interview transcripts were later used to verify indication of option A, B, or C.

Through initial open coding of Questions 1 and 3, subcategories of Mastery and Performance goals emerged and a document of definitions of each category and examples of each subcategory was created to aid in later inter-rater reliability (see Table 4 and Appendix C). Hierarchical codes were assigned for achievement goals--Mastery or Performance goals. The codes were not mutually exclusive, because many students' responses expressed simultaneous endorsement of both goals. Subcategories for Mastery goals included: Learning for the Sake of Learning, Skill Development, Interest in Field or Topic, Application to Life, and Mastery Avoidance. Subcategories for Performance goals included: Grade Emphasis, University Admission, Performing/Outperforming, Stickers/Rewards, and Performance-Avoidance. The category of Teacher Qualities/Classroom Culture included two subcategories: Positive Teacher Qualities and Classroom Culture. Table 4 outlines brief examples and working definitions for

the subcategories with illustrative student statements. Two researchers were trained to use the coding definitions and 10% of the transcripts were used to practice consistent use of the coding definitions (Hruschka et al., 2004). Then 30% of the transcripts were independently coded by two researchers (blind to instructional group). Inter-rater reliability estimates were calculated and revealed "almost perfect agreement" ($\kappa = .85$, 95% CI [.79 - .91], $p < .001$, Landis & Koch, 1977), with the proportion of agreement falling at 90%. After calculating reliability estimates, the researchers discussed inconsistent items and reached consensus.

Table 4

Content Analysis Coding Categories with Illustrative Student Quotes

Categories and Subcategories	Examples	Illustrative Student Statements
Mastery		
Learning for the Sake of Learning	Learning for the sake of learning; wanting to learn more; wanting to learn even when challenging; enjoying learning; enjoying effortful learning; wanting a deeper understanding of the course material	S14: "I am not really too worried about grades, I mean they are numbers to me, I am more worried about what I take out of it because I think knowledge, in general, is more important than numbers you get . . . determined by someone else."
Skill Development	Wanting to learn new skills (e.g., writing techniques, improve essay writing, how to analyze literature); build one's knowledge base	S55: "[laughs] Um…I think [I'd like to improve in] writing essays cause I'm not very good at them, so being able to compose my thoughts and write a well-thought-out essay would be what I want to get out of this class."
Interest in Field or Topic	Finding a topic interesting; enjoying reading/writing; liking an author like Shakespeare etc.; liking a twist on the topics	S36: "I guess I've always liked books and literature so it's always fun to do that, and it's kind of an excuse to do that and kind of a way of like slipping that into the day."
Application to Life	Learning life skills; thinking about bigger concepts that apply outside of school; development of personal qualities; gaining perspectives on life	S64: "I feel like we're connecting it a lot to stuff that's happening in real life so it's making a lot of sense . . . it also makes you want to do something about what's happening, especially with the Jian Ghomeshi case."

Categories and Subcategories	Examples	Illustrative Student Statements
Mastery		
Mastery Avoidance	Worrying about not learning as much as one possibly can; perfectionistic tendencies (need to learn it all; don't want to not learn it all)	S08: "I am a very self-driven personality so I always do my work in all of my classes but I don't want to miss out on stuff that's going on in English, you know?"
Performance		
Grade Emphasis	Wanting a good grade/a better grade; wanting an award or recognition associated with a certain GPA; wanting a good or decent grade with little effort	S15: "I think everybody is motivated by grades and getting the best grade possible."
University Admissions	Wanting to do well to get into university/a good university/a specific program in university; needing the class for university; wanting the AP credit or other university credits	S61: "Well I'm not going into English post-secondary so it's not something that I'm particularly interested in, but I want to get a 90ish mark so that it can help with getting some scholarships and stuff when I go away."
Performing or Outperforming	Wanting to do well in comparison to others; wanting to do as well or better than classmates; wanting to do well because of family expectations; wanting to "succeed"; wanting to do well with little effort; challenging/pushing oneself for a better grade	S50: "Well I've noticed our grade-12 students, we have a lot of pretty intelligent people so the fight . . . not the fight, but you have competition . . . not competition, but you have people who are doing well all around you and you want to, like, try to do better than them and get as good marks as them."
Rewards or Stickers	Wanting external reinforcement (e.g., stickers, praise); rewards (e.g., if family gives reward for doing well)	S19: "He also has this like policy, I don't know if it's a policy, but if you participate in class or do something he gives you stickers . . . And the more stickers you have at the end of the year, you can turn in and get different prizes and stuff, which helps motivate kids."
Performance-Avoidance	Not wanting to fail or do poorly	S74: "Just a pass."

Categories and Subcategories	Examples	Illustrative Student Statements
Teacher Qualities and Classroom Culture		
Positive Teacher Qualities	Liking the teacher; good relationship; feeling supported by (him); (he) makes it fun; liking the way (he) directs conversations; liking the way (he) puts responsibility in the students' hands; he is supportive, encouraging, engaging, motivating, etc.	S52: "(Teacher). He's a good guy. I love talking to him and stuff like that. I love just joking around with him, so, he's just a good teacher overall. He's probably my favorite teacher in this school, so…yeah."
Classroom Culture	Liking the classroom; being allowed/encouraged to have open conversations; liking one's classmates; fun atmosphere; getting to take responsibility; the classroom culture/context is supportive, motivating, encouraging, engaging, etc.	S70: "I guess there's a lot of…open-mindedness. You can say something and there won't be a backlash on you. There's more of a discussion . . . You can really say what you have on your mind within a certain limit. Like, I won't offend people. Even in the end people will get offended, but yeah, it's an enjoyable thing about that class."

Quantitative analyses. Quantitative analyses were run in SPSS 23 (IBM, 2015). To address the research questions of the present study, several analyses were conducted. The relation between Instruction on Implicit Theory was assessed through an independent samples *t*-test. To address the second research question and the primary focus of the study, the predictive abilities of Implicit Theory and style of Instruction on adoption of achievement goals were investigated. With regard to the primary research question, parallel Binary Logistic Regression analyses were run on the self-reported achievement goal-outcome variables. Responses to student-interview Questions 1, 2, and 3 were coded to reflect the presence or absence of Mastery goals and Performance goals based on student interview questions. Interview Question 1 had an additional outcome variable of the presence of expressed positive Teacher or Classroom qualities. As described previously, Performance-Approach and Performance-Avoidance

responses on interview Questions 1, 2, and 3 were collapsed to form a single Performance variable due to low response frequency for Avoidance goals. The continuous independent variable, Implicit Theory, was based on mean score on the *Implicit Theory Scale* (ITS), on which a high score reflected higher levels of expressed Entity mindset. The six, six-point Likert-scale items on the ITS were averaged and the dichotomous item was scored as a 1 or a 6 reflecting indication of Incremental or Entity rating. Implicit Theory followed a normal distribution (M = 3.26; see Table 6). Instructional group (Inquiry, Teacher-Structured) was a binary independent variable. Interaction effects between Implicit Theory and Instruction were also examined to determine if Instruction predicted additive or interactive effects on the likelihood of adopting Mastery or Performance goals. Assumptions were checked with regard to sample size, empty cells, multicollinearity of independent variables, and appropriateness of variables (Orme & Combs-Orme, 2009). Although there is no set criterion for sample size, a general rule of thumb is a sample size with a minimum of 10 cases per estimated parameter (Long & Freese, 2006). Table 5 shows Pearson and point-biserial correlations for the continuous and categorical predictor and outcome variables. The predictor variables, Instruction and Implicit Theory, were not significantly correlated (r = .06, p = .58).

To address a tertiary research hypothesis of the study, the extent was examined to which Instruction and Implicit Theory influenced a series of achievement behaviors and emotions. These variables included Deep Learning Strategies, Shallow Learning Strategies, Test Anxiety, Fear of Failure, and Feedback-Seeking Frequency based on self-reported ratings on the *Motivational Strategies for Learning Questionnaire* (MLSQ), *Performance Failure Appraisal Inventory--Short Form* (PFAI), and the *Feedback-Seeking Frequency Questionnaire* (FSFQ). Implicit Theory was converted into a dichotomous variable by using a split-half method on the

score to create two groups reflecting the upper and lower 50% of scores (*n*(incremental) = 42, *n*(entity) = 39). A series of parallel 2 × 2 ANOVAs were run to determine the effects of Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity) on the mean scores of Deep Learning Strategies, Shallow Learning Strategies, Test Anxiety, and Fear of Failure. Assumptions of normality, skewness, and homogeneity of variance were checked (Tabachnick & Fidell, 2013). Absolute values of skewness and kurtosis were well within a range of 2 (George & Mallery, 2010). Levene's Test of Equality of Error was run for each of the 2 × 2 ANOVAs and was not significant, which indicated that the assumption of homogeneity of variance was met. Feedback-Seeking Frequency was also analyzed as a categorical outcome variable in which it was grouped into two categories: (a) not seeking or seeking feedback once within the term, or (b) seeking feedback two or more times within the term. Chi-square analyses were conducted on these Feedback-Seeking data. Two participants were excluded from these analyses because they did not complete the full battery of questionnaires. Descriptive statistics for these variables and correlations to the independent variables are presented in Table 6.

Results

Implicit Theories

To assess the first research question of whether Inquiry relates to Implicit Theory, an independent samples *t*-test was conducted to compare mean ratings of Implicit Theory (from the *Implicit Theory Scale*, with higher scores reflecting higher ratings of Entity Theories) in Inquiry compared to Teacher-Structured student groups. As hypothesized, Implicit Theory did not significantly vary with Instruction. No significant differences in Entity Theory endorsement were seen between students in Inquiry settings ($M = 3.21$, $SD = 0.91$) and Teacher-Structured settings ($M = 3.32$, $SD = 0.87$), $t(79) = -0.56$, $p = .58$. Instruction and Implicit Theory were not

significantly correlated (r = .06).

Achievement Goals

The primary hypothesis of the study was that Implicit Theories and Instruction would both predict the likelihood of adopting achievement goals, in which students with Incremental Theories and students in Inquiry-based instruction will be more likely to adopt Mastery goals, and the effects of these predictors would either add to or interact with one another. For students with Entity Theories, it was hypothesized they would be more likely to express Performance goals, but this might also have an added or interactive effect of Instructional setting. The predictors Instruction, Implicit Theory, and Instruction by Implicit Theory were examined to determine their ability to predict students' reported achievement goals in responses to Questions 1, 2, and 3 on the semistructured student interview (see Table 5):

- Question 1 (Q1)--What is motivating about the class?
- Question 2 (Q2)--In this class, if you had to pick would you say you are mostly motivated by: (a) wanting to understand the material or learn new skills, (b) wanting to do well in comparison to others or get good grades, or (c) to avoid bad grades or failing?
- Question 3 (Q3)--What do you hope to achieve at the end of the class?

Each question was coded to reflect whether the students' responses included Mastery goals (Yes or No), or Performance goals (Yes or No), and for Q1 the additional category for Teacher or Classroom qualities as reported motivators (Yes or No) was coded. The Implicit Theory variable was centered and a dummy variable was created for Instruction. Initial Binary Logistic Regression analyses identified outliers with standardized deviance residuals exceeding the value of $z = \pm 2$ (Orme & Combs-Orme, 2009); these were then checked for influential cases (Long & Freese, 2006). Seven (1%) outlying data points out of a total of 567 were removed

from the analyses. Comparing the models before and after removal of the outliers, the outlying data points did not influence significance of overall model fit, however, one effect changed from just outside the confidence interval for significance on the Wald statistic to significant; the Instruction predictor on Q1-Mastery changed from $p = .065$ to $p = .038$. The subsequent results of the Binary Logistic Regression analyses are presented in the following section. Proportions of reported achievement goals by Instruction and Implicit Theory (by split-half) are presented for each outcome in Figures 1 through 8. These proportions do not necessarily add up to 100% because they are based on students' spontaneous reporting of achievement goals on open-ended interview questions. Implicit Theory was separated into a high (Entity) and low (Incremental) group for these graphic representations to more clearly view the relations (as discussed in Long & Freese, 2006). Because the Instruction sample sizes were uneven (43 vs. 38), the percentages of students in each instructional group reporting the presence of the various achievement goals are reported, rather than numbers of students. Given the moderate sample size, the Wald test was interpreted in conjunction with change in log likelihood values in the following analyses. The Wald test has been described as conservative and inappropriate in smaller sample sizes (Jennings, 1986; Kleinbaum & Klien, 2004; Peng & So, 2003); the likelihood test was recommended due to concerns with power as well as the increased risk of quasicomplete separation (Allison, 2012; Peng & So, 2003). Model suitability and specific effects of predictors are explained by comparing the log-likelihood value change with the predictors in the model (-2 Log Likelihood) compared to the model without the predictors in the model (reduced models) and assessing the resulting chi-square significance.

In the following logistic regression results, three measures of effect size were included, namely, Nagelkerke's R^2, the correct classification rate, and the odds ratio (OR). In reporting

Nagelkerke's R^2, there are no set criteria for reporting interpretive ranges due to varying interpretability based on the nature of the variables of interest (Orme & Combs-Orme, 2009), however, convention in educational psychology research suggests that a Nagelkerke's $R^2 \geq .25$ reflects a moderate proportion of variance explained. Correct classification rates above the at-chance (null) classification rates are described as adequate (Orme & Combs-Orme, 2009). Odds ratios of .67 to 1.50 reflect weak predictors, .4 to .66 and 1.5 to 2.5 reflect moderate predictors, and below .39 and above 2.5 reflect strong predictors (Rosenthal, 1996).

Table 5

Nonparametric Bivariate Correlations among Independent and Dependent Variables Entered into the Binary Logistic Regressions

Variable	IV-Instruction	IV-Implicit Theory	Q1-M	Q2-M	Q3-M	Q1-P	Q1-P-w/oS	Q2-P	Q3-P	Q3-T/C
IV-Instruction[1]										
IV-Implicit Theory[2]	.06									
Q1[3]-Mastery	-.23*	-.32**								
Q2-Mastery	-.36**	-.33**	.39**							
Q3-Mastery	-.37**	-.28**	.36**	.46**			.			
Q1-Performance (with Stickers)	-.25*	.03	-.40**	-.05	.06					
Q1-Performance (without Stickers)	-.09	-.05	-.33**	-.12	-.02	.84**				
Q2-Performance	.36**	.33**	-.39**	-1**	-.46**	.05	.12			
Q3-Performance	.28*	.39**	-.36**	-.43**	-.50**	.02	.03	.43**		
Q1-Teacher/ Classroom	.06	.04	-.05	.03	-.07	-.36**	-.38**	-.03	.21	

* $p < .05$, ** $p < .01$ (both two tailed)
Note 1: A positive correlation with Instruction represented a positive relation with Teacher-Structured instruction
Note 2: High values on the Implicit Theory scale represented higher ratings of Entity Theory endorsement
Note 3: Q1, Q2, and Q3 refer to the three student-motivation interview questions.

Mastery. *Interview Question 1 (Q1)--What is motivating about the class?* The full model assessed the likelihood of reporting Mastery goals on Q1 based on the predictors: (a) Instruction, (b) Implicit Theory, and (c) their interaction. The full model was significant, $\chi^2(3, N = 80) = 16.94$, $p = .001$, and the variables accounted for a moderate amount of variance in reported Mastery goals overall, Nagelkerke's $R^2 = .26$. Classification in the model was reasonable, with an overall correct classification rate of 67.5%. The Hosmer-Lemeshow goodness-of-fit test was significant for the reduced model at the $p < .05$ level ($p = .013$). Thus, some caution should be taken in interpretation of this finding; however, this test has been suggested to be problematic when conducted with smaller sample sizes (Allison, 2012). Instruction and Implicit Theory both significantly predicted reporting of Mastery goals, Wald $\chi^2(3, N = 80) = 4.31$, $p = .038$, Wald $\chi^2(3, N = 80) = 8.29$, $p = .004$, respectively. The interaction was a significant predictor; the -2 Log Likelihood for the reduced model was 97.54, and when introduced to the model the interaction resulted in a log likelihood value for the full model of 93.51 ($\chi^2(1, N = 80) = 4.03$, $p < .05$). There was a strong effect in which students with Incremental Theories were more likely to report Mastery goals over those with Entity Theories, however, this relation was significantly stronger in Inquiry classes whereas a weaker effect was seen in Teacher-Structured classes (OR = 3.57, 95% CI [0.97 – 13.15]; see Figure 1). The percent change in odds of reporting Mastery goals in Inquiry settings over Teacher-Structured classes was 187% (OR = 2.87, 95% CI [1.06 – 7.75]), and the percent change in Mastery goals reduced by 78% with an increase in Entity Theory score (OR = .22, 95% CI [.08 - .61]).

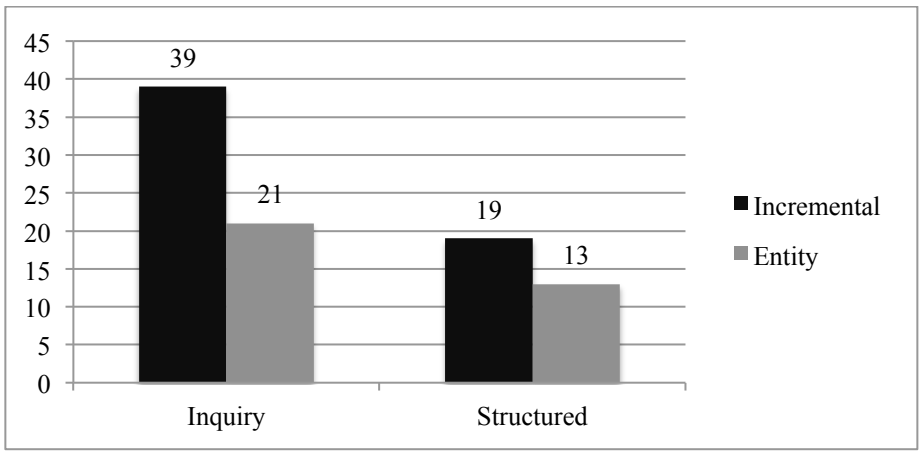

Figure 1. Percentage of students reporting Mastery goals on Interview Question 1 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

Interview Question 2 (Q2)--If you had to pick would you say you are mostly motivated by: (a) wanting to understand the material or learn new skills, (b) wanting to do well in comparison to others or get good grades, or (c) to avoid bad grades or failing? The next question was posed as a multiple-choice question rather than in open-response form, thus the selection of either a Performance or Mastery goal was mutually exclusive; therefore the Binary Logistic Regression produced the same results for the overall model prediction of the likelihood of Instruction, Implicit Theory, and their interaction predicting the adoption of Performance or Mastery goals, with inverse odds ratios for Mastery and Performance goals. The full model (Instruction, Implicit Theory, and their interaction) significantly predicted the likelihood of students expressing Mastery and Performance goals, $\chi^2(3, N = 79) = 20.90$, $p < .001$; however, the interaction was not significant (based on the Wald statistic and change in -2 Log Likelihood), thus a reduced model was run excluding the interaction. The reduced model was significant, $\chi^2(2, N = 79) = 19.71$, $p < .001$. The Hosmer-Lemeshow goodness-of-fit test was not significant ($p = .24$), which indicated good fit for the reduced model. The variables accounted for a moderate amount of variance in reported Mastery goals, Nagelkerke's $R^2 = .30$. Classification in

the model was reasonable, with an overall correct classification rate of 67.1%. Mastery and Performance goals were significantly predicted by Instruction and Implicit Theory, Wald $\chi^2(2, N = 79) = 9.51$, $p = .002$, Wald $\chi^2(2, N = 79) = 7.82$, $p = .005$, respectively. Instruction was a strong predictor, in which students in Inquiry settings were over five times more likely to report Mastery goals than those in Teacher-Structured settings (OR = 6.06, 95% CI [1.93 – 19.05]). The percent change in Mastery goals decreased moderately with increases in Entity Theory score (OR = .40, 95% CI [.21 – .76]). Thus, there was an additive effect of Inquiry settings and Incremental Theories making it much more likely to express Mastery goals, whereas students in Teacher-Structured settings holding Entity Theories were much less likely to express Mastery goals, and rather were much more likely to report Performance goals (see Figures 2 and 6).

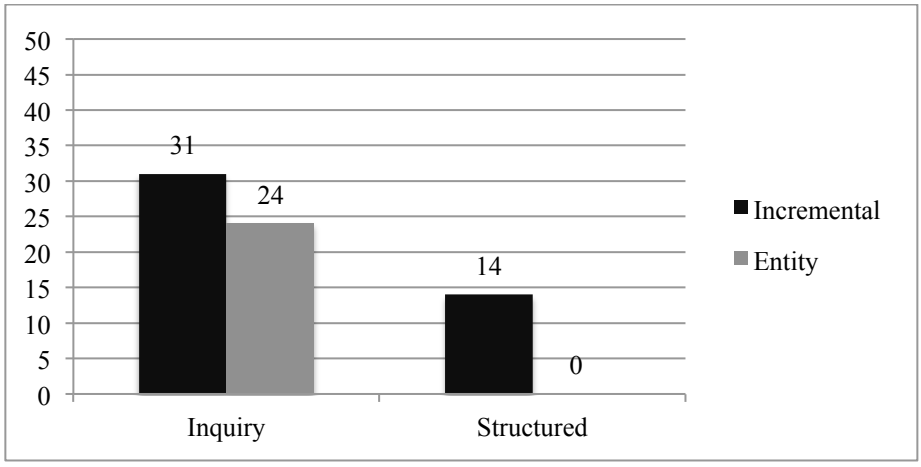

Figure 2. Percentage of students reporting Mastery goals on Interview Question 2 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

Interview Question 3 (Q3)--What do you hope to achieve at the end of the class? The full model of Instruction, Implicit Theory, and the interaction between them was assessed to predict the likelihood of expressing Mastery goals on Q3. The full model was significant, $\chi^2(3, N = 80) = 18.78$, $p < .001$, however, the interaction was not significant (based on the Wald statistic and change in -2 Log Likelihood), thus a reduced model was run excluding the interaction. The

reduced model was significant, $\chi^2(2, N = 80) = 17.94$, $p < .001$. Evidence of fit for the reduced model was also supported by the Hosmer-Lemeshow goodness-of-fit test, which was not significant ($p = .39$). Nagelkerke's $R^2 = .29$ indicated that the parameters accounted for a moderate amount of variance in reported Mastery goals on this item. Overall classification by the reduced model was good, with a correct classification rate of 74%. Instruction, Wald $\chi^2(2, N = 80) = 9.55$, $p = .002$, and Implicit Theory, Wald $\chi^2(2, N = 80) = 5.72$, $p = .017$, both significantly impacted the ability to predict Mastery goals. As hypothesized, students with Incremental Theories were more likely to report Mastery goals, however, as also hypothesized, in Inquiry settings students were also more likely to report Mastery goals (see Figure 3). There was a strong predictive power for Instructional setting on reported Mastery goals, in which the percent change in odds of reporting Mastery goals was over 500% in Inquiry settings over Teacher-Structured settings (OR = 6.57, 95% CI [1.99 – 21.69]. Implicit Theory had a moderate predictive effect on Mastery goals (OR = .41, 95% CI [0.20 – 0.85].

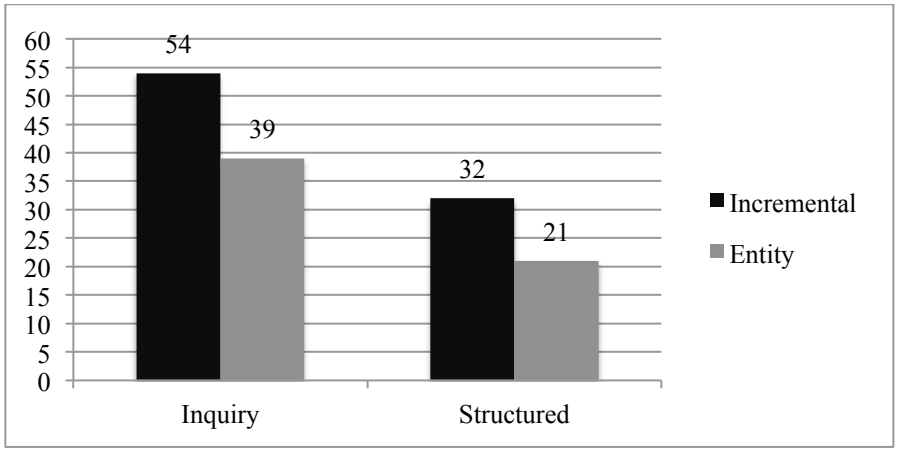

Figure 3. Percentage of students reporting Mastery goals on Interview Question 3 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

Performance. *Interview Question 1 (Q1)--What is motivating about the class?* Performance goals on Q1 were not significantly predicted within the full model, $\chi^2(3, N = 81) =$

5.67, $p = .13$. Instruction, Implicit Theory, and their interaction did not significantly predict the likelihood of students reporting Performance goals on Q1. Although the overall model was not significant, the percentage of students reporting Performance goals in Inquiry classes was 67% as compared to 42% in Teacher-Structured classes, which was in contrast to the hypothesized relationship. When the individual Performance-goal codes were examined closely, this finding was related to numerous students in the Inquiry classes having reported motivation from the

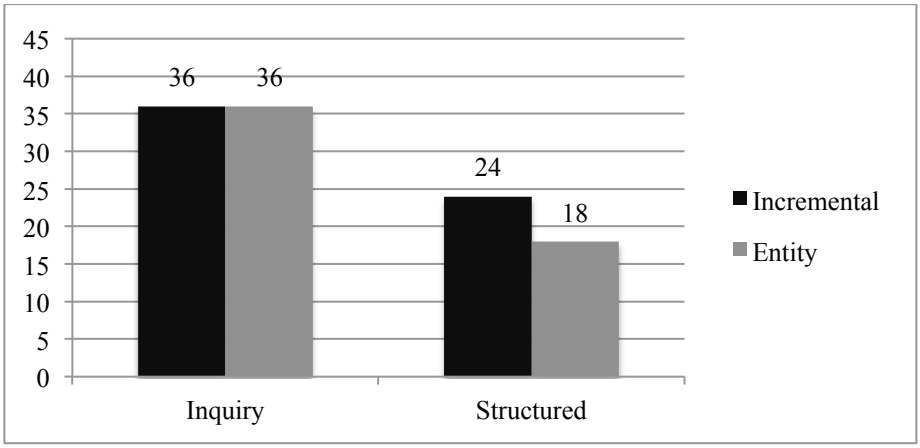

Figure 4. Percentage of students reporting Performance goals (including stickers as a motivator) on interview Question 1 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

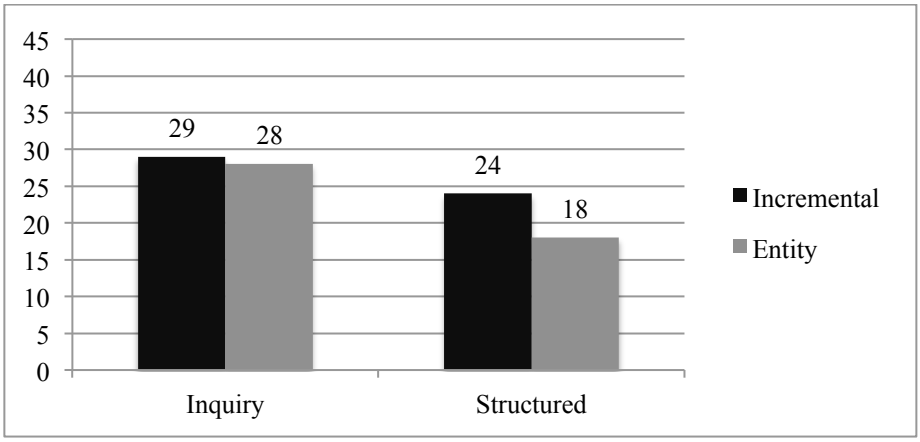

Figure 5. Percentage of students reporting Performance goals (excluding stickers as a motivator) on interview Question 1 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

sticker-reward system used in the class (coded as an external indicator for acknowledgement of performance and thus a Performance goal). We wished to determine if the reporting of stickers impacted the results of otherwise stated Performance goals (e.g., grades, outperforming others). When these Sticker/Reward subcategory responses were excluded from the analysis, the model again did not significantly predict reporting of Performance goals, $\chi^2(3, N = 81) = 0.80$, $p = .85$. The percentage of students reporting Performance goals in Inquiry dropped from 67% to 57%, thereby reducing the percentage difference between instructional groups from 25% to 15% (see Figures 4 and 5--in the latter both Inquiry columns are reduced).

Interview Question 2 (Q2)--If you had to pick would you say you are mostly motivated by: (a) wanting to understand the material or learn new skills, (b) wanting to do well in comparison to others or get good grades, or (c) to avoid bad grades or failing? As described previously for Q2-Performance, a reduced model, with the predictors Instruction and Implicit Theory, was significant, $\chi^2(2, N = 79) = 19.71$, $p < .001$; the Hosmer-Lemeshow goodness-of-fit test was not significant ($p = .24$). A moderate amount of variance in reported Mastery goals (Nagelkerke's $R^2 = .30$) was predicted by the reduced model, with significant effects of Instruction ($p < .01$) and Implicit Theory ($p < .01$). Performance goals were more likely to be expressed by individuals with Entity Theories, although this relationship also varied with Instructional setting, in which they were more likely to report Performance goals in Teacher-Structured class settings over Inquiry (see Figure 6). Classification in the model was reasonable, with an overall correct classification rate of 67.1%. Moderate to strong predictive effects from Implicit Theory (OR = 2.49, 95% CI [1.31 – 4.70])) and Instruction (OR = .17, 95% CI [0.05 – 0.52]) were observed (see Figure 6).

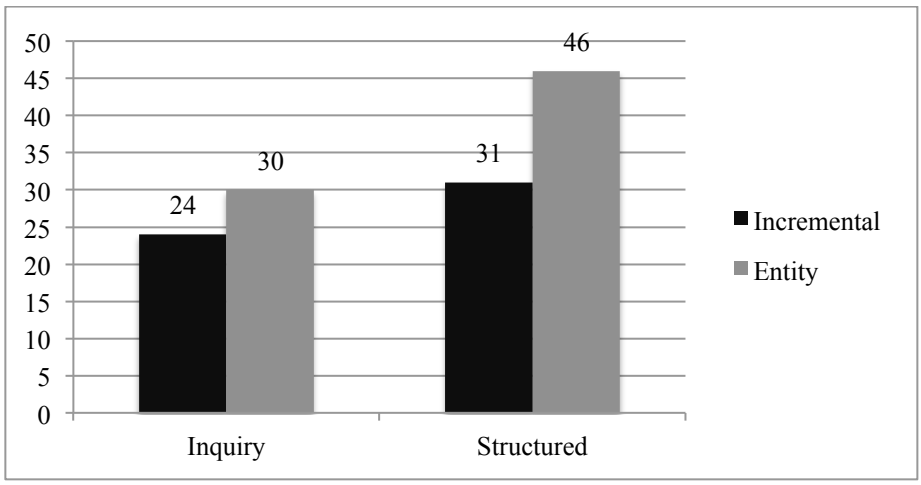

Figure 6. Percentage of students reporting Performance goals on interview Question 2 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

Interview Question 3 (Q3)--What do you hope to achieve at the end of the class? The full model assessed the likelihood of reporting Performance goals on Q3 based on the predictors: (a) Instruction, (b) Implicit Theory, and (c) their interaction. The full model was significant, $\chi^2(3, N = 80) = 19.80$, $p < .001$, however the interaction was not significant (based on the Wald and -2 Log Likelihood statistics), thus a reduced model was run with the predictors of Instruction and Implicit Theory. Against a constant-only model, the reduced model was significant, $\chi^2(2, N = 80) = 19.18$, $p < .001$. The Hosmer-Lemeshow goodness-of-fit test was not significant, indicating good fit of the reduced model. The variables accounted for a moderate amount of variance in reported Performance goals, Nagelkerke's $R^2 = .29$, and correct classification for the model was reasonable, with an overall correct classification rate of 71.3%. Instruction and Implicit Theory were significant predictors of Performance goals in students (Wald $\chi^2(2, N = 80) = 5.72$, $p = .017$, and Wald $\chi^2(2, N = 80) = 10.67$, $p = .001$, respectively). A strong predictive power of instruction was found in which the percent change in odds of reporting Performance goals in Inquiry settings was reduced by 72% (OR = .28, CI 95% [0.10 – 0.79]), and a moderate

effect of Implicit Theory was found in which the percent change in odds of reporting Performance goals increased by 190% for students with higher Entity Theory ratings (OR = 2.90, CI 95% [1.53 – 5.50]). Students in Teacher-Structured classes (regardless of Implicit Theory) and those with Entity Theories (regardless of Instructional setting) were more likely to report Performance goals over students in Inquiry classes or those with Incremental Theories (see Figure 7).

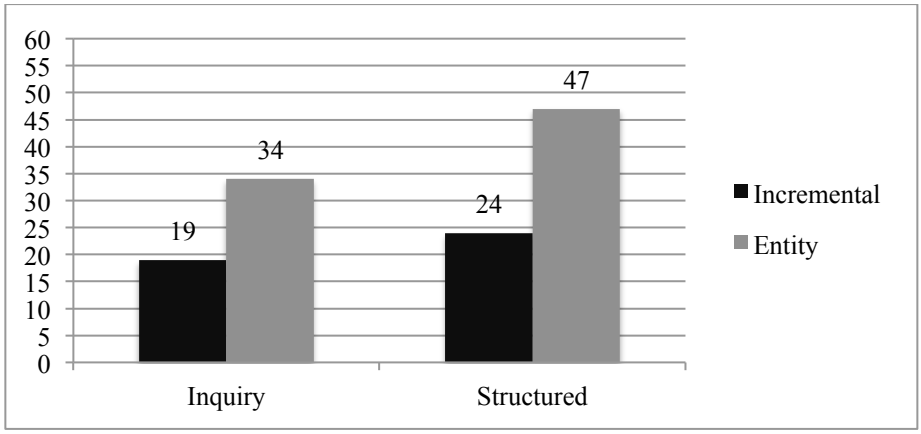

Figure 7. Percentage of students reporting Performance goals on interview Question 3 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

Teacher or Classroom. A final coding category emerged on interview Question 1 (What do you find motivating about the class?) and was assessed as a third outcome variable to determine if Instruction, Implicit Theory, or their interaction significantly predicted likelihood of expressing positive Teacher or Classroom qualities. The full model was not significant, $\chi^2(3, N = 81) = 0.82$, $p = .85$. When a reduced model was run to determine if Instructional setting could predict expressed Teacher or Classroom qualities as a motivating factor, again the model was not significant, $\chi^2(1, N = 81) = 0.30$, $p = .58$. This demonstrated that teachers and classroom qualities for both instructional setting (Inquiry and Teacher-Structured) received comparable levels of student endorsement (49% in Inquiry, 50% in Teacher-Structured; as shown in Figure

8).

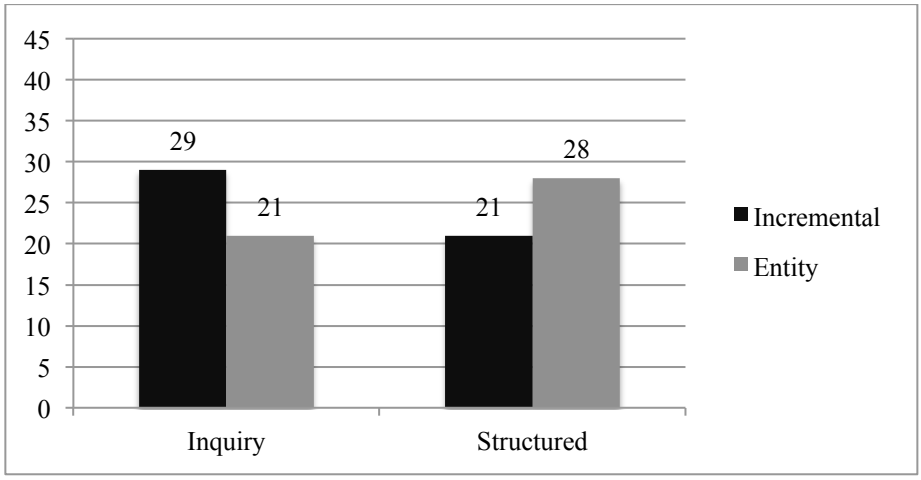

Figure 8. Percentage of students reporting positive Teacher or Classroom qualities on interview Question 1 by Instruction (Inquiry, Teacher-Structured) and Implicit Theory (Incremental, Entity).

Learning Strategies, Performance Appraisals, and Achievement Emotions

The third research question was addressed through multiple parallel 2 × 2 ANOVAs calculated with the independent variables of Instruction and Implicit Theory and the dependent variables of Deep Learning Strategies, Shallow Learning Strategies, Test Anxiety, and Fear of Failure. Chi-square analyses were conducted on Feedback-Seeking Frequency with instruction and implicit theory. Table 6 shows the means, standard deviations, and correlations for the aforementioned variables.

A two-way ANOVA revealed a significant but modestly sized effect of Implicit Theory on reported use of Deep Learning Strategies $F(1,75) = 8.15$, $p = .006$, $\eta^2 = .10$. Students with Incremental Theories of ability ($M = 4.69$) reported using significantly more Deep Learning Strategies than students with Entity Theories of ability ($M = 4.20$). No significant differences in Deep Learning Strategy use were found between students in different Instructional settings $F(1, 75) = 0.37$, $p = .55$, and no significant interaction effect was found, $F(1, 75) = 0.16$, $p = .69$.

Table 6

Descriptive Statistics for Learning Strategies and Achievement Emotions

Scale	Mean	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis	Instruction[1] Correlations	Implicit Theory[2] Correlations
Implicit Theory	3.26	0.89	1.29	5.00	-.29	-.60	.06	
Deep Learning Strategies	4.45	0.79	2.20	6.00	-.84	1.06	.06	-.39**
Shallow Learning Strategies	3.79	1.06	1.00	6.00	-.49	.01	.27*	-.02
Test Anxiety	3.59	1.06	1.20	5.80	-.13	-.41	.19	.30**
Fear of Failure	2.13	0.94	0.20	3.80	-.06	-.81	.09	.26*
Feedback-Seeking Frequency (Teacher)							.23*	-.10
Feedback-Seeking Frequency (Peers)							.25*	.05

* $p < .05$ (two-tailed)
** $p < .01$ (two-tailed)
Note 1: A positive correlation with Instruction represented a positive relation with Teacher-Structured instruction
Note 2: High values on the Implicit Theory scale represented higher ratings of Entity Theory endorsement

The related variable of Shallow Learning Strategy use was assessed through a two-way analysis of variance that investigated the effects of Implicit Theory and Instruction on Shallow Learning Strategy use. A significant main effect of Instruction indicated that students in Teacher-Structured classes ($M = 4.10$) were more likely to report using Shallow Learning Strategies than students in Inquiry classes ($M = 3.53$), $F(1, 75) = 5.92$, $p = .017$, $\eta^2 = .07$, but the effect size was small. No significant effect was shown for Implicit Theory, $F(1, 75) = 0.40$, $p = .53$ and no significant interaction effect was found, $F(1, 75) = 0.04$, $p = .84$.

With regard to Test Anxiety, no significant effects were found for Instruction, $F(1, 75) =$

2.58, $p = .11$, Implicit Theory, $F(1, 75) = 2.64$, $p = .11$, or their interaction, $F(1, 75) = 0.59$, $p = .44$. No significant effects of Instruction, Implicit Theory, or Instruction by Implicit Theory on Fear of Failure were found either (Instruction, $F(1, 75) = 0.50$, $p = .48$; Implicit Theory, $F(1, 75) = 0.89$, $p = .35$; interaction, $F(1, 75) = 0.33$, $p = .57$). However, significant correlations were found between Implicit Theory and Test Anxiety ($r = .30$, $p < .01$) and Fear of Failure ($r = .26$, $p < .05$).

The impact of Instruction and Implicit Theory on Feedback-Seeking Frequency was examined through chi-square analyses. Instruction was significantly related to students' level of Feedback Seeking with their teacher, $\chi^2(1, N = 81) = 3.99$, $p = .046$, $\eta^2 = .23$, and peers, $\chi^2(1, N = 81) = 3.99$, $p = .02$, $\eta^2 = .25$. Effect sizes were moderate. However, this relation was in the opposite direction than was hypothesized. Students in the Structured classes engaged in more Feedback Seeking than students in Inquiry classes. No differences between those with Incremental Theories and Entity Theories were found in Feedback-Seeking Frequency with teachers, $\chi^2(1, N = 81) = 0.27$, $p = .61$, or peers, $\chi^2(1, N = 81) = .40$, $p = .53$.

Discussion and Conclusions

The present study had three main purposes. The first was to assess whether a difference in implicit theory existed between students in inquiry-based classes compared to teacher-structured classes. The second and primary research question was to investigate whether a relation existed between implicit theories of ability, instructional style, and adoption of achievement goals in high-school students. We wished to determine whether students in inquiry-based instructional settings were more likely to express mastery goals, and if any additive effects or interactions existed between instruction and implicit theory. Relatedly, we wished to examine whether students in inquiry settings would be less likely to express performance goals compared

to students in teacher-structured settings, and the added or interactive effects of entity theories of ability. The third research question was exploratory and aimed to examine whether instructional setting could further relate to a specific set of achievement goal-related behaviors and emotions, including learning strategies, test anxiety and failure appraisal, and feedback-seeking behavior.

Research Question One: Implicit Theories

As hypothesized, enrollment in a single inquiry-based class is not sufficient to change general implicit theories in students. Students in inquiry settings showed similar ratings of entity theories as students in comparison, teacher-structured classes. Much research investigating changing implicit theories has focused on direct training and praise to promote growth mindsets in students (e.g., Blackwell et al., 2007; Good et al., 2003; Mueller & Dweck, 1998), whereas this study investigated the potential for indirect effects of social-constructivist based learning to promote incremental theories. The present findings provide additional evidence that changing implicit theories may require longer-term intervention (e.g., Donohoe et al., 2012; Liu, 2012).

Research Question Two: Achievement Goals

Answering the primary research question, and consistent with findings from previous research (e.g., Dweck, Mangels, & Good, 2004; Haimovitz, Wormington, & Corpus, 2011; Lerdpomkulrat et al., 2012; Mueller & Dweck, 1998; Stipek & Gralinski, 1996), in this study, students' implicit theories were related to their tendency to adopt certain achievement goals. Based on a self-report measure of implicit theory and semistructured interviews on students' motivation in their English class, Grade-12 students with incremental theories were more likely to report mastery goals as a motivating factor in their classes, whereas students with entity theories were more likely to report performance goals, consistent with past research. However, of specific interest to the present study, instructional setting also accounted for a significant

amount of the variability in predicting the likelihood of adopting mastery or performance goals as an additive effect. As hypothesized, the influences of implicit theory and instructional setting both significantly predicted adoption of classroom achievement goals.

In inquiry classes, not only do students with incremental theories report higher levels of mastery goals, but an added effect of inquiry-based instruction was observed resulting in even higher rates of reported mastery goals. These students are more likely to report learning for the sake of learning, learning out of inherent interest, seeking challenge, being driven to develop learning skills or gain new knowledge, or seeking personal growth in ways that will apply to life outside of school. Consistent with Ciani and Sheldon (2010) and Sideridis and Mouratidis (2008), very few mastery-avoidance goals were reported in this open-ended interview format, which provides more evidence that in non-forced-choice evaluations of students' achievement goals, mastery-avoidance goals might be rare.

The influence of implicit theory and instructional style on adoption of achievement goals was assessed through a semistructured student interview, asking students a combination of open-ended and directive questions about what motivates them in their classes. Three questions assessing students' motivation were asked to verify convergence of responses. Implicit theory had significant, moderate-to-strong effects on the likelihood of adopting mastery goals on all three questions and instruction showed strong predictive effects on mastery-goal adoption on all three questions. A significant interaction between implicit theory and instruction was assessed on only one out of the three questions, for which inquiry settings greatly increased the relation between incremental theories and mastery goals, while teacher-structured settings reduced the expected relation between implicit theories and mastery goals. In other words, inquiry-based instructional settings seem to augment the effect of incremental theories on mastery-goal

adoption, and to encourage some with entity theories to take a different approach to goal setting and adopt mastery-based learning goals in their classes.

Inquiry environments can also offer a buffer to the potentially negative effects of entity theories, making it less likely for entity theorists to express performance goals. Students with incremental theories and students in inquiry are less likely to report motivations relating to an emphasis on grades, the desire to outperform their peers or seek external recognition, being driven for instrumental purposes of university admission or prestigious scholarships, or being driven by attempts to avoid perceived failure.

Two out of the three questions in the semistructured student interview revealed a significant effect of instruction on the adoption of performance goals with strong predictive power, and these questions also showed moderate effects of implicit theory on reported performance goals; no interactive effects were observed. Students holding entity theories were more likely to report performance goals. Instruction had an added effect in which performance goals were more likely to be reported by students in teacher-structured classes, with lower levels of performance goals indicated in inquiry classes. Inquiry-based approaches may limit students' tendencies to being driven by comparative, performance-based goals in their classes. Collaboration, student engagement, peer and teacher communication, sharing of results, and emphasis on the learning process are core parts of inquiry experiences that might limit these performance-based tendencies and promote mastery approaches to learning goals.

Research Question Three: Achievement Behavior and Emotions

The third hypothesis of the study was that instructional style would influence not only the adoption of achievement goals, but might also impact related, goal-directed behavior and achievement emotions. Students in teacher-structured classes were significantly more likely to

report using shallow learning strategies when studying. Although significant, this was a small effect between the groups. Instruction did not have a significant impact on the use of deep learning strategies, test anxiety, or failure appraisals. For reported deep learning strategy use, a small yet significant effect was found for implicit theory. Implicit theory was significantly correlated with test anxiety and fear of failure, but was not significant when comparing groups. Instructional setting significantly influenced the frequency of feedback-seeking behavior, but this relation was in the opposite direction from that hypothesized. Students in the teacher-structured group approached their teachers and peers more frequently for feedback than students in the inquiry group. During the classroom observations, we observed a difference in the types of questions and student comments made between instructional groups, in which those in inquiry were observed to ask more open-ended, curiosity-driven questions (e.g., not directly relating to what they would be assessed on), whereas students' questions and comments in the teacher-structured classes were more likely to be centered on clarifying understanding or answering a question asked by the teacher. Although students in teacher-structured groups engaged in more feedback-seeking behavior, there may also be a difference in kind of feedback seeking between instructional groups worth investigating in future studies. Students in inquiry are more likely to engage in asking questions as expressions of interest, curiosity, or for the purposes of exploring a topic (Hua, 2016), rather than for clarification or other help. It is also possible that the positive student-teacher relationship in the teacher-structured classes contributed to the higher levels of feedback seeking seen, in that students in the teacher-structured classes might have felt more comfortable to approach their teachers.

Based on the results from this study, a single, inquiry-based class or course experience is insufficient to make changes in achievement behaviors and emotions. Students in inquiry are

nonetheless less likely to use shallow learning strategies (e.g., rote memory, rehearsal), but this difference is very small. Students in a single inquiry class do not report higher use of deep learning strategies, more feedback seeking, or lower levels of anxiety or fear of failure compared to students in other, non-inquiry classes.

Additional Findings

When recruiting teachers for the two samples, great care was taken to ensure excellent teaching skills for both groups, although by different criteria. In the teacher-structured comparison group they were sought to be highly regarded teachers who use good pedagogical strategies, but strategies that are not specifically inquiry-based. A positive referral was provided for the teachers in the teacher-structured group, as well, they self-identified as using good teaching strategies, but not specifically inquiry strategies. A corroborating finding for teacher quality was that, on an open-ended question asking students what they found motivating about the class (interview Question 1), a large number of students reported positive teacher or classroom qualities, and students in the instructional groups equally reported positive teacher or classroom qualities as their motivation. Students in the inquiry classes and students in the teacher-structured classes both endorsed their teachers and the classes in considerable numbers (approximately 50% of the students in each group). Both groups of students liked and respected their teachers and felt supported and encouraged by them.

An interesting and unanticipated outcome of this study was that the inquiry teacher, while taking a highly inquiry-based approach, also employed certain teaching methods that are contrary to those suggested to promote mastery goals and incremental theories. In the inquiry classes, the teacher used a sticker-reward system (external reinforcers) and frequently and explicitly gave entity-theory praise (e.g., “You’re smart!” “You’re geniuses!”). These should

theoretically undermine students' likelihood to hold incremental theories and adopt mastery goals (Ames, 1992; Mueller & Dweck, 1998). As discussed in Ames (1992) evaluation and recognition procedures, inciting social comparison may hinder students' pursuit of mastery goals in favor of performance goals. Publicly handing out stickers in a contest-like manner should be negatively associated with mastery goals. However, the context in which the stickers were awarded--for participation versus a "right" answer--may have mitigated this association. Brophy (1983) suggested that classroom features emphasizing learning products over the process of learning might enhance performance-orientation. In the inquiry classes, by recognizing students based on participation, an emphasis was placed on students' learning process as opposed to their contributions being right or wrong. The inquiry teacher, however, also praised students for their intelligence, which has been shown to influence the adoption of entity theories of ability (Mueller & Dweck, 1998). This teacher had his doctorate and was well-respected at the school. It is possible that this intelligence-praise discourse, in conjunction with other aspects of his student-autonomy-promoting teaching style, served to promote the sense of an equal playing field between the teacher and students. Rather than the teacher presenting himself as an expert authority figure, by constantly telling the students how bright they were, he might have given them a sense that they were experts too. He did not wait for the most articulate or highest achieving student to make a comment calling the student a genius, but did this after many comments of varying quality coming from numerous students, again, reinforcing participation and effort as opposed to a "correct" end product. Further, it is possible that other qualities of inquiry instruction may have a more powerful effect, resulting in the significant differences in achievement goals seen in this study for which inquiry significantly promoted the adoption of mastery goals and limited the adoption of performance goals. Inquiry-based settings often

promote process over product, the exploration of questions, development of learning skills, and student autonomy (Aulls & Shore, 2008). In an inquiry-based approach to learning there are often many ways to solve a problem and often more than one right answer. This may help pull learners away from typical habits of trying to study to the test to get the best grade possible, or look to their peers in attempts to perform as well as or outperform one another.

As predicted, the power of a single high school course, in this study, was not sufficient to change students' implicit theories. Yet, inquiry classrooms positively related to the likelihood of students' adopting mastery goals and negatively related to the likelihood of performance goals in their classes. Inquiry-based learning experiences enhanced the power of incremental theories to encourage mastery goals, and curbed the relation between entity theories and performance goals. However, although instruction significantly predicted achievement goals in this study, classroom setting had a limited impact on goal-related behavior and emotions for students.

Limitations and Directions for Future Research

In the present study, purposive sampling was used to ensure a strong comparison between highly inquiry and inquiry-limited samples. As a result, the inquiry and the comparison samples were taken from different geographical regions. Efforts were made to closely match the instructors on many other aspects (e.g., years of experience, advanced education degrees). The purpose of the study was to examine student motivation reported across different instructional styles, thus curriculum differences between the groups should not have influenced the interpretation of the findings, however future research could control for this (e.g., sampling from different teachers within a single school). Additionally, the teacher of the inquiry group held an EdD in contrast to master's- and bachelor's-level education degrees for the comparison-group teachers. However, assessing various outcomes (e.g., student achievement versus motivation),

past studies have revealed no or minimal differences in student outcomes from teachers holding advanced degrees (Goldhaber & Brewer, 1997; Harris & Sass, 2011). Differences were found between instructional groups in parental education levels, which was used as an index of socio-economic status; however, evidence suggests that socio-economic status does not relate to achievement-goal orientation (Anderman, Anderman, & Griesinger, 1999; Roeser, Midgley, & Urdan, 1996). Other differences emerged between the groups of students, including achievement level and sex ratios. Efforts were made to reduce the likelihood of demographic differences between groups of students (e.g., characteristics of the towns, matching students from advanced and "general" English classes, similar rates of participation across groups), however, these group differences might have influenced the findings. High achieving students may be less likely to report performance-avoidance goals. However, although achievement differences were found, there were no significant differences in IQ between groups. Future research could assess low achieving students or a broader range of achievement levels in students to investigate the effect of instruction on achievement goals. The difference in proportions of male and female students between the samples was another unanticipated difference between groups that could be controlled for in future research. Some researchers have suggested that such sex differences could influence achievement-goal orientations in which females might be more likely to adopt mastery goals (Ablard & Lipschultz, 1998; Church, Elliot, & Gable, 2001), whereas others have found no differences in goal orientation between males and females (Senko & Harackiewicz, 2005; Smiley & Dweck, 1994).

In this study, students in inquiry were more likely to hold mastery goals. It is possible that, through the same mechanism underlying the positive relation between inquiry and mastery goals, more prolonged exposure to inquiry (e.g., having a single teacher for a full year while in

elementary school) could potentially influence implicit theories, too. This would be an interesting topic for future study.

Implications

Although inquiry-based learning is already part of the foundation for widespread curricular reform across North America and elsewhere, this study added evidence of increased mastery-oriented motivation for students in inquiry settings, thereby further supporting the numerous, already documented, positive effects of inquiry-based learning for students.

For teachers, framing learning tasks and assessment practices as hands-on and "minds-on," process-based, effort-based, collaborative, with emphasis on more than one right approach or answer to a problem, could help promote mastery goals, and possibly influence the nature of implicit theories held by their students. Classroom teachers who build student autonomy with scaffolding as needed, and model and encourage high levels of question asking in addition to problem solving, might have students who are more likely to report inherent enjoyment in their learning and who will readily apply their learning outside of the classroom. These students might be more likely to believe that with effort and strategies, not only can they build their knowledge and skills, but their abilities can grow and develop.

Another implication is that intelligence praise might not have a negative impact on students across all situations, but this might be dependent on context. Liberal use of praise, including high-intelligence praise, might not promote entity theories or performance goals when used as a reinforcer for effort (e.g., immediately following an attempt at participation, regardless of quality). This type of praise in classrooms at-risk for having hierarchical teacher-student relationships might promote students' sense of autonomy and "expert-status." This is not to suggest teachers should rush to adopt these reinforcement practices, but the practice need not be

universally eschewed under suitable circumstances and this might be an interesting nuance if confirmed with additional empirical research.

Beyond methods of praise, de-emphasis of evaluation, and explicit mindset-training, the social-constructivist features of inquiry instruction might promote incremental theories and mastery-orientation through more indirect means. It is possible that entity-theorist and performance-oriented students might be more inclined toward the belief in a single correct approach or right answer. In contrast, the belief that there can be many ways to approach a task and that divergent outcomes can be valuable is a belief that is fostered in inquiry settings. The long way around a problem might not only be as good as the conventional approach, but might have other added value and inquiry learners see this. This "inquiry mindset" might be highly connected with growth-mindset, mastery-oriented ways of thinking.

Chapter 5

General Conclusions

Within the context for this research, grades and other external indices of achievement are ubiquitous in the educational system. However, many caring educators are driven, not only to get students to achieve, but to support students in a journey of believing in themselves, believing that their efforts make a difference rather than solely the hand they have been dealt, and believing in themselves despite obstacles that will most certainly present at one point or another. Many students may be at-risk for underachievement due to socio-economic factors, belief in negative stereotypes about themselves, gifted labels for students already at the top of their class, or resulting from difficult transitions. Incremental theories of ability, also referred to as growth mindsets, may help combat these risks through personal beliefs that, with effort and strategy use, one's abilities can develop and can grow. This type of belief in one's abilities may result in a resilient type of motivation and individuals with incremental theories will be more likely to approach learning tasks in a mastery-oriented manner and aim to build and develop their competencies by facing and approaching challenging learning scenarios.

The present research aimed to bridge psychological literatures examining implicit theories and achievement goals and educational literature on inquiry-based instruction. Through the many features of guided-inquiry that are consistent with Ames' (1992) mastery-oriented classroom structures of specified task, authority, and evaluation and recognition practices, it was proposed that guided inquiry might be a context associated with mastery goals and incremental theories of ability.

Three research questions investigated the potential for the proposed relationship between inquiry, achievement goals, and implicit theories. The first research question posited that being

in an inquiry-based class might be related to differences in implicit theories between groups of students. However, the present study examined students enrolled in a single, inquiry-based high-school class over a single term, and thus no differences in implicit theory were found between students in the inquiry classes and students not in inquiry classes. Student engagement in inquiry settings over a more prolonged period of time, however, might promote the adoption of incremental theories of ability in students and future research could address this.

The second research question was the primary topic of interest for the present research. We asked if instructional setting along with implicit theory would predict achievement goals in students. Being in an inquiry-instruction setting does predict higher levels of mastery goals and lower levels of performance goals over and above that of holding implicit theories alone. Although a single inquiry class might not be enough to change underlying beliefs about one's abilities, but it might be sufficient to influence how likely one is to adopt specific achievement goals, typically associated with implicit theories.

The third and final research question queried whether or not instructional setting and implicit theory were furthermore related to achievement behaviors and emotions, including strategy use (deep or shallow learning strategies), feedback-seeking behavior, test anxiety, and fear of failure. The present study revealed limited evidence for inquiry settings and incremental theories relating to higher levels of deep learning strategies or lower levels of negative achievement emotions. Again, this might have been due to the limited effect of a single class as compared to more prolonged engagement in inquiry-learning settings. Feedback seeking was related to instruction, however inquiry was associated with lower levels of feedback seeking which was contrary to the hypothesis. The nature of student-teacher questions, comments, and feedback may be different in high versus low inquiry settings. Students in inquiry might be more

inclined to ask questions out of curiosity and interest at particular times in the learning process, as opposed to more frequent requests for clarification and assistance.

Incremental theories and mastery goals are associated with numerous long-term cognitive-affective and achievement benefits for students. Overall, students with incremental theories of ability, also known as growth mindsets, report more mastery goals, however, students in inquiry-based instructional settings also express higher levels of mastery goals, above that predicted by implicit theories alone. More research is needed to determine if this relationship could result in increases in adoption of incremental theories by students in guided-inquiry settings.

Implications for School Psychology

Underachievement and disengagement are serious issues faced by educators, support personnel, specialists, consultants, and administrators. Often reactionary methods are employed for disengaged or underachieving youth, however, having students participate in inquiry-based learning might constitute a proactive strategy to promote student engagement and resilience in the face of obstacles or challenges. While working with students, considering the implicit theory they hold or whether they are prone to adopting one achievement goal over the other might influence the approach taken. For students presenting with learning or behavioral difficulties, a brief mindset or achievement goal assessment could be helpful to determine additional underlying factors beyond the traditional battery of cognitive, behavioral, socio-emotional measures used. Psychologists and counselors working in schools may provide psychoeducation for at-risk students or hold student workshops for interested students on how to think in "growth-mindset" ways and how to take a mastery approach to learning and academic tasks.

Original Contribution to Knowledge

No previous review of the literature has examined guided, inquiry-based educational contexts as a framework in which to examine classroom conditions that can foster incremental theories of ability and mastery-goal orientations. Although much theoretical and empirical research has focused on classroom features to promote mastery goals, few studies have investigated inquiry-based classroom qualities in relation to adopting mastery goals. Additionally, few empirical studies have looked at classroom features other than praise or growth-mindset training to assess potential differences in implicit theories of abilities. This study assessed the possibility that social-constructivist qualities of inquiry could impact students' beliefs about their ability. Although this research did not provide empirical support for the relation between inquiry and implicit theories, a strong theoretical argument was presented for future research to investigate the effects of more prolonged engagement in inquiry learning to foster incremental theories of ability.

This research directly contributes to achievement-goal theory, implicit-theories research, and inquiry-based teaching and learning. Although some previous studies have examined motivational outcomes for students in inquiry, the constructs of achievement goals and implicit theories had not been examined specifically in these contexts. A strong body of literature exists on the potential benefits of incremental theories and mastery goals. The present research provides strong empirical and theoretical support for guided-inquiry as a context in which to promote mastery goals and incremental theories of ability.

The methodology used in this study was also somewhat unique, with empirically validated instruments as well as open-ended questions about students' motivation in their class. The open-ended response format provided additional evidence to an emerging theory (e.g., Ciani

& Sheldon, 2010; Sideridis & Mouratidis, 2008) that mastery-avoidance goals might be a low-frequency achievement goal when assessed in an open-response format. Additionally, the open-ended questions about student motivation in the present research provided additional information about teacher quality, which is infrequently obtained in motivational research as unprompted, direct student endorsements or complaints, and allows for strong comparison of "comparison-group" teachers as well-liked educators, rather than the potential of poorer-quality comparison groups.

An unanticipated contribution of this research is the finding that entity-theory praise might not have a universally negative impact on students, but might be context-dependent. Although further research is needed, high-ability praise, when administered as reinforcing effort and used in a manner to promote student autonomy and sense of expertise, might not detract from mastery-goal orientations or incremental theories of ability.

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Appendix A: Recruitment Email for Inquiry

Hello,

I am a researcher based out of McGill University currently conducting a study on learning and motivation. As part of the study, we are seeking Grade-12 English teachers using inquiry-based instruction in their classrooms. Do you, or someone you know, use high levels of guided to open, inquiry-based teaching strategies? Inquiry is a social-constructivist form of education and although there are numerous definitions of this instructional style, some of the specific classroom features that the researchers are interested in in this study are:

- Are there multiple examples of project-based work?
- Are the projects centered around real-world problems and student interest?
- Do students have the opportunity to choose questions to investigate?
- Do students use many different types of learning resources beyond the teacher and a textbook, for example, they may go to a museum, watch a documentary, read a newspaper or magazine article, listen to an invited speaker, search company websites, etc.?
- Is student-student dialogue an important part of the learning process?
- Is assessment centered around the learning process as much as specific content knowledge?
- Is creativity or critical thinking encouraged, instructed, or assessed?
- Is your role as the teacher less directive and structured, giving your students more room to explore?

If some or many of these classroom features describe your teaching methods please let us know if you would be interested in participating. Participation would require a brief interview about teaching methods and a classroom observation (approximately 1 hour in total). After which, participating teachers will be asked to distribute letters to their students about participating in the study. Students and parents would be given a brief description of the study and asked for student assent and parent consent. Participating students would be interviewed and asked to complete some brief questionnaires about learning and motivation, and a brief test of cognitive abilities would be given (approximately 1 hour in total) in a private location. Students will absolutely not be asked to evaluate their teachers in any way--this study is looking at classroom contexts and student motivation.

Thank you very much your consideration of our request. Please contact us for more information.

Petra D. T. Gyles & Bruce M. Shore

Primary Contact:
Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

Appendix B: Recruitment Email for Teacher-Structured

Hello,

I am a researcher based out of McGill University currently conducting a study on learning and motivation. As part of the study, I am seeking Grade-12 English teachers who are interested in participating and your name had been mentioned as someone who may be interested. Specifically, I am looking for teachers employing one of two types of instruction:

1) We are seeking highly regarded high-school teachers, who teach in a structured style. Does this instructional style describe you or someone you know? Some of the specific classroom features that we are interested in are:

- As a teacher, would you consider your main roles in the class to convey the material to the students in a clear and organized manner, and to evaluate student learning?
- Is information presented, students get the opportunity to practice it, then the material is tested?
- Does the practice often involve worksheets or a number of opportunities for the students to apply the material?
- Do you feel you create well-designed tests to capture the knowledge students learn in your lessons?
- Do the students have a textbook upon which they rely heavily?
- Do you consider yourself fairly structured; do you find it quite important to follow the structure you had planned for the course, unit, lesson, etc.?

2) We are also seeking teachers using inquiry-based instruction in their classrooms. Do you, or someone you know, use high levels of guided to open, inquiry-based teaching strategies? Inquiry is a social-constructivist form of education and although there are numerous definitions of this instructional style, some of the specific classroom features that the researchers are interested in in this study are:

- Are there multiple examples of project-based work?
- Are the projects centered around real-world problems and student interest?
- Do students have the opportunity to choose questions to investigate?
- Do students use many different types of learning resources beyond the teacher and a textbook, for example, they may go to a museum, watch a documentary, read a newspaper or magazine article, listen to an invited speaker, search company websites, etc.?
- Is student-student dialogue an important part of the learning process?
- Is assessment centered around the learning process as much as specific content knowledge?
- Is creativity or critical thinking encouraged, instructed, or assessed?
- Is your role as the teacher less directive and structured, giving your students more room to explore?

If in one of these categories, some or many of these classroom features describe your teaching approach please let us know if you would be interested in participating. Participation would require a brief interview about teaching methods and a classroom observation (approximately 1 hour total). After which, participating teachers will be asked to distribute letters to their students inviting them to participate in the study. Students and parents would be given a brief description of the study and asked for student assent and parent consent. Participating students would be interviewed and asked to complete some brief questionnaires about learning and motivation, and a brief test of cognitive abilities would be given (approximately 1 hour in total) in a private location. Students will absolutely not be asked to evaluate their teachers in any way--this study is looking at classroom contexts and student motivation.

Thank you very much your consideration of our request. Please contact us for more information.

Petra D. T. Gyles & Bruce M. Shore

Primary Contact:
Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

Appendix C: Content Analysis Coding Definitions

MASTERY

Mastery goals are aimed at *improving* one's competence through effortful learning. A mastery goal orientation is defined in terms of a focus on developing one's abilities, mastering a new skill, trying to accomplish something challenging, and trying to understand learning materials. Success is evaluated in terms of self-improvement, and students derive satisfaction from the inherent qualities of the task, such as its interest and challenge. Those with mastery-approach goals strive to learn or improve. On the other hand, those with mastery-avoidance goals strive to avoid learning failures (e.g., not knowing as much as one can, skill decline, perfectionism).

Learning for the Sake of Learning:
Learning for the sake of learning; wanting to learn more; wanting to learn even when challenging; enjoying learning; enjoying effortful learning; wanting a deeper understanding of the course material

Skill Development:
Wanting to learn new skills (e.g., writing techniques, improve essay writing, how to analyze literature); build one's knowledge base

Interest in Field or Topic:
Finding a topic interesting; enjoying reading/writing; liking an author like Shakespeare etc.; liking a twist on the topics

Application to Life:
Learning life skills; thinking about bigger concepts that apply outside of school; development of personal qualities; gaining perspectives on life

***Mastery Avoidance:**
Worrying about not learning as much as one possibly can; perfectionistic tendencies (need to learn it all/don't want to not learn it all)

PERFORMANCE

Performance goals focus on a desire to *demonstrate* one's competence. For example, wanting to achieve academically to demonstrate ability, outperform other students, attain certain grades/marks, or to obtain tangible rewards associated with academic performance. A performance goal orientation represents a focus on demonstrating high ability relative to others, striving to be better than others, and using social comparison standards to make judgments of ability and performance. A sense of accomplishment is derived from doing better than others and surpassing normative performance standards. Performance-approach goals focus on achieving by outperforming others, whereas performance-avoidance goals correspond to the aim of avoiding the demonstration of incompetence relative to others.

Grade Emphasis:
Wanting a good grade/a better grade; wanting an award or recognition associated with a certain GPA; wanting a good or decent grade with little effort

University Admissions:
Wanting to do well to get into university/a good university/a specific program in university; needing the class for university; wanting the AP credit or other university credits

Performing/Outperforming:
Wanting to do well in comparison to others; wanting to do as well or better than classmates; wanting to do well because of family expectations; wanting to "succeed"; wanting to do well with little effort; challenging/pushing oneself for a better grade

Stickers/Rewards:
Wanting external reinforcement (e.g., stickers, praise); rewards (e.g., if family gives reward for doing well)

***Performance Avoidance:**
Not wanting to fail or do poorly

TEACHER QUALITIES / CLASSROOM CULTURE

Having teacher qualities or a classroom culture that are supportive, encouraging, engaging, or motivating.

Positive Teacher Qualities:
Liking the teacher; good relationship; feeling supported by (him); (he) makes it fun; liking the way (he) directs conversations; liking the way (he) puts responsibility in the students' hands; he is supportive, encouraging, engaging, motivating, etc.

Classroom Culture:
Liking the classroom; being allowed/encouraged to have open conversations; liking one's classmates; fun atmosphere; getting to take responsibility; the classroom culture/context is supportive, motivating, encouraging, engaging, etc.

Appendix D: Teacher Consent Form

McGill

Letter of Consent for Teacher Participation

Dear Teacher,

We are part of the High Ability and Inquiry Research (HAIR) team from McGill University currently conducting a study on instructional style in classrooms, ability, and performance. We are examining students' educational environments and how this relates to their understanding of their effort and abilities.

As part of the study, I am looking for Grade-12 students to share their experiences with styles of education and their understanding of their effort and abilities in school. Your participation would involve a brief interview about your instructional style (approximately **15 minutes**) and a brief classroom observation (approximately **45 minutes**). With parental consent and student assent, students would be asked to complete six short questionnaires, a brief test of cognitive ability, and a short interview asking students to share examples of classroom experiences, academic goals, and self-perceptions of ability. This would take place privately at their school and would take approximately **1 hour**. Interviews will be audiorecorded so the examples of classroom experiences can be transcribed and analyzed. A parent or guardian would also be asked to complete a short demographic form, which would take approximately **five minutes**. In addition, performance on state-wide/provincial achievement tests will be obtained through the permission of the principal. All of the information obtained will be kept confidential and will not be shared with school personnel.

We ask for your name and contact information to be able to contact you if we need help with any of the replies, but we shall then remove all identifying information. I or a research assistant will remove or hide yours and your students' names after we extract and tally the data. We shall keep all data in a locked office at McGill University, which will be accessible only to members of the HAIR research team. We shall only use grouped data for the students with no personal names, although we may wish to quote from some of the replies without the use of names or any identifying information for you or your students. The audio recordings however will only be used for research purposes and will not be shared. We hope to use the data in research publications, conference presentations, and theses.

We hope you will agree to participate so that we can learn more about student responses to different learning approaches. If you agree to participate, sign the consent form on the following page and return it to the researcher. If you would rather not, please return the material blank, but feel free to look it over.

If you have any questions about the study, please contact us using the contact information below.

Thank you very much for your consideration of our request. Please continue to the next page.
Sincerely yours,

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

If you have questions or concerns regarding your/your students' rights or welfare as a participant in this study, please contact the Manager, Research Ethics at 514-398-6831 or lynda.mcneil@mcgill.ca

To indicate your agreement to participate, please complete and sign this page. We need your actual signature to include the data you grant us in the study, so please, if you agree, sign and date the indicated lines below and return this form.

I agree to participate in the project on **Instructional Style, Attributions of Ability, and Performance** with the High Ability and Inquiry Research (HAIR) team from McGill University, and note in particular that my and my students' participation is entirely voluntary and I or my students may choose to withdraw participation at any time for any reason without penalty. This consent is limited to the provision of an interview about instructional style, a classroom observation, and providing students with a brief outline of the study to determine student interest in participating. Students who participate in the study will be given the chance to win one of two $30 gift certificates, based on a random draw. In addition, the findings from this study intend to be used to impact educational research and future classroom practice.

_____ _____ _____

Printed Name of Teacher Signature Date

Grade levels and subjects taught: _____

*my best e-mail address: _____

*home telephone number with area code: _____

*other telephone number (optional): _____

*in case we need to contact you to understand one of your replies.

Please indicate if you consent to allow your responses and data to be used in other studies conducted by the High Ability and Inquiry Research team (circle one): **yes / no**

Please check the boxes below if you are interested.

☐ I am interested in knowing the outcomes of this research. Please e-mail me abstracts of the main published or reported studies that arise from this research. (Note: These are expected to be available between 2015 and 2018, and some preliminary conference reports may appear earlier.)

McGill

Teacher Consent for Future Research

Please let us know if you are interested in being contacted for future research projects through the High Ability and Inquiry Research team at McGill University.

Thank you again for your consideration of our request.

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

Please check one of the boxes below.

☐ I am interested in being contacted for future research.

☐ I am NOT interested in being contacted for future research.

_____	_____	_____
Printed Name	Signature	Date

Appendix E: Parent Consent Form for Participating Students

McGill

Letter of Consent for Child/Adolescent Participation

Dear Parent,

We are part of the High Ability and Inquiry Research (HAIR) team from McGill University in Montréal currently conducting a study on instructional styles in classrooms, ability, and performance. We are examining students' educational environments and how this relates to their understanding of their effort and abilities.

As part of the study, I am looking for Grade-12 students to share their experiences with styles of education and their understanding of their effort and abilities in school. Participating would involve your son or daughter completing six short questionnaires, a brief test of cognitive ability, and a short interview asking students to share examples of classroom experiences, academic goals, and self-perceptions of ability. This interview would take place privately at their school. This meeting will be audiorecorded so the examples of classroom experiences can be transcribed and analyzed. Students would be taken out of class for about **1 hour**. A parent or guardian would also be asked to complete a short demographic form, which would take approximately **five minutes (see attached Demographics form)**. In addition, performance on achievement tests will be obtained through the permission of the principal. All of the information obtained about your child will be kept confidential and will not be shared with teachers or school personnel. You and your child's decision to participate in this study will in no way affect your child's academic grades or school performance.

We ask for your child's name, grade, and date of birth so that we can categorize the data, and to be able to contact you if we need help with any of the replies, but we shall then remove all identifying information. I or a research assistant will remove or hide your child's name after we extract and tally the data. We shall keep all data in a locked office at McGill University, which will be accessible only to members of the HAIR research team. We shall only use grouped data with no personal names, although we may wish to quote from some of your replies without the use of names or any identifying information. The audio recordings however will only be used for research purposes and will not be shared. We hope to use the data in research publications, conference presentations, and theses.

We hope you will agree to have your child participate so that we can learn more about student responses to different approaches to learning. If you agree to your child's participation, please discuss this with your child and, if you agree, please sign the consent form on the following page and return it to the researcher. If you would rather not, please simply return the material blank, but feel free to look it over.

If you have any questions about the study, please contact us using the contact information below.

Thank you very much for your consideration of our request. Please continue to the next page.

Sincerely yours,

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

If you have questions or concerns regarding your/your students' rights or welfare as a participant in this study, please contact the Manager, Research Ethics at 514-398-6831 or lynda.mcneil@mcgill.ca

To indicate your agreement for your child to participate, please complete and sign this page. We need your actual signature to include the data you grant us in the study, so please, if you agree, sign and date the indicated lines below and return this form.

I agree to have my child participate in the project on **Instructional Style, Attributions of Ability, and Performance** with the High Ability and Inquiry Research (HAIR) team from McGill University, and note in particular that my child's participation is entirely voluntary and I or my child may choose to withdraw participation at any time for any reason without penalty. This consent is limited to the provision of my completed demographics form about my child named below, my child's six completed questionnaires (*Entity Theorist Questionnaire, Achievement Goal Questionnaire-Revised, Performance Failure Appraisal Inventory-Short Form, Feedback Seeking Frequency, Motivational Strategies for Learning Questionnaire*, and *Ten-Item Personality Inventory*), a brief test of cognitive abilities, and an audio recording of my child's description of classroom experiences, academic goals, and self-perceptions of ability. Students who participate in the study will be given the chance to win one of two $30 gift certificates, based on a random draw. In addition, the findings from this study hope to be used to impact educational research and future classroom practice.

_____	_____	_____
Printed Name of Parent	Signature	Date

_____	_____	_____
Printed Name of Child	Date of Birth of Child	Grade

Sex of child (please check one): ☐ Female ☐ Male

*my best e-mail address: _____

*home telephone number with area code: _____

*other telephone number (optional): _____

*in case we need to contact you to understand one of your replies.

Please indicate if you consent to allow yours and your child's responses and data to be used in other studies conducted by the High Ability and Inquiry Research team (circle one): **yes / no**

Please check the box below if you are interested.

☐ I am interested in knowing the outcomes of this research. Please e-mail me abstracts of the main published or reported studies that arise from this research. (Note: These are expected to be available between 2015 and 2018, and some preliminary conference reports may appear earlier.)

Parent Consent for Future Research

Please let us know if you are interested in being contacted for future research projects through the High Ability and Inquiry Research team at McGill University.

Thank you again for your consideration of our request.

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

Please check one of the boxes below.

☐ I am interested in being contacted for future research.

☐ I am NOT interested in being contacted for future research.

_____ _____ _____
Printed Name of Parent Signature Date

_____
Printed Name of Student

Appendix F: Student Consent Form for Students of the Age of Consent

McGill

Letter of Consent for Adolescent Participation

Dear Student of the Age of Consent,

We are part of the High Ability and Inquiry Research (HAIR) team from McGill University currently conducting a study on instructional styles in classrooms, ability, and performance. We are examining students' educational environments and how this relates to their understanding of their effort and abilities.

As part of the study, I am looking for Grade-12 students to share their experiences with styles of education and their understanding of their effort and abilities in school. Participating would involve you completing six short questionnaires, a brief test of cognitive ability, and a short interview asking students to share examples of classroom experiences, academic goals, and self-perceptions of ability. This interview would take place privately at your school. This meeting will be audiorecorded so the examples of classroom experiences can be transcribed and analyzed. This meeting would take about **1 hour**. A parent or guardian would also be asked to complete a short demographic form, which would take approximately **five minutes**. In addition, performance on achievement tests will be obtained through the permission of the principal. All of the information obtained about you will be kept confidential and will not be shared with teachers or school personnel. Your decision to participate in this study will in no way affect your academic grades or school performance.

We ask for your name, grade, and date of birth so that we can categorize the data, and to be able to contact you if we need help with any of the replies, but we shall then remove all identifying information. I or a research assistant will remove or hide your name after we extract and tally the data. We shall keep all data in a locked office. We shall only use grouped data with no personal names, although we may wish to quote from some of your replies without the use of names or any identifying information. The audio recordings however will only be used for research purposes and will not be shared. We hope to use the data in research publications, conference presentations, and theses.

We hope you will agree to participate so that we can learn more about student responses to different approaches to learning. If you agree to participate, please sign the consent form on the following page and return it to the researcher. If you would rather not, please simply return the material blank, but feel free to look it over.

If you have any questions about the study, please contact us using the contact information below.

Thank you very much for your consideration of our request. Please continue to the next page.

Sincerely yours,

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

If you have questions or concerns regarding your/your students' rights or welfare as a participant in this study, please contact the Manager, Research Ethics at 514-398-6831 or lynda.mcneil@mcgill.ca

To indicate your agreement to participate, please complete and sign this page. We need your actual signature to include the data you grant us in the study, so please, if you agree, sign and date the indicated lines below and return this form.

I agree to participate in the project on **Instructional Style, Attributions of Ability, and Performance** with the High Ability and Inquiry Research (HAIR) team from McGill University, and note in particular that my participation is entirely voluntary and I may choose to withdraw participation at any time for any reason without penalty. This consent is limited to the provision of the completed demographics form, six completed questionnaires (*Entity Theorist Questionnaire, Achievement Goal Questionnaire-Revised, Performance Failure Appraisal Inventory-Short Form, Feedback Seeking Frequency, Motivational Strategies for Learning Questionnaire*, and *Ten-Item Personality Inventory*), a brief test of cognitive abilities, and an audio recording of my description of classroom experiences, academic goals, and self-perceptions of ability. Students who participate in the study will be given the chance to win one of two $30 gift certificates, based on a random draw. In addition, the findings from this study hope to be used to impact educational research and future classroom practice.

_____ _____ _____

Printed Name Signature Date

_____ _____

Date of Birth Grade

Sex (please check one): ☐ Female ☐ Male

*my best e-mail address: _____

*home telephone number with area code: _____

*other telephone number (optional): _____

*in case we need to contact you to understand one of your replies.

Please indicate if you consent to allow your responses and data to be used in other studies conducted by the High Ability and Inquiry Research team (circle one): **yes / no**

Please check the box below if you are interested.

☐ I am interested in knowing the outcomes of this research. Please e-mail me abstracts of the main published or reported studies that arise from this research. (Note: These are expected to be available between 2015 and 2018, and some preliminary conference reports may appear earlier.)

McGill

Student Consent for Future Research

Please let us know if you are interested in being contacted for future research projects through the High Ability and Inquiry Research team at McGill University.

Thank you again for your consideration of our request.

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

Please check one of the boxes below.

☐ I am interested in being contacted for future research.

☐ I am NOT interested in being contacted for future research.

Printed Name	Signature	Date

Appendix G: Student Assent Form

McGill

Letter of Assent for Student Participation

Dear Student,

We are part of the High Ability and Inquiry Research (HAIR) team research team from McGill University currently conducting a study. We are looking at students' educational environments and how this relates to their understanding of their effort and abilities.

As part of the study, I am looking for Grade-12 students to share their experiences with styles of education and their understanding of their effort and abilities in school. Your participation would involve completing six short questionnaires, a brief test of cognitive ability, and a short interview asking students to share examples of classroom experiences, academic goals, and self-perceptions of ability. This would take place privately at the school and would take approximately **1 hour**. Interviews will be audiorecorded so the examples of classroom experiences can be transcribed and analyzed. In addition, performance on achievement tests will be obtained through the permission of the principal. All of the information obtained will be kept confidential and will not be shared with your teacher or other school personnel. All identifying information will be removed for research publications. Your decision to participate in this study will in no way affect your academic grades or school performance.

Participation is entirely voluntary and I may choose to withdraw participation at any time for any reason without penalty. Students who participate in the study will be given the chance to win one of two $30 gift certificates, based on a random draw. If you agree to participate, please sign this form.

If you have any questions about the study, please contact us using the contact information below.

Thank you very much for your consideration of our request.

Sincerely yours,

Petra D. T. Gyles, MA
PhD Candidate
Educational and Counselling Psychology
McGill University

Bruce M. Shore, Professor Emeritus
Supervisor
Educational and Counselling Psychology
McGill University

If you have questions or concerns regarding your/your students' rights or welfare as a participant in this study, please contact the Manager, Research Ethics at 514-398-6831 or lynda.mcneil@mcgill.ca

If you agree to participate in the study, please sign your name on the line below.

_____ _____ _____

Printed Name of Student Signature Date