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# Emotion and Metacognitive Monitoring: The Role of Emotion in the Development of Learning Beliefs

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**EMOTION AND METACOGNITIVE MONITORING: THE  
ROLE OF EMOTION IN THE DEVELOPMENT OF  
LEARNING BELIEFS**

by

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B.S. Mathematics, Kennesaw State University 2007

M.A. Educational Psychology, University of New Mexico 2012

DISSERTATION

Submitted in Partial Fulfillment of the  
Requirements for the Degree of

**Doctor of Philosophy**

**Educational Psychology**

The University of New Mexico  
Albuquerque, New Mexico

**May 2018**

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## **Dedication**

To my friends and family:

You make every journey an adventure worth having.

## Acknowledgements

Few people have seen me at my best and worst, and even fewer have been a constant source of support and inspiration. For being such a positive constant, I will forever be grateful to Terri Flowerday. Thank you for always being the kind of professor and human being to which I always want to aspire to become more like. I look forward to working with you on the other side of graduate school.

Thank you to my committee. This wasn't the most painless, and your patience with me as I crawled to the finish line is deeply appreciated, as is your participation in general. My proposal was a rogue event of academic exchange that will forever be the defining moment of graduate school for me. I feel lucky to have the support of such an amazing group of people. You have my gratitude for your help and your dedication to our field.

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If the cost of this work were metered out to each person who made some contribution or sacrifice, no one would get a heavy portion than my daughter. Amber, you had to sacrifice more than anyone, including myself. You have only encouraged me and believed in me, even when it was hardest to believe in myself. I cannot imagine

having to give up so much time with a parent as you were asked to do. You are my motivation and my inspiration. Thank you, I am forever grateful.

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## **Abstract**

Educators have daily experience with how students' emotional states influence their behaviors and levels of motivation. What is more poorly understood and even counterintuitive in effect is the subtler role of emotion in the role of metacognitive monitoring in the form of learning belief development. The research driving current understanding in this area is limited and fragmented across disciplines. The purpose of the current quantitative, cross-sectional study was to contribute to our understanding of the role that emotion plays in metacognitive monitoring. The study used self-report measures given before and after a video-based learning task. Metrics included measures of emotional state, intelligence, and self-reported metacognitive monitoring in the form of self-efficacy and post-assessment performance beliefs. The sample consisted of 104 college students from the University of New Mexico attending one of several sessions held during the spring semester. Participants completed the assessments while watching two videos, one a presentation on positive psychology and the other a philosophy lecture on logical fallacies. Demographic and environmental details were examined as intervening variables. Results of multiple regression analysis suggest a relationship between emotion and beliefs formed during metacognitive monitoring. Positive emotions



tended to be associated with overestimation of ability and performance while negative emotions showed a more complex influence with type of negative emotion determining the strength and direction of effect. Findings suggest these effects are independent of environmental or demographic factors and are congruent with the literature on the influence of emotions on cognition and metacognitive beliefs. Developing a better understanding of the influence of emotion on metacognitive processes may help educators take steps to improve students' self-assessments and researchers' understanding of hot cognition.

## Table of Contents

<b>LIST OF TABLES .....</b>	<b>XIII</b>
<b>LIST OF FIGURES .....</b>	<b>XIV</b>
<b>LIST OF ABBREVIATIONS .....</b>	<b>XV</b>
<b>CHAPTER I INTRODUCTION .....</b>	<b>1</b>
BACKGROUND.....	1
Emotion.....	1
Metacognition .....	2
PROBLEM STATEMENT .....	3
PURPOSE OF THE STUDY .....	5
DEFINITION OF KEY TERMS .....	6
ENVIRONMENT.....	7
<b>CHAPTER II LITERATURE REVIEW.....</b>	<b>9</b>
EMOTIONAL STATES .....	9
Mood.....	10
Emotion.....	10
Affect .....	11
Emotion in the Current Study .....	11
EMOTION INDUCTION.....	11
EMOTION AND LEARNING .....	12
METACOGNITIVE MONITORING.....	13

Self-Efficacy Beliefs .....	15
Feeling of Knowing .....	20
Reflective Confidence Judgment .....	21
METACOGNITION AND EMOTION.....	21
SOCIAL COGNITION.....	24
MEMORY AND LEARNING .....	25
THE CURRENT STUDY .....	28
<b>CHAPTER III METHODS.....</b>	<b>30</b>
OVERVIEW .....	30
OBJECTIVE .....	30
PARTICIPANTS.....	31
PROCEDURE .....	33
INSTRUMENTS .....	35
Demographics and Self-Efficacy Beliefs Questionnaire .....	37
Knowledge and Belief Assessments .....	37
Positive and Negative Affect Schedule – Expanded Form .....	37
Self-Assessment Manikin .....	38
Four-Dimension Mood State.....	39
Distress Tolerance Scale .....	39
Raven’s Advanced Progressive Matrices.....	40
POWER.....	40
DATA ANALYSIS .....	41
CONCLUDING REMARKS .....	43

<b>CHAPTER IV RESULTS .....</b>	<b>44</b>
OVERVIEW .....	44
STUDY CONDITIONS.....	45
Exclusions.....	45
Additional data preparation.....	45
Missing Data.....	46
Locations.....	46
Instruments.....	47
Assumptions.....	48
OUTCOMES .....	48
Correlations.....	48
Research Questions.....	51
SUMMARY.....	56
<b>CHAPTER V DISCUSSION.....</b>	<b>58</b>
SUMMARY OF STUDY .....	58
RQ1 .....	59
RQ2.....	60
RQ3.....	61
RQ4.....	62
RQ5.....	62
FINDINGS AND IMPLICATIONS .....	62
LIMITATIONS.....	63
FUTURE RESEARCH.....	67

CONCLUSION .....	68
<b>REFERENCES.....</b>	<b>69</b>
<b>APPENDIX A DEMOGRAPHICS AND SELF-EFFICACY BELIEFS.....</b>	<b>87</b>
<b>APPENDIX B KNOWLEDGE &amp; BELIEF ASSESSMENTS .....</b>	<b>88</b>
<b>APPENDIX C KNOWLEDGE &amp; BELIEF ASSESSMENT – LOGICAL FALLACIES.....</b>	<b>92</b>
<b>APPENDIX D PANAS-X .....</b>	<b>95</b>
<b>APPENDIX E SAM.....</b>	<b>97</b>
<b>APPENDIX F 4DMS.....</b>	<b>98</b>
<b>APPENDIX G DTS.....</b>	<b>101</b>

**List of Tables**

Table 1	Summary of study variables .....	36
Table 2	Belief and Performance Differences Between LF and PS .....	50

**List of Figures**

Figure 1. Learning Beliefs and Performance Score Correlations. ....49

Figure 2. Measures of Arousal.....50

### **List of Abbreviations**

MM	Metacognitive Monitoring
PS	Positive Psychology (video, instrument)
LF	Logical Fallacies (video, instrument)
SEB	Self-efficacy Beliefs
FOK	Feeling of Knowing
RCJ	Reflective Confidence Judgment
PANAS-X	Positive and Negative Affect Schedule – Expanded Form
SAM	Self-Assessment Manikin
4DMS	Four-Dimension Mood Scale
DTS	Distress Tolerance Scale
APM	Advanced Progressive Matrices (Raven's)



## Chapter I

### Introduction

Anyone who has taught in a classroom has experienced an array of effects arising from their own emotions and those of their students. Beyond the interplay of student-teacher emotional states, the underlying mood can create an atmosphere wherein each day is a painful, forced march or a celebrated exploration of ideas and vigorous conversation. When painted with large brushstrokes, the effects of emotions in the classroom are common memes to which any teacher will relate and share stories. Yet, accessing a more granular view of the influence of a student's emotions and the beliefs they form about their learning are not well known to educators and are still under consideration by researchers.

Student behavior and cognitive processes are modeled by diverse, even competing constructs. While human behavior is too complex to reliably predict the behavior of any single individual, certain patterns generally hold true for groups of learners. Being motivated and goal-directed is associated with success, as are having good study habits, persistence, and strong social support. However, the mechanisms that drive motivation and the choices that impact learning are still much debated.

### Background

**Emotion.** The experience and implications of emotions have long been a popular topic within psychology, and it has been established as playing a critical role in several domains of the human experience (Gardiner, Metcalf, & Beebe-Center, 1937; James, 1884). The nature of emotion and its role in cognitive processing has traditionally been subject to much debate, but its role has become more secure as a separate but influential

process in cognition (Damasio, 2000; LeDoux, 2000). Researchers using brain scanning technology, such as fMRI, have been able to continuously reveal more of the structural relationship of the brain to associated emotional states, but this type of research cannot yet directly reveal the subtler effects of emotion on psychological constructs, such as how future recall of an event will be altered by the emotions that were experienced at the time it was encoded.

Everyone has experience with how intense emotions such as anger can influence their thinking or experience of an event, but the subtler effects, such as on long-term memory, are still under study (LeBlanc, McConnell, & Monteiro, 2015). Even more so, secondary implications for behavior are less understood. An example is its influence on some physical actions, such as performance during sporting events (McCarthy, 2011). Researchers have even demonstrated a implications for the role of emotions in health outcomes (Cappellen, Rice, Catalino, & Fredrickson, 2018; Richman et al., 2005).

Emotion is a key component of emerging theories of behavior, such as the recent development of the field of positive psychology. Positive psychology is concerned with answering the question “what causes a human being to flourish?” (Seligman & Csikszentmihalyi, 2014). Positive psychology theory holds that emotions influence well-being by impacting not only physical health, but mental and social well-being as well. Further, positive psychology research suggests there is a strong correlation between positivity of emotion and level of motivation and task engagement (Fredrickson, 2001; Pajares, 2001; Seligman & Csikszentmihalyi, 2014).

**Metacognition.** Schraw (1998) identified knowledge about knowledge, or metacognition, as having two distinguishable features: knowledge of cognition and

regulation of cognition. Knowledge about one's knowing and ability are components of metacognitive knowledge, while knowledge of how best to use one's ability and direct learning is metacognitive regulation. Metacognition research has demonstrated its direct impact on learning by informing a learner about their current state of learning and how best to self-direct their own learning behaviors (T.O. Nelson & Narens, 1994; Schraw, 1998).

Models of metacognition do not always agree on its components or mechanisms for influencing behavior (Schraw, 1998; Shimamura, 2008). While monitoring may not appear prominently in all theories and assemblies of a metacognitive construct, it is an inescapable component of the mechanisms driving metacognition (Shimamura, 2008). Nelson and Narens (1994) identified metacognitive monitoring (MM) and its neurological process as the inference and translation of objective information from the posterior cortex to a meta level of thought in the prefrontal cortex. The interpretation of objective information into more subjective meta level interpretations of knowledge is the MM of interest in the current study as a potential vector of influence by emotional states that then result in inaccurate metacognitive appraisals.

### **Problem Statement**

The ubiquitous interest in emotion has not resolved the uncertainty that has arisen from their study or the inconsistency in the conclusions about their roles in cognition. Studies of emotion provide several challenges, including the difficulties that come from any self-assessment, differences in how emotion is defined, and overlap with congruent constructs such as affect and mood. However, the greatest problems that occur in regard

to emotion and metacognition are not methodology or construct definition, but rather the overall lack of salient research informing theory and practice.

A student's level of accuracy with MM has direct implications for learning outcomes. If the student is unable to accurately self-monitor their abilities and their learning progress, they cannot effectively implement metacognitive strategies or otherwise exert effective control over their own learning progress (Nietfeld, Cao, & Osborne, 2005). Metacognitive monitoring is central to a student's ability to self-regulate their own learning processes (Butler & Winne, 1995). However, MM is often highly inaccurate (Glenberg & Epstein, 1987). Previous research into the cognitive processes contributing to MM has focused on top-down processing (Thomas O. Nelson & Narens, 1990).

Current models of metacognition focus on what an individual knows about the difficulty of a task, their ability, and strategies for learning. What is less clear is how emotions influence the development of beliefs that play a central role in metacognitive monitoring. It seems counterintuitive studies of metacognition and behavior would neglect belief or treat it as a separate component of metacognitive regulation. The importance of this relationship is further punctuated by the tenacity of beliefs and the reciprocal relationship implied by the role of cognition on emotion.

Given the evidence that the physiological effects of emotion directly influence the assessment of the self and circumstances (Bandura, 1993; Damasio, Everitt, & Bishop, 1996), the role of emotion appears to be an underexplored topic for metacognition. Emotions have multiple opportunities to interact with cognitive processes that influence metacognition, including influencing the beliefs that inform and result from the

metacognitive process. The number of potential interactions with differences both within individuals and environments hint at what may be a substantial gap in the literature.

The largely unaccounted-for effect of emotion in the MM literature limits the ability to accurately model metacognition as a robust construct. The current literature acknowledges emotion is an inseparable component of cognitive processes; however, few studies have been done to examine how emotion during a learning experience influences the MM progress and the resulting feelings the individual holds on their level of ability or self-efficacy (Damasio, 2000). This implies a core component of metacognitive theory, MM, is still poorly understood. The lack of literature limits understanding, but the extent of absence of conclusive, replicable findings appears to be an indicator that development and refinement of metacognitive theory has been impeded.

### **Purpose of the Study**

Despite the increase in research and interest in the role of emotion in cognition and learning, many questions remain. Metacognitive monitoring has a growing body of literature, but these studies are not always in agreement and may not be arriving at the most parsimonious explanation of observed outcomes. The current study helps to clarify outcomes from previous studies, and it is among the first to examine an entirely new line of research: MM as a hot cognition process.

Understanding the influence of emotion in this context is important because effective interventions already exist for mitigating emotional influence in cognitive processes (Chambers, Gullone, & Allen, 2009; Kavanagh & Bower, 1985; Siemer & Reisenzein, 1998). Evidence of a significant role of emotion in MM needs to be established before such interventions can be justified; therefore, a clear need exists for the

research within the current study. The current study provides initial evidence to drive future research and hints at the importance of emotion as a consideration during the learning process.

The purpose of this study is to address a weakness in the literature on metacognition by examining the role of emotions in the beliefs associated with MM. Due to scarce literature on the topic, a more exploratory approach was taken to explore the relationship through a quantitative, cross-sectional study of emotions and beliefs during a learning task. The goal was to widely approach bridging the gap and to serve as an initial exploration to inform future research on the topic. The current study is among the first to investigate the role of bottom-up, emotion-driven MM.

Metacognitive monitoring is examined by exploring three beliefs that serve as proxies, or more easily measured dimension of the MM process. Self-report on these belief states serve as the dependent variables: self-efficacy belief (SEB), feeling of knowing (FOK), and retrospective confidence judgments (RCJ). Emotion is the independent variable, examined with a focus on the dimensions of valence (positive and negative) and arousal. The current study also seeks to examine intervening variables that may be influencing any main effects. The intervening variables of interest are demographics, emotion monitoring, intelligence, and environmental influence. The study used a video-based learning task given amidst a battery of self-report and assessment measures.

### **Definition of Key Terms**

**Arousal.** The level of intensity of emotion; the level of psychological stimulation.

**Distress Tolerance.** Distress Tolerance is the meta-emotional capacity to resist aversive psychological states. It is a multifaceted construct composed of dealing with difficult emotions through: (1) tolerance; (2) acceptance; (3) prevention of cognitive disruption; and (4) regulation of behaviors in relation to emotional state (Simons & Gaher, 2005; Zvolensky, Vujanovic, Bernstein, & Leyro, 2010).

**Environment.** For this study, environment is the culmination of the experience driven by the sensory ecology of the location where the participants completed the study, time and date of data collection, and order in which learning material was provided. There were two locations to which participants were apportioned: A newer, well-lit, comfortable classroom and a starker, basement lab room.

**Emotion.** Emotion is still poorly defined in the literature, in part due to competing theories as to the nature of emotion, the difficulty in defining the edges between emotions and the more subtle distinctions such as between emotion and affect (Gendron, 2010). For the current study, emotion is defined in the most general terms as a physiological state associated with lower brain functions distinct from purely logical reasoning experienced as subjective feelings that one is or can become aware of experiencing.

**Intelligence.** Intelligence is the ability to use logic and complex thinking to solve novel problems; this definition most closely aligns to the concept of fluid intelligence more than a general concept of intelligence (Cattell, 1971; Humphreys, 1979).

**Learning Beliefs.** Beliefs are a state or conclusion that is acted upon or held in faith. The current study operationalizes learning beliefs as conclusions regarding predicted ability and faith in the level of understanding achieved. For pre-learning beliefs

in ability, self-efficacy is used. For confidence conclusions post assessment FOK and RCJ are used. This study uses learning beliefs as the dimension of metacognitive monitoring that can be accessed through participant self-evaluations.

*Self-efficacy belief (SEB).* Self-efficacy is the domain-specific belief in one's ability to learn or perform tasks within that domain (Bandura, 1977).

*Feeling of knowing (FOK).* Feeling of knowing is a subjective belief of one's level of knowledge that is not informed by sufficient feedback to make an objective decision (Koriat, 1997).

*Reflective confidence judgment (RCJ).* Reflective confidence judgment is a post-learning belief of one's knowledge informed by an external measure but lacking sufficient information to make an objective judgment (Koriat, 1997).

**Metacognition.** Metacognition is the knowledge and thoughts about one's own thinking, knowledge, and learning (Dunlosky & Metcalfe, 2008; Schraw, 1998).

**Metacognitive monitoring (MM).** Metacognitive monitoring is the process of assembling objective information into a metacognitive schema, measured as a confidence judgment on learning performance (Schraw, 2009; Shimamura, 2008).



## **Chapter II**

### **Literature Review**

Current formal, cognitive models are inherently limited due to their inability to account for the role of emotion in appraisal processes (Forstmann, Wagenmakers, Eichele, Brown, & Serences, 2011; Winocur, Moscovitch, & Bontempi, 2010). The literature acknowledges emotion is an inseparable component of cognitive processes; however, few studies examine how emotion during learning influences MM, specifically in the form of learning beliefs. Of interest in this study are the learning beliefs operationalized as self-efficacy belief (SEB), feeling of knowing (FOK), and retrospective confidence judgments (RCJ). Understanding the influence of emotion on learning beliefs is important because if certain emotions are negatively impacting student's metacognitive monitoring through poor judgments and counterproductive learning beliefs, steps can be taken to ameliorate those effects. Established interventions, such as mindfulness, can help students become more aware of how they are feeling and learn metacognitive strategies for better informing their learning beliefs. However, before such intervention can be justified, evidence of a significant role of emotion in the self-assessed beliefs about learning needs to be established.

### **Emotional States**

Ekkekakis (2009) devised a three-step process for choosing a measure of emotion: (1) determine the appropriate construct and dimensions of study, including emotion, mood and core affect; (2) choose the theoretical model within the construct; and (3) consider the psychometric properties of each assessment. The current study does not examine all dimensions of emotion but focuses on positive emotion (PE) and negative

emotion (NE). This approach is congruent with Russell's (1980) model of core emotional space having the two orthogonal factors of valence and activation. Under this model, all emotional states can be placed within varying degrees of positive or negative emotion (valence) and the extent of arousal level (activation). It is generally held that emotion is too complex to capture in self-report; therefore, measures of affect are typically used as a proxy for emotional states (Russell, 2003).

**Mood.** The construct of mood is an individual's persistent emotion state whose source is difficult to identify. Mood states may include an individual's default state of emotion arising from the sum of all ongoing experience and environmental inputs (Frijda, 2009), or they may be a temporary but persistent emotional state whose source is either vague or temporally remote (Beedie, Terry, & Lane, 2005). Examples of mood include an extended period of time where an individual was depressed after a particularly difficult week, or it may be an ongoing default state of irritability for an author who has faced continual rejection for publications.

**Emotion.** Russell and Barrett (1999) defined emotion as a dynamic system of events occurring in relation to a specific source. The source is specific and identifiable, but with little limitation to what might cause the genesis. The components they identified for an emotion response is: (1) core affect; (2) observable behavior congruent with core affect; (3) a significant level of focus on the source of the response; (4) cognitive appraisal of the stimuli; (5) attributing the current affective response to the event; (6) recognition and experience of the emotion itself; and (7) neural and physiological changes congruent with the emotion. Within this paradigm, the fourth step is the critical differentiating component (Russell & Barrett, 1999).

**Affect.** If emotion requires appraisal, affect is then the immediate response to stimuli that occurs without reflection (Russell & Barrett, 1999). As we are constantly under the influence of external and internal stimuli, we are constantly experiencing affect of varying degrees (Ekkekakis, 2009). Affect is therefore differentiable from, but can be a component of, emotion and mood. For example, the sight of a spider might elicit fear as an affective response that evolves into fear and disgust as the individual considers the presence of the spider.

**Emotion in the Current Study.** Emotion is a challenging construct. It does not have a single, widely accepted definition. It can be difficult to distinguish between its edges and states. If a construct cannot be decomposed into discrete, objective components and a universal definition is not forthcoming, there is a temptation to rely on intuition as the coagulant for manifesting agreement. For the current study, empirical availability for emotional states is gained through administering established self-report assessments of emotion.

### **Emotion Induction**

There are several experimental methods for the induction of an emotional state, but few have been as validated across disciplines as a five-minute writing exercise wherein participants are asked to write about an experience that elicited the target emotion (Schwarz & Clore, 1983). Inductions that use music, videos, or faces have been used successfully but lack the consistency of a writing induction. This is attributed, at least in part, to differences in appraisal and interpretation of the medium being presented. For example, a face that one person may find to be hostile and angry may appear humorous and exaggerated to another. However, inducing emotional states, especially

negative ones, can raise ethical concerns. With little evidence in the literature that artificially induced emotional act equally to endogenous ones, induction was avoided in the current study.

### **Emotion and Learning**

There is a rich literature which supports the central and inseparable role of emotion in cognitive processes (Damasio, 1994; Izard, 1993; Pessoa, 2008). Cognition involves both top-down executive function and bottom-up emotional processing with each playing a role in the monitoring of the other (Clore & Huntsinger, 2007). It has been a challenge for research to include emotion into cognitive models as a systems-level understanding of the scope and range of possible effects is unknown; however, researchers are revealing through a growing body of literature how emotion changes executive functioning. Examples include research demonstrating a direct effect of emotion on schema activation (Bless, Schwarz, & Wieland, 1996; Strack, Schwarz, Bless, Kübler, & Wänke, 1993) and cognitive strategies in decision making (Fiedler & Walther, 2004; Nadler, Rabi, & Minda, 2010; Zivot, Cohen, & Kapucu, 2013). Emotion has further been associated with rapid, heuristic thought that could be correlated to the feelings associated with learning beliefs, but that relationship is yet to be established specific to learning beliefs (DeWall, Baumeister, & Masicampo, 2008; Phelps & Sharot, 2008).

When emotion has been examined in the context of learning, it has typically centered on the appraisals that occur during learning that lead to emotional states or the resultant, observable motivational or behavioral states that follow, typified by Perun (2006).

## **Metacognitive Monitoring**

Student's ability to objectively self-assess learning is plagued with challenges. Despite the increased importance placed on self-evaluated learning, individuals' knowledge of their own learning or learning outcome expectations tends to correlate poorly with objective or standardized assessments (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Shell, Murphy, & Bruning, 1989). Students make errors in calibrating their learning progress through such mechanisms as source errors, influence of prior inaccurate information, and failure to identify when an effective strategy has improved their learning (Salas, Minakata, & Kelemen, 2011; Schwartz & Efklides, 2012; van Loon, de Bruin, van Gog, & van Merriënboer, 2013). If top-down cognitive processes are limited in their influence on learning beliefs, the need to examine bottom-up emotional processes becomes more salient.

Failure to accurately assess strengths, weaknesses, and misconceptions from a learning experience can significant impact future progress. Students who overestimate their development may decrease their time on task and effort in future studies (Dunning et al., 2003; van Loon et al., 2013). Alternately, if a student believes they require greater time to study than is actually necessary, they may engage in a detrimental practice of overlearning (Langer & Imber, 1979). While individual learning experiences may not suffer from minor miscalibrations, an ongoing pattern of repeatedly misjudging progress may begin to impair academic progress. This condition is compounded by a frequent deficiency in metacognitive strategies, even when the calibration is correct (McCabe, 2011).

Koriat (1997) identified three categories of cues used for MM used by learner: intrinsic, extrinsic, and mnemonic. Intrinsic cues are the most immediately salient sensory experience of the presentation of material, such as number and quality of illustrations. Extrinsic cues include the type of instructions given for study and the time allotted for different tasks. The individual's feelings of the material, the subjective judgments on the ease of which material is recalled are called mnemonic cues. Heuristic thinking is also the type of judgment most influenced by mood and emotional, bottom-up processing (Forgas, 1995)

Among Koriat's MM heuristics, learners tend to default to heuristics that overemphasize the intrinsic rather than the more objective extrinsic factors while largely failing to attend to the influence of mnemonic cues in their thinking (Koriat, 1997). Incorrect judgment of learning is known to arise from specific temporal issues. Students who practice for extended periods or on repeated occasions without significant gains tend to undervalue their progress, as do students who assess after an extended delay from their last study session (Koriat, Sheffer, & Ma'ayan, 2002; Pyc & Rawson, 2012). Additionally, recent investigations into MM are increasingly turning toward perceiving metacognitive strategies as being not only unconscious, but based on "noetic feelings" that are used to inform conscious metacognitive choices (Koriat, 2000; Koriat & Levy-Sadot, 2000). These findings provide specific evidence for knowledge of learning arising largely from judgments based on aesthetic or emotional response.

A last key emotional component of knowledge of learning results from a bottleneck effect that occurs when self-regulation and self-assessment must co-occur (Dunning et al., 2003; Yeo & Neal, 2013). Such a limitation on resources for MM would

indicate that an increase in emotional intensity and the need for emotion regulation provide an additional pathway through which emotions can impact learning assessment. This creates a temporal condition to MM. A student might assess their progress differently if experiencing strong emotion as opposed to waiting until they have returned to a more neutral emotional state.

**Self-Efficacy Beliefs.** The way an individual's experiences, social interactions, and motivations can be assembled into a multitude of constructs, with self-efficacy being one of the most indelible for educators and educational psychologists due to its persistence and popularity in the literature. Self-efficacy can be defined as an individual's domain-specific beliefs in their performance capabilities (Bandura, 1977, 1993). The construct is a belief based on the self-assessed performance for a specific task rather than a broader global measure such as self-esteem and requires task specificity to be accurately measured (Bandura, 1986; Linnenbrink & Pintrich, 2003; Schunk & Pajares, 2002).

It should be noted that, perhaps paradoxically, a construct of general self-efficacy has been proposed. Measures that rely on the construct report validation through psychometric studies (Luszczynska, Scholz, & Schwarzer, 2005). However, the definition of validity used in these studies tends to be limited to quantitative evaluations such as factor analysis and reliability measures. Studies that measured correlation between generalized self-efficacy and similar constructs such as self-esteem, locus of control, and neuroticism found low discrimination due to overlap in constructs and perhaps an unidentified higher-order construct (Judge, Erez, Bono, & Thoresen, 2002; Tipton & Worthington, 1984). As the evidence supports discrimination between

Bandura's self-efficacy as a domain evaluation of skill and a general self-perception, generalized self-efficacy is not applicable to the current study.

Self-efficacy, when measured as being content specific, is an important construct in education as it is a direct predictor of learning behavior and education outcomes (Multon, Brown, & Lent, 1991; Pajares, 1996; Shell et al., 1989). Pajares (1996) describes it as the mechanism by which social and personal knowledge translate into actions that drive learning or its avoidance. Higher self-efficacy beliefs (SEBs) result in increased expectancy outcomes and are associated with both volume and intensity of effort as demonstrated by: increased tenacity when faced with setback or difficulties; active engagement with metacognitive strategies; self-regulatory behaviors; and aspirations and goal setting (Bandura, 2010; Pintrich & de Groot, 1990; Schunk, 1985; Zimmerman, 2000; Zimmerman, Bandura, & Martinez-Pons, 1992). Low self-efficacy not only decreases desirable cognitive and motivational states, it can impart undesirable effects such as avoidant behavior, rumination, and anxiety (Bandura, 2010; Pajares, 1996).

Bandura recognizes four sources of self-efficacy: (1) mastery experiences; (2) vicarious social modeling; (3) social persuasion; and (4) misinterpretation of physiological states (Bandura, 1977; 1993). Additional research has identified other contributors, such as perceived task difficulty, locus of control, and learning environment (Gist & Mitchell, 1992). These factors indirectly illustrate that self-efficacy is more than a single impression, but an evolving belief formed through experience and interaction with others. However, as experiences increase in number and salience, a more persistent



SEB can form that begin to become self-reinforcing, coloring how additional experiences are interpreted and recalled (Gist & Mitchell, 1992; Pajares, 1996).

Bandura tends to not focus on emotion, even though he recognizes physiological arousal is a key contributing factor. When he does investigate the influence of emotion, it tends to only be in the context of stress or a negative emotion contributing to a physiological response that is observed and misinterpreted as a lack of ability by the learner (Bandura, 1993). Other research of emotion with self-efficacy tends to focus on self-efficacy as a predictor of emotion rather than as an outcome of the emotion during formation of the self-efficacy beliefs or as low self-efficacy and anxiety being a looping cycle of effect (Bandura, 1977; Pajares, 1996).

The research on self-efficacy appears to conform to research on emotion and cognition, such as mood congruent judgment (Schwarz & Clore, 1983), but comprehensive evidence or measures of magnitude of different emotions on self-efficacy are lacking. Kavanagh & Bower (1985) provided evidence that positive emotional states increased self-efficacy while negative emotions decreased them in one of the only studies attempting to access the role of emotion on self-efficacy. There are several criticisms available to this work that limit its generalizability. They including the lack of discrimination between different positive and negative emotions as well as possible implications from the emotions states being hypnotically induced rather than being those endogenous to the learning environment and domain. Further, the measure of self-efficacy lacked domain specificity and may have been more strongly correlated with self-confidence than self-efficacy as applied to any specific domain.

In the current study, the questions assessing self-efficacy are congruent to outcome expectation for brevity and ease of interpretation. Although Bandura (1977) was emphatic that outcome expectations are distinct from SEBs, he later admitted the two are strongly correlated after Kirsch (1985) brought the discriminability between the constructs into question causing Bandura (1986) to admit the strength of correlation between the constructs in later works. Research supports the constructs are distinct beliefs (Meece, Wigfield, & Eccles, 1990); however, examples where one construct isn't a direct proxy for the other appears to be the exceptional edge case rather than in general application or there is a discrepancy between self-efficacy and a desire to engage with the task (Pajares, 1996).

The Dunning-Kruger Effect exemplifies the complications and inaccuracies that occur with self-assessment and metacognition and needs to be considered when examining self-efficacy. The Dunning-Kruger Effect is that the less capable overestimate their performance and lack the metacognitive ability to recognize their poor performance with the magnitude of the effect being negatively correlated with actual ability (Kruger & Dunning, 1999). Ongoing research into this effect suggests impairments of metacognitive ability are not only associated with an overestimation in ability, but these impairments are associated with continued poor performance directly resulting from an inability to self-reflect and accurately appraise performance (Ehrlinger, Johnson, Banner, Dunning, & Kruger, 2008).

An important conclusion from research into the Dunning-Kruger effect is that an individual's poor metacognitive performance varies by domain and need not be a terminal state in the domains in which it occurs (Ehrlinger et al., 2008; Kruger &

Dunning, 1999). This effect in an individual appears to be unaffected by modifications in motivation or quality of feedback but is only diminished through gaining additional experience in a domain and having directed guidance in acquiring additional metacognitive skills can significantly decrease this effect (Ehrlinger et al., 2008). These findings further support the premise of the current study that impaired metacognitive states can negatively influence learning behaviors but this cycle can be broken through effective intervention.

An additional implication for the Dunning-Kruger Effect arises in its implications for emotional processing. While the initial research focused on academic, physical, and work performance-related skills, there is evidence that the effect also occurs in self-appraisal and management of emotions (Sheldon, Dunning, & Ames, 2014). The individual who is least capable to recognize or deal with strong emotional states is going to tend to believe they do not have an issue and will lack insight and ability to decrease the effects of these states on their metacognitive evaluations and the beliefs resulting from them. As with academic performance, however, interventions can increase emotional intelligence and diminish the implications of the Dunning-Kruger Effect on cognitive processing influenced by an emotional state (Dacre Pool & Qualter, 2012; Nelis, Quoidbach, Mikolajczak, & Hansenne, 2009; Sheldon et al., 2014).

Given the research on the Dunning-Kruger Effect, an important consideration with self-efficacy becomes learner's overestimation of their ability. While high self-efficacy is generally associated with positive outcomes, evidence suggests that overconfidence negatively impacts academics and is even more resistant to change than low self-efficacy (Gist & Mitchell, 1992; Vancouver, Thompson, Tischner, & Putka,

2002). It is therefore prudent to consider learners with the lowest level of ability and the likelihood that they may be the most susceptible to inflated self-efficacy, especially if reinforced or exacerbated by congruent emotional states.

For the current study, SEB specifically refers to the pre-learning self-efficacy of participant's ability to learn and pass an assessment on instructional material on positive psychology (SEB<sub>PS</sub>) and logical fallacies (SEB<sub>LF</sub>).

**Feeling of Knowing.** After a learning experience, the FOK is a confidence judgment expressed as an individual's belief in how well they have understood and successfully completed a learning task. Hart (1965, 1966, 1967) developed a four-stage FOK assessment where researchers: (a) identified questions participants were unable to answer through production; (b) ask if participants felt they could correctly identify the correct answer; (c) administer a multiple-choice test; and (d) compare recognition performance with FOK. The FOK assessment process was the first way of directly assessing MM (Butterfield, Nelson, & Peck, 1988).

The current study limits its examination of FOK to the relative assessment of performance relative to peers. Throughout a student's learning process, the metacognitive monitoring and cues for self-efficacy occur before a summative assessment. It is these general feelings of progress that the current measure is attempting to access, drawing from the spirit of Hart's work rather than replication of the methodology. The reliance on performance relative to others is more likely to be aligned and influenced by self-efficacy, but perceived social comparison is one of the strongest influences on updates to self-efficacy and resulting behaviors (Bandura, 1977, 1986).

**Reflective Confidence Judgment.** After demonstrating a skill or responding to an evaluation inquiry through a summative assessment, the feeling an individual has as to the accuracy of the demonstrated knowledge is their RCJ. Reflective cognitive judgment is similar to FOK, but instead of a relative measure of performance to others, it asks individuals to express their performance relative to the questions asked. Reflective cognitive judgment allows individuals to respond more independently of SEB, and it allows their metacognitive reflection to be more strongly influenced by the difficulty of the assessment rather than being a function of their perceived ability or relative performance.

### **Metacognition and Emotion**

Emotion cannot be functionally separated from cognition and has been labeled by Damasio (1994) as a form of cognition itself. Emotion is deeply interconnected with physiological states, both influencing and being informed by somatic responses in the body (Damasio et al., 1996; Immordino-Yang & Damasio, 2007; Levin, Eisenberg, & Benton, 1991). Further, judgments and behavioral decisions are informed by emotion, especially when objective information is lacking or equivoque (Clore & Huntsinger, 2007; Schwarz & Clore, 1983). It is, therefore, reasonable to assume that the cognitive appraisal of learning would be subject to somatic and emotional states present at the time of appraisal.

The interrelated connection between body, mood, and cognition can create errors in judgments when misattribution of physiological or emotional response is misattributed to the cognitive process. An example would be the way students would rate their life satisfaction on a sunny day as more satisfying than those asked on rainy days (Schwarz &

Clore, 1983). Most people are unaware of the extent to which they are being influenced by unrelated emotional and physiological stimuli exerting influence on behavior (Ikegami, 1993). It is reasonable to conclude that there is an emotional influence on MM that is outside of conscious awareness and therefore unavailable for monitoring by the individual.

Koriat's intrinsic component of MM is expanded upon by research that has examined how the salience of certain stimuli can increase correct judgment of estimated recall. A weighting of information occurs based on emotion and embodied cognition as theorized by Damasio for general cognition (Alban & Kelley, 2013). As intrinsic metacognitive evaluation is a primary channel for assessing learning, the relationship between embodied cognition and knowledge of learning appears to be theoretically sound.

Another important implication for MM arising from the influence of emotion on cognition is in the selective attending to information. Individuals attend more strongly to emotionally congruent information (Bhanji & Beer, 2012). During a MM task involving overall growth from multiple learning and assessment experiences, we would expect that an individual would incorporate and weigh more heavily those events that evoke an emotional recall that parallels the assessing individual's current state.

Cognition is not entirely subject to emotion as top-down processes can significantly alter emotional states and limit the effects of bottom-up processes (Dolcos, Jordan, & Dolcos, 2011a). Emotion can have positive effects on cognition, such as increased creativity and problem-solving arising from positive emotion (Ashby, Isen, & Turken, 1999); therefore, it is not necessary or desirable to eliminate or minimize

emotion during MM tasks. Learners should instead increase their monitoring of the influence of emotion and acquire the ability to test and validate their feelings with external, objective points of assessment.

Flavell (1979) separated metacognition into four components: (a) metacognitive knowledge; (b) metacognitive experience; (c) goals; and (d) strategies. In the current study, the distinction between metacognitive knowledge and experience are of particular interest. Flavell calls metacognitive experience “any conscious cognitive or affective experience that accompany and pertain to any intellectual enterprise” (1979, p. 906). While cognition cannot be directly accessed (Johansson, Hall, Sikström, Tärning, & Lind, 2006; Nisbett & Wilson, 1977), we are able to examine and update our metacognitive beliefs. Flavell (1979, p. 906) gives an example of “... the sudden feeling you do not understand something another person just said.” The arrival of such a feeling without an external indicator would be the result of emotional processes that could then drive goal setting and choice of strategies.

Increased metacognitive skills are generally associated with better learning outcomes as individuals are able to make better use of instructional material and make better choices in studying and information seeking (Spada, Hiou, & Nikcevic, 2006). The role of emotion in making metacognitive judgments is less understood. If emotion is inseparable from cognition, it would follow that metacognition is similarly driven by emotional and mood states. A clearer understanding of the influence of emotion in metacognition may further illuminate MM, but this research is still largely lacking from the literature.

## **Social Cognition**

Learners use external information to determine their progress within learning. They seek social cues of expectation and standards for normal outcomes either through direct instruction or social comparison. Social cognition therefore plays a role in setting and interpreting learning outcomes.

Through fMRI and brain scanning research, we have gained insights into the connection between learning judgments, emotion and social cognition (Longe et al., 2010). Pathology studies of the left temporal pole and insula have shown how the neural systems responsible for emotional responses such as empathy and compassion are also utilized in self-reassurance (Longe et al., 2010). The implication for these findings is that poor emotional regulation within the social domain could have implications for social referencing and information acquisition as well as one's ability to make a self-assuring evaluation of behavioral or learning outcomes.

As a learner seeks information for comparison or feedback from either a fellow student or an instructor, their social engagement and the resulting processing of information will arise from emotion-based cognition and decision-making processes (Forgas, 2008; Lemerise & Arsenio, 2000). The extent to which the individual is aware of the influence of emotion allows for greater social competence and information monitoring (Dolan, 2002), but not all emotional influence will be under conscious awareness (Forgas, 2008). Emotion should then have both a direct and indirect effect on MM through social cognition. Directly, the quality of externally obtained measures of progress are in part based on social engagement mediated by emotion, and indirectly, emotional response influences how the learner reflects on obtained information.



If knowledge of learning is assessed after working with a group or interacting with others, social cognition can impact MM indirectly through changes in emotional states. While individuals with highly adaptive social functioning may have healthy emotional and social cognition, an important secondary effect may occur as emotions are transferred from a group or individuals to the learner (Barsade, 2002; Hatfield, Cacioppo, & Rapson, 1993). Socially acquired emotions could later influence the individual's cognition when the person reflects on their learning experience regardless if the emotions are relevant to their judgments or their objective experience of their own learning.

The transfer of emotion from social exposure can be expanded to include an even larger transference of attitudes. As new associations are made during the learning process between the central learning process and the peripheral social exposure, transfer of favorable attitudes can take root in a student and become part of their experience and beliefs around their learning (Aiken, 1970; Das & Nanda, 1963). These attitudes and their associated emotion can be also come from outside of the learning environment, such as those learned by parents (Parsons, Adler, & Kaczala, 1982), and may inform judgments without being based in actual academic experience. Depending on their source and congruence with learning, these contagion attitudes may help or hinder individual assessments of academic understanding.

### **Memory and Learning**

Both memory and learning are directly affected by emotional states, but most learners are not accurately informed of this relationship. It is typically assumed that strong emotions enhance episodic memory, but this relationship is not a simple one as different emotions and interacting levels of intensity can work to either increase or

decrease recall (Shafer & Dolcos, 2012). Factors influencing the effect of emotion on memory are multifaceted and include factors such as level of distraction due to the relatedness of the current emotion, cognitive demands of material to be remembered, and even moderation by gender (Canli, Desmond, Zhao, & Gabrieli, 2002; Shafer & Dolcos, 2012).

Emotional responses cause the amygdala to modulate memory processes within the hippocampus through traditional Hebbian synaptic responses, the influence of elevated neurohormones such as cortisol but additionally through synchronization of theta waves across multiple brain regions (McIntyre, McGaugh, & Williams, 2012). The result is a direct causal relationship between emotional arousal in the amygdala and changes in synaptic plasticity in the hippocampus associated with memory, specifically with the consolidation of long-term potentiation (LTP) into long-term memory, a process called emotional tagging (Bergado, Lucas, & Richter-Levin, 2011).

Strong emotional responses may facilitate memory consolidation, thereby increasing recall afterward; however, immediate recall may actually be decreased due to emotional intensity until consolidation has occurred and emotional arousal may work against memory beyond a certain level of intensity (Kleinsmith & Kaplan, 1963). This relationship is further complicated by the possibility that strong emotion can increase our beliefs in our memories fidelity without actually increasing its accuracy (Forgas, 2011). Rather than emotion, it is attentional focus and the level of distinctiveness predictive of immediate recall (Talmi & McGarry, 2012) with emotion rather than salience becoming increasingly important post consolidation (Hunt, 2009; Kleinsmith & Kaplan, 1963). While emotion serves to direct attention, emotion is differentiable from attention in its

ability to stimulate and maintain accurate information for peripheral details unattended to by attentional processes (Heuer & Reisberg, 1990). The difficulty in assessing the precise nature of emotion on memory becomes more complex when considered in the context of more complex learning tasks. When presented with a list of items, individuals under emotionally aroused states or prompts tend to have higher recall than non-emotional groups; however, when the task extends to learning associations between items rather than rote recall, the emotional recall group either tends to perform poorly or no differently when compared to controls (Madan, Caplan, Lau, & Fujiwara, 2012) or only show improvement when the elicited emotional state is positive (Zimmerman & Kelley, 2010).

Apart from objective recall, the role of memory and emotion has an important secondary effect. The remembrance and reactivation of emotions and mood states from prior experience tend to be more salient and of greater intensity when the event is negative (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). This effect can be paradoxically detrimental in the case of feedback. When individuals are asked to recall feedback they have received, they tend to have a stronger immediate recall for negative feedback; however, negative feedback is recalled with a strong defensive bias and tends to be inaccurately retained in memory when compared to more positive feedback (Baumeister & Cairns, 1992). Self-assessment of learning arising from a bias for negative outcomes and unreliable negative feedback cannot be expected to be reliable report of a student's actual progress in a learning task. Further, such biases can significantly influence an individual to avoid both further feedback and additional negative experiences if they perceive they are unable to be successful (Baumeister &

Cairns, 1992; Maier & Seligman, 1976). This type of avoidance behavior, if maintained, begins to effect self-regulation (Oertig et al., 2013) and further diminish the ability to make effective assessments.

Learning has a complex relationship with emotional states distinct from simple memory processes (Kornell & Bjork, 2009). In addition to the social influence, emotion can impact learning by creating extra cognitive load that may interfere with the learning process (Van Dillen, Heslenfeld, & Koole, 2009). If the learners associate this additional cognitive load with the material being learned rather than their current emotional state, this misattribution could result in the learner overestimating the difficulty of the material and the extent of their own progress.

### **The Current Study**

This study proposes an investigation of the effect of emotion on the self-assessed learning beliefs of metacognitive monitoring. There are few previous studies to establish an evidence-based foundation for the basis of this study, mostly conjecture and the theoretical implications from related literature. The current study helps to address the current lack of literature on this topic.

The research investigator of the current study seeks to answer the following research questions:

- RQ1: Are emotions associated with how people predict their ability to perform on a learning task (SEB)? Positive emotion is predicted to increase beliefs in self-efficacy, while negative emotion will decrease self-efficacy.

- RQ2: Are emotions associated with how learners believe they have performed on a learning task (FOK and RCJ)? Positive emotion is predicted to increase beliefs in post-assessment performance, while negative emotion will decrease them.
- RQ3: Are distress tolerance or intelligence intervening variables in the relationship between emotion or arousal and learning beliefs? Distress tolerance and intelligence are both predicted to influence the model for the impact of emotions on learning beliefs.
- RQ4: Do demographic factors influence the relationship between emotion and learning beliefs? Variables such as age are predicted to be important intervening variables in the emotion/MM relationship.
- RQ5: Do environmental factors influence the relationship between emotion and learning beliefs? Environment is predicted to have a small effect but largely only serve as a proxy for emotional states.

## Chapter III

### Methods

#### Overview

The current chapter reports the procedures, participants, and analytic approach applied to answer the research questions for this study. The quantitative, cross-sectional survey methods employed were chosen to investigate the hypothesis that emotional states have a direct relationship to an individual's state beliefs about their learning, both in terms of self-efficacy before learning and the outcome of a learning event after assessment. Measures of emotional states and learning beliefs were applied before and after an educational video and related assessment to determine the strength of the relationship between study variables.

#### Objective

The purpose of this study was to examine the role of emotions in learning beliefs. Study variables and assessments were selected to reveal possible relationships between emotional states and beliefs about learning, both before and after a learning event. The general hypothesis, that there is a direct relationship between emotion state and beliefs on learning efficacy and outcome, are explored as five research questions:

- RQ1: Are emotions associated with how people predict their ability to perform a learning task (SEB)?
  - H<sub>01</sub>: There is no relationship between emotion and self-efficacy.
- RQ2: Are emotions associated with how learners believe they have performed on a learning task (FOK and RCJ)?
  - H<sub>02</sub>: There is no relationship between emotional state and FOK or RCJ.

- RQ3: Are distress tolerance or intelligence intervening variables in the relationship between emotion or arousal and learning beliefs?
  - H<sub>03</sub>: Neither distress tolerance nor intelligence are intervening variables in the relationship between emotion and learning beliefs.
- RQ4: Do demographic factors influence the relationship between emotion and learning beliefs?
  - H<sub>04</sub>: Demographics are not intervening variables in the relationship between emotion and learning beliefs.
- RQ5: Do environmental factors influence the relationship between emotion and learning beliefs?
  - H<sub>05</sub>: Environmental factors are not intervening variables in the relationship between emotion and learning beliefs.

### **Participants**

The study used a convenience sample of volunteers from the University of New Mexico research pool. These individuals were students currently enrolled in EDPY 310 or EDPY 303 and receiving class credit for participation. Volunteers were primarily students enrolled in or entering the teacher education program at UNM. Participation was not mandatory as an option for an alternative assignment for equivalent class credit was provided. As participation in a research study for class credit needed to be equally available to all students, a maximum number of participants was determined by total enrollment for the Spring 2016 semester rather than meeting an obtained power, but 100 students was the minimum expected number of participants.

After approval by the University of New Mexico Institutional Review Board (IRB), a total of 104 individuals entered the study. The sample consisted of 87.5% females ( $n = 91$ ) and 12.5% males ( $n = 13$ ). Freshman accounted for 8.7% of the sample ( $n = 9$ ), sophomores 21.2% ( $n = 22$ ), juniors 40.4% ( $n = 42$ ), seniors 29% ( $n = 20$ ) and graduate students less than 1% ( $n = 1$ ). The distribution of ethnicities was 2.9% Asian ( $n = 3$ ), 3.8% Black ( $n = 4$ ), 35.6% Hispanic ( $n = 37$ ), 41.3% White ( $n = 43$ ), and 8.7% reporting Multiracial ( $n = 9$ ). Participants' ages ranged from 17 to 54 ( $M = 24.3$ ,  $SD = 7.21$ ). Therefore, the study produced a sample that was predominantly White and Hispanic females.

One participant fell asleep during the presentation of the study videos. The participant would not be measurable on what they have learned, and their level of engagement with the study in general was in question. The participant was asked to withdraw when they awoke at the end of the video. They had completed only the initial demographics, but none of their data were included in the study.

A priori conditions were set to examine possible exclusion of additional individuals from the dataset. Given the sample was obtained by offering class credit that was more efficient than the alternative assignment, consideration of participant's fidelity in answering questions seemed prudent to ensure participants were full participants and not simply apathetically filling a seat for course credit. Exclusion was considered by category rather than by individual participants. The categories were: (1) participants who completed the Ravens in less than 15 minutes; (2) participants who were inconsistent in answering a repeated question the same way; and (3) participants who fell into both groups 1 and 2. However, the resulting analysis of participants responses was not



statistically significant than non-group members; therefore, no additional exclusions were made.

Two different locations were used. One was a small, dark basement room and the other was a large, well-lit classroom. The basement used a small projector with a screen approximately 42 inches, while the classroom used a full-sized, 90-inch projector screen with a higher quality sound system. Available participation times were split between the two locations with 48.1% participating in the classroom ( $n = 50$ ) and 51.9% participating in the basement ( $n = 54$ ). Two-hour sessions were scheduled between 10 a.m. and 6 p.m. at both locations between March 28 and April 8, 2016. Participants were asked to remain in the study for the full two hours, even if they completed their questionnaires early.

### **Procedure**

Each session began with volunteers being informed of their rights as participants, including the ability to do an alternative assignment for course credit. After being informed about the study, individuals agreeing to participate gave signed consent. Participants were instructed that this the study involves a learning task and that they will be given a brief assessment of what they have learned and understand from two different videos they were shown. Subjects were given explicit instruction on how to take each assessment as well as the purpose of those assessments. They were informed the duration of the study was approximately two hours.

Participants were asked on a five-point Likert scale from 1 – “Far worse than others” to 5 – “Far better than others” to rate how well they believed they would perform on two different assessments. This self-rating was used as an indicator of SEB. One assessment would be covering a video on logical fallacies, and another on positive

psychology. After completing the SEB questions, they completed the PANAS-X and the SAMS measures of emotion and arousal.

Participants were then shown two different videos. One was a lecture on positive psychology by one of the leading psychologists in the field, Dr. Martin Seligman. The second was a philosophy video on logical fallacies produced by US Represented. Video order was randomly assigned, with order of video being recorded as a possible intervening variable. These two videos were chosen as they were both familiar to the researcher and, through previous instructional use, it was believed there would be significant variance in efficacy beliefs between the two videos. Previously, students tended to believe the positive psychology content would be far easier to understand and master.

As emotion was not being artificially induced, it was desirable to have content that was unfamiliar to the participants, yet whose brief introduction was sufficient to evoke strong responses. Most learning takes place in the presence of strong, pre-formed learning experiences, such as a high school student attending an English class. A more longitudinal, naturalistic approach would be desirable to access the influence of these preformed conditions. Without the ability to access natural classroom interactions for the current study, videos that elicited distinct, strong responses was desirable to ensure response and performance variance across participants.

After watching the videos, participants were given a 15-question test over each of the video's content. One question on each test was redundant, checking if participants would give the same response on both questions. The positive psychology assessment was multiple selection and the logical fallacies assessment was multiple choice. In each

case, the content assessment was followed with questions assessing performance beliefs. One question was a relative measure, or FOK, where participants were asked to rate on a five-point Likert scale how well they believed they understood the content, from “not at all” to “very well.” The second belief question was an absolute measure used to measure RCJ, where participants were asked to guess how many questions they believed they had answered correctly out of the 15 possible. Order of assessment matched the order of video presentation.

Following the content assessments, participants were given the Four-Dimension Mood Scale (4DMS) and the Distress Tolerance Scale (DTS). When all participants had completed the DTS, the Raven’s Advanced Progressive Matrix (APM) was administered. Participants were given 50 minutes to complete the Ravens, with their completion time being recorded as they finished.

### **Instruments**

The following instruments were used to assess study constructs. Both the demographics and self-efficacy belief questionnaire and the knowledge and belief assessment were created for the current study, the other instruments were taken from the literature based on congruency to use in other studies. See Table 1 for a complete list of study variables and instruments.

Table 1

## Summary of study variables

Variable	Source	Type
Demographics	DESBQ	Independent
Age		
Gender		
Years Attendance		
Ethnicity		
Learning Beliefs		Dependent
SEB	DESBQ	
FOK	KBA	
RCJ	KBA	
Performance	DESBQ	Control
Emotion		Independent
Positive	PANAS-X	
Negative	PANAS-X	
Fear	PANAS-X	
Hostility	PANAS-X	
Guilt	PANAS-X	
Sadness	PANAS-X	
Joviality	PANAS-X	
PvN	SAM	
Intensity	SAM	
Dominance	SAM	
Positive energy	4DMS	
Relaxation	4DMS	
Negative arousal	4DMS	
Tiredness	4DMS	
Distress Tolerance	DTS	Independent
Tolerance		
Absorption		
Appraisal		
Regulation		
Intelligence	APM	Intervening
Environment	Observation	Intervening
Date		
Video Order		
Classroom		
Date		
Time of day		

*Note.* PvS = positive vs negative; DESBQ = Demographic and self-efficacy beliefs questionnaire; KBA = Knowledge and belief assessment

**Demographics and Self-Efficacy Beliefs Questionnaire (see Appendix A).**

Participants were asked to provide their date of birth, gender, years of college attendance, and ethnicity; these measures served as independent variables. Self-efficacy beliefs were assessed by having participants rate their confidence in their predicted performance on each of the learning tasks.

**Knowledge and Belief Assessments (see Appendix B and C).** The knowledge and belief assessments were used to generate the control variable of performance and the dependent variables of FOK and RCJ. Two knowledge and belief assessments were used, one each covering the positive psychology and learning fallacies videos. Both consisted of 14 knowledge questions covering the content and one question that was a repeat of a previous question for a total of 15 questions. The logical fallacies questions were multiple choice, but the positive psychology could optionally be graded as multiple selection. Both assessments had a 14-point total score, but a sum score was calculated for positive psychology, where each most questions had multiple possible selections for a possible maximum score of 50 points. The belief assessments asked students to rate how well they believed they did relative to other and as an estimate of the correct number of questions they were able to get correct, providing FOK and RCJ respectively.

**Positive and Negative Affect Schedule – Expanded Form (PANAS-X; see Appendix D).** The PANAS-X was used to assess the independent variables positive and negative emotion, fear, hostility, guilt, sadness, joviality, self-assurance, attentiveness, shyness, fatigue, serenity, and surprise. It is a measure of state and trait emotionality (Tellegen, Watson, & Clark, 1999; Watson & Clark, 1999). It is organized in a hierarchical structure, with most variance accounted for by the two higher-order

dimensions of positive and negative emotion. There are several second-order subscales, such as fear, guilt, attentiveness, and fatigue. Instructions may reference different timeframes, from current feelings to experiences over the past few weeks. The current study asked individuals to score how they feel in the moment the PANAS-X was being completed. The PANAS-X presents 60 words to the participant (such as “bold” and “blue”) that they are asked to score on a five-point Likert scale from 1 – “very slightly or not at all” to 5 – “extremely”. Most words used in the primary scales are not reused in subscales. Reliability, as measured by Cronbach’s alpha, has been shown to range from .85 to .9 with strong convergent validity with other measures of emotion (Merz et al., 2013; Watson & Clark, 1999).

**Self-Assessment Manikin (SAM; see Appendix E).** The SAM was used to assess the independent variables positive versus negative emotion, intensity, and feelings of dominance (Bradley & Lang, 1994). Each scale consists of five pictographs. The SAM simplifies the process of measuring emotional states to identification of simple graphics along the most researched dimensions of emotionality and is based on the demonstrated strength of the pictographic pain scale now widely in use (Bynion & Feldner, 2017; Lang, Greenwald, Bradley, & Hamm, 1993). Lang and colleagues (1993) established strong convergent validity between the SAM and externally observable measures, such as facial expression and galvanic skin response; other studies suggesting a Cronbach’s alpha reliability measure for adults ranging from .82 to .98 (Backs, da Silva, & Han, 2005; Nabizadeh Chianeh, Vahedi, Rostami, & Nazari, 2012). The SAM is the only assessment in this study’s battery that treats positive and negative emotion as polar

ends of a single dimension. Its treatment of arousal as the most general, and it is the only measure of dominance.

**Four-Dimension Mood State (4DMS; Appendix F).** The 4DMS is used to measure the independent variables positive energy, relaxation, negative arousal, and tiredness in the current study. The 4DMS consists of questions designed to measure emotion by having participants give a five-point Likert rating on a scale from 1 – “very slightly or not at all” to 5 – “extremely” to 20 adjectives which assesses emotional level according to four dimensions used as independent variables in the current study: positive energy, relaxation, negative arousal, and tiredness. The 4DMS was designed to emphasize positive and negative emotion similar to the PANAS-X (Gregg & Shepherd, 2009; Tellegen et al., 1999). The 4DMS is distinguished from the PANAS assessment by including low-arousal PA and low-arousal NA factors (relaxation and tiredness, respectively). Cronbach’s alpha reliability ranges from .88 to .93 for the different dimensions (Huelsman, Richard C. Nemanick, & Munz, 1998).

**Distress Tolerance Scale (DTS; Appendix G).** The DTS is used as a measure of the independent variables tolerance, absorption, appraisal and regulation. These variables are used as measures of distress tolerance, or the ability to manage and adjust to the effects of states of negative emotion (Simons & Gaher, 2005; Zvolensky et al., 2010). The DTS consists of 15 statements, such as “I’ll do anything to stop feeling distressed or upset.” Participants rate each statement on a five-point Likert scale from 1 – “Strongly Disagree” to 5 – “Strongly Agree.” All questions are used as a higher order, general assessment of distress tolerance. Four second-order subscales are also scored: tolerance, appraisal, regulation, and absorption. Simon and Gaher (2005) report Cronbach alphas

for the DTS from .82 to .82, values are consistent with later studies, with the general factor supporting the greatest internal consistency (Leyro, Bernstein, Vujanovic, McLeish, & Zvolensky, 2011).

**Ravens Advanced Progressive Matrices (APM; Pearson, 2011).** The APM was used to assess the independent variable of intelligence. The APM consists of 48 puzzles to assess fluid intelligence through problem-solving and reasoning (Raven, 1989; Raven, Raven, & Court, 2011). The 48 items are divided into two sets, a 12-item set and a 36-item set. For each question, seven images are presented that represents a progressive pattern. Participants are asked to choose one of eight possible images that would best complete the presented pattern. The assessment is scored by counting the total number of correct answers. The APM was selected as it is an intelligence measure well-suited to college students as it designed to differentiate people at or above a mean level of intelligence (Bors & Stokes, 1998; Raven, 1989; Raven et al., 2011). Pearson reports a Cronbach's alphas ranging from .77 to .85 for English-speaking samples (2011). Standard administration can be timed (40-minute) or untimed. For the current study, a 40-minute administration was used; however, the individual times taken were also recorded to the nearest minute.

### **Power**

G\*Power software (v. 3.1) was used to estimate post-hoc achieved power (Faul, Erdfelder, Buchner, & Lang, 2009). Using an assumption of medium effect size ( $f^2 = .15$ ) and an  $\alpha = .05$ , a multiple regression with five independent variables achieved 80% power ( $1-\beta$ , where  $\beta$  is the probability of error) at 98 participants. For the current study, achieved power ranged from 94.4% (two independent variables) to 85.6% (five



independent variables). However, actual power achieved is lower due to the inflated false-positive error rate that occurs through repeated tests of significance (Lazzeroni & Ray, 2012). Additionally, as other researchers have previously noted, the relevance of post-hoc power analysis is of questionable value (Hoenig & Heisey, 2001). Current study power may most strongly indicate the over-exclusion of significant variables, especially in regression models with more than two explanatory variables.

### **Data Analysis**

The current study used the statistical programming language R (v. 3.3.2) for all data management and analyses after initially entering data into Microsoft EXCEL. Multiple linear regression was the primary statistical strategy to examine the research questions. As the literature on direct effects of emotion on SEB is sparse, an exploratory approach was taken to examine these relationships. In each case, forward and backward regression models were examined to arrive at a parsimonious, simultaneous entry multiple regression models.

Variables were examined for outliers and the meeting of assumptions (homoscedasticity, normality, multicollinearity). Descriptive statistics were generated for each study variable. Correlation between variables was examined. Missing data were assessed and missing values imputed with modeled data.

*RQ1: Are emotions associated with how people predict their ability to perform a learning task (SEB)?* Stepwise multiple linear regression was used to assess the effects of emotional states on SEB for both the positive psychology and logical fallacies videos. The PANAS-X, SAM, and 4DMS were used for measures of emotion, and the pre-video assessment was used for SEB.

*RQ2: Are emotions associated with how learners believe they have performed on a learning task (FOK and RCJ)?* Stepwise multiple linear regression models were constructed to analyze if emotion predicted FOK and RJC. Self-efficacy belief was used as a control variable. The PANAS-X, SAM, and 4DMS were used for measures of emotion, and the post-video assessments were used for FOK and RJC.

*RQ3: Are distress tolerance or intelligence intervening variables in the relationship between emotion or arousal and learning beliefs?* Stepwise multiple linear regression models were constructed to examine the role of intelligence and emotion regulation as intervening variables on the relationship between emotion and SEB, FOK, and RJC. Outcomes from the APM were used as intelligence scores, and the DTS was used as the measure of distress tolerance. Models from RQ1 and RQ2 were re-examined with the addition of the intelligence and distress tolerance variables.

*RQ4: Do demographic factors influence the relationship between emotion and learning beliefs?* Stepwise linear regression was used to re-examine the models used in RQ1 – RQ3 with demographics variables as intervening variables. Specifically, age, ethnicity, gender, and year were used from the initial survey form.

*RQ5: Do environmental factors influence the relationship between emotion and learning beliefs?* Stepwise linear regression was used to examine if environmental effects acted as intervening variables in effects observed in regression models from RQ1 – RQ4. Environment variables included testing location, time of day, and day of the week, an order of presentation of learning material.

**Concluding Remarks**

The current study is intended to provide a basis for future research on emotion and learning as well as a rationale for interventions that focus on emotion regulation with metacognitive strategies. This work seeks to clarify the relationship between emotional state during a learning experience and the metacognitive monitoring process. Direct as well as intervening effects were examined through multiple linear regression models.

## Chapter IV

### Results

#### Overview

The purpose of the current research was to examine the role of emotion and arousal in learning belief development. The research questions were informed by a variety of analyses but relied most heavily on stepwise multiple regression linear models. No participants were excluded from the study based on *a-priori* criteria for exclusion. Missing data were imputed rather than excluded from the study.

There was little literature to inform decisions in model building. As there was no *a priori* hypothesis for order of variable entry, a direct method was used for entering independent variables rather than hierarchical modeling. Models were examined from both a step-up and step-downward approach. As supporting literature on the study variables is limited, a flexible and exploratory approach was taken in the regression models, favoring the step-down regression models at the risk of overfitting.

Individual models were built for the two different content types, logical fallacies (LF) and positive psychology (PS). To answer the research questions, beliefs about learning performance, before and after the learning experience, were used as the dependent variable with measures of emotions, arousal, dominance, regulation, and intelligence as predictors. Intelligence, distress tolerance, environment, and demographic variables were examined as intervening variables.

The first research question examines the role of emotion and arousal in pre-learning beliefs. The second examines the relationship of emotion and arousal predicting post-learning beliefs. The third research question examines how the relationships in the

first two research questions are modified or explained by intelligence and emotion regulation. The fourth research question examines the previous models in context of demographic variables. The fifth research question examines any influence environmental study variables may have had on model outcomes.

### **Study Conditions**

**Exclusions.** It is clear some students may have become rushed or used a non-traditional approach to answering some questions; however, there was insufficient evidence that any participant was willfully careless or non-participatory. While some scores may be more extreme and exert some questionable influence, no evidence could be produced that would argue for their exclusion from the study beyond providing trimmed values, closer approximating mean behavior. Despite some minor anomalies, no individual's scores were excluded or considered missing in favor of an imputed value. This choice may have lowered the total variance accounted for in the models that follow; however, that may yet be appropriate until the reason for the anomalies can be better accounted for or controlled through experimentation.

**Additional data preparation.** Data were entered twice and the two data sets checked against each other. Of all data entered, 2.8% of the data were inconsistent between the two entries. Any non-matching data points were reconfirmed. After data entry, continuous predictor variables were mean centered and standardized to simplify interpretation. Dependent variables were left in the scale in which they were assessed and scaled at the time of analysis if they were later used as control variables in other analyses.

**Missing Data.** Missing data were assessed for missing at random (MAR) and missing completely at random (MCAR). There were 11 possible data patterns discovered, but these all appeared to be related to formatting (missing the back of page) or skipping a random question. There were no clear markers of missing data (for example, skipping all questions related to Sadness). Little's test was not-significant ( $X^2 = 140.83$ ,  $df = 155$ ,  $p = .786$ ) retaining the null hypothesis that the data is MCAR. Little's test was conducted on each major scale, with no significance found in any subset of the data. Evidence suggests then that imputation may continue assuming missing values are MAR.

Of the total dataset, 1.9% of the data were missing. If restricted to calculated and study variables, 2.6% was missing. Approximately one in five assessment questions contained at least one row of missing data. The variables with the greatest amount of missing data were the negative and positive emotion measure (PANAS-X) at 6.7% and 3.9%, respectively. All other variables had less than 2% missing data.

Missing data were imputed using MICE – multiple imputation via chained equations –and predictive means matching (Azur, Stuart, Frangakis, & Leaf, 2011; van Buuren & Groothuis-Oudshoorn, 2011). Multiple iterations were performed and the first complete imputed dataset was retained. The imputed dataset was checked against the initial dataset for significant alterations to the score distributions; however, the imputations appeared to have minimal impact on the overall behavior of the study variables.

**Locations.** Data collection occurred either in a well-lit, open classroom or in a darker, slightly less appealing lab room in a basement. All data were collected at the

University of New Mexico. Data collection occurred from March 25 to April 8, during the Spring 2016 semester.

**Instruments.** All instruments demonstrated sufficient reliability and internal structure for the needs of the current study. The factor structure of the PANAS-X, DTS, and 4DMS was examined and found to have structures congruous with the published factor analyses of each measure. Reliability was calculated on the DTS ( $\omega_h = .74$ ,  $\omega_t = .93$ ), the 4DMS ( $\omega_h = .50$ ,  $\omega_t = .93$ ), and a limited PANAS-X (restricted to positive, negative, fatigue, and self-assurance;  $\omega_h = .79$ ,  $\omega_t = .91$ ). Reliability estimates are low but sufficient for the DTS and PANAS-X. The small sample size for this study made it unlikely that appropriate model fit would be achieved for a CFA or accurate estimation of omega. As the data for each of these tests are generated from a Likert scale questionnaire, the polychoric correlation matrix for each assessment was used to account for the ordinal nature of the data.

The 12 item APM short form has an expected reliability of about  $\alpha = .71$ , but the current study only produced  $\alpha = .59$ . The full, set 2 APM typically has reported reliabilities of about  $\alpha = .85$ , which was similar to the reliability found for the current study ( $\alpha = .86$ ). The low reliability in the short APM was also seen in the two knowledge assessments ( $\alpha_{LF} = .56$ ,  $\alpha_{PS} = .67$ ). Low reliabilities may be due, in part to sample size, but more likely internal consistency wasn't a primary concern in the creation of these assessments. When the performance measures were examined through IRT 2PL models, a sufficient level of test information was achieved. While not ideal, given the sample size and type of tests, reliability may be an indicator low power was achieved, but sufficient to support study findings.

**Assumptions.** The data and analyses that follow were examined extensively for violations of assumptions and overall model fit. Independence was largely assumed, though items were screened for repeated or dependent language and the Durbin Watson test was used to check for non-independence of errors. Outliers and heteroscedasticity were examined statistically and graphically. Variance inflation factor was used to check against multicollinearity. Negative emotion and its sub-components suffered from a floor effect. Using a square root transformation had minimal influence on effect size and model fit; therefore, the data were presented without square root transformation to simplify interpretation.

### **Outcomes**

**Correlations.** Correlations between the variables were examined to better understand the strengths of association between the variables in general. The research questions for this study require more complex modeling than simple correlations, as they require that many of the variables in question be considered as intervening variables rather than ones of direct association.

The video outcomes generally demonstrate positive, moderate correlations with linear relationships. Participant's SEB on the LF assessment ( $M = 3.47, SD = .79$ ) was significantly lower than how well their SEB for PS ( $M = 3.71, SD = .68$ ),  $t(103) = 3.08, p = .003$ , and were moderately correlated ( $r = .42, p < .001$ ). Despite initial beliefs, participants did significantly better,  $t(103) = 13.21, p < .001$ , on the LF assessment ( $M = 6.53, SD = 2.43$ ) than the PS assessment ( $M = 3.64, SD = 2.26$ ); however, they were strongly correlated (scores,  $r = .57, p < .001$ ). The correlation between learning beliefs before and after the videos and assessment were similar for both the LM (see Figure 1 for



all). Post-assessment learning beliefs were significantly different between subject (see Table 2). The total and sum scores for the PS video assessment were strongly correlated ( $r = .86, p < .001$ ).

Figure 2 shows the factors of arousal from the 4DMS and SAM. Surprisingly, the general measure of arousal from the SAM was not correlated with the arousal measures from the 4DMS. Tiredness was associated with negative arousal ( $r = .66, p < .001$ ) and positive energy was associated with relaxation ( $r = .42, p < .001$ ), but the other correlations were weak.

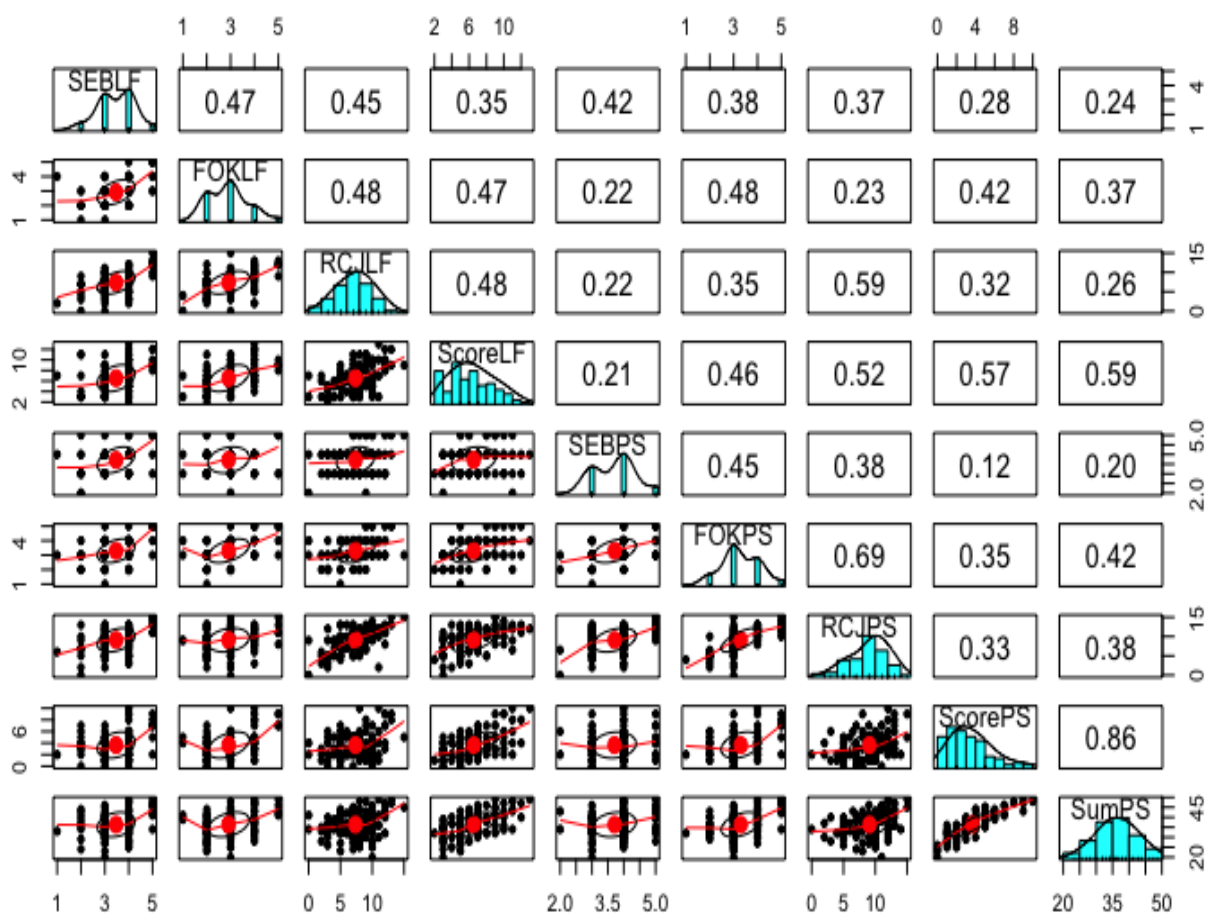


Figure 1. Learning Beliefs and Performance Score Correlations. ScoreLF and ScorePS = performance scores on LF and PS. SumPS = PS scored as a total of partial credit points

Table 2

## Belief and Performance Differences Between LF and PS

Variable	Logical Fallacies		Positive Psychology		$t(103)$	$p$
	$M$	$SD$	$M$	$SD$		
SEB	3.47	.79	3.71	.68	3.09	.003
FOK	2.91	.67	3.30	.82	4.55	<.001
RCJ	7.36	2.98	9.09	3.08	6.40	<.001
Score	6.53	2.54	3.64	2.26	13.21	<.001

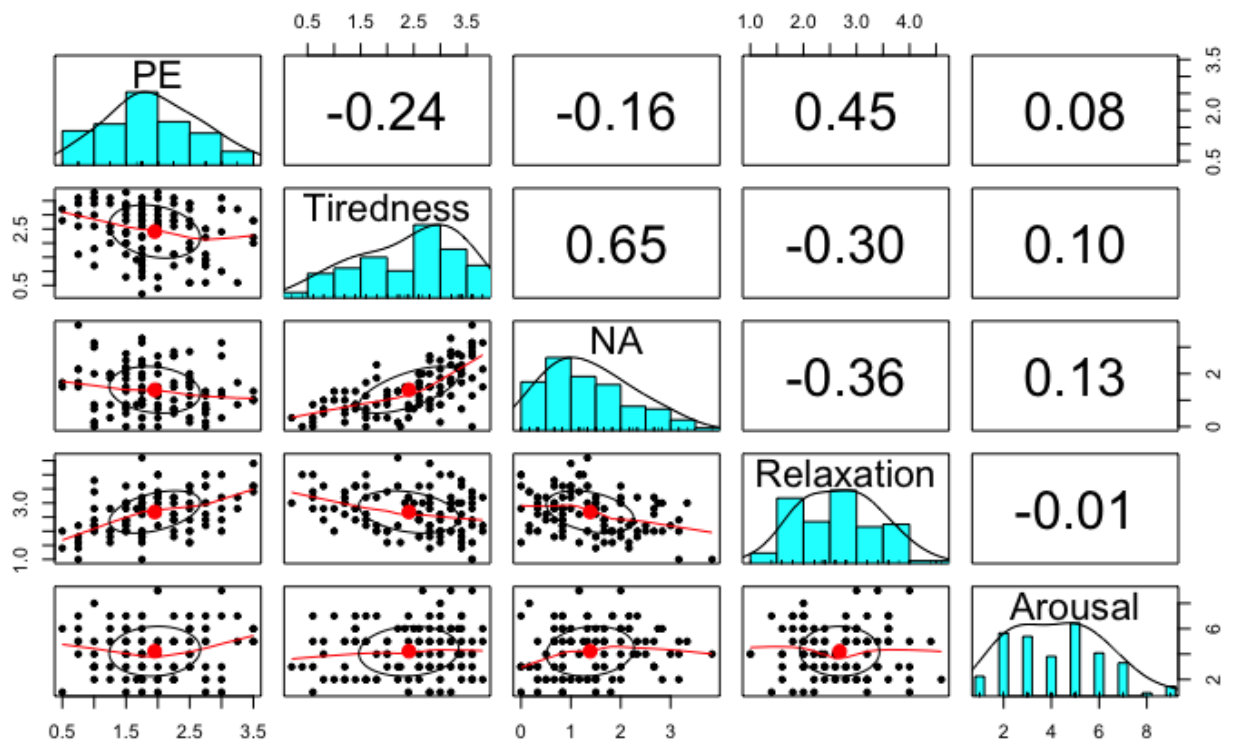


Figure 2. Measures of Arousal.

PE = Positive energy; NA = Negative arousal

The outcomes from the learning events were examined for a relationship to the other study variables. The only significant predictor of performance was intelligence as measured by the APM. Intelligence accounted for about 28.6% of the variance in performance on the positive psychology content and 38.1% of the variance in the logical fallacies content.

### **Research Questions.**

*RQ1. Are emotions associated with how people predict their ability to perform a learning task (SEB)?*

Multiple linear regression models were created to analyze the relationship between self-efficacy beliefs and measures of emotion. Models were examined using a combination of ANOVA based model testing and AIC stepwise multiple regressions. Hostility, fear, sadness, fatigue, and positive emotion were from the PANAS-X. Tiredness and negative arousal were from the 4DMS. Dominance was from the SAM.

Modeling expected outcome beliefs for the logical fallacies video, a significant regression equation was found ( $F_{(5,97)} = 5.43, p < .001$ ) with an  $R^2 = .219$  indicating the model accounted for about 21.9% of the variance in the  $SEB_{LF}$  belief. The final model indicates  $SEB_{LF}$  is predicted by sadness ( $\beta = .204$ ) fear ( $\beta = -.158$ ) positive emotion ( $\beta = .265$ ), tiredness ( $\beta = -.233$ ), and fatigue ( $\beta = .224$ ). All factors were significant,  $p < .05$ .

Modeling expected outcome beliefs for the positive psychology video, a significant regression equation was found ( $F_{(7,95)} = 4.88, p < .001$ ) with an  $R^2 = .264$ , indicating the model accounted for about 26.4% of the variance in the  $SEB_{PS}$  belief. The  $SEB_{PS}$  model was significantly improved ( $F_{(1,2)} = 4.04, p = .02$ ) by adding a negative arousal and a dominance factor to the model. Based on the final model, participant

SEB<sub>PS</sub> is predicted by sadness ( $\beta = .126$ ) fear ( $\beta = -.140$ ) positive emotion ( $\beta = .232$ ), tiredness ( $\beta = -.213$ ), fatigue ( $\beta = .166$ ), negative arousal ( $\beta = .159$ ), and dominance ( $\beta = .131$ ). All factors were significant,  $p < .05$ , except sadness. Sadness was retained for model salience and relative size of effect despite not obtaining significance ( $p = .07$ ).

Negative emotion did not fit the model as a single factor. When multiple measures of negative emotion were included in the model, there was an issue of independence as multiple questions were repeated in the calculations for each of their scores. Overall report of negative emotion was also low. Therefore, the individual constructs for negative emotions were examined in the regression models.

*RQ2. Are emotions associated with how learners believe they have performed on a learning task (FOK and RCJ)?*

Multiple linear regression models were constructed to analyze the relationship FOK and RCJ with measures of emotion and arousal, controlling for SEB and actual performance as measured by a learning outcome assessment. Modeling belief of relative outcome, FOK, for the Logical fallacies video, a significant regression equation was found ( $F_{(3,99)} = 18.48, p < .001$ ) with an  $R^2 = .359$  indicating the model accounted for about 35.9% of the variance in the FOK<sub>LF</sub> belief. Based on the model with standardized predictor variables, participant FOK<sub>LF</sub> was decreased by fear ( $\beta = -.180$ ), and increased by previous prediction (SEB<sub>LF</sub>,  $\beta = .298$ ) and actual learning performance ( $\beta = .289$ ). Modeling post-learning belief on the number of items correct, RCJ<sub>LF</sub>, a significant model was found ( $F_{(4,98)} = 13.96, p < .001$ ) with an  $R^2 = .363$  indicating the model accounted for about 36.3% of the variance in the RCJ<sub>LF</sub> belief. An increase in RCJ<sub>LF</sub> was predicted by increased positive energy ( $\beta = .562$ ), tiredness ( $\beta = .440$ ), previous prediction (SEB<sub>LF</sub>,  $\beta =$

1.11) and actual learning performance ( $\beta = .934$ ). All variables were significant ( $p < .05$ ) except tiredness in the RCJ<sub>LF</sub> model ( $p = .08$ ). For the RCJ<sub>LF</sub> model, dominance was not a significant factor.

Modeling outcome FOK<sub>PS</sub> beliefs for positive psychology, a significant regression equation was found ( $F_{(3,99)} = 19.16, p < .001$ ) with an  $R^2 = .367$  indicating the model accounted for about 36.7% of the variance in the FOK<sub>PS</sub> belief. Participant FOK<sub>PS</sub> was decreased by fear ( $\beta = -.136$ ), and increased by previous prediction (SEB<sub>PS</sub>,  $\beta = .320$ ) and actual learning performance ( $\beta = .309$ ). Modeling post belief on number of items correct, RCJ<sub>PS</sub>, a significant model was found ( $F_{(3,99)} = 10.6, p < .001$ ) with an  $R^2 = .243$  indicating the model accounted for about 24.3% of the variance in the RCJ<sub>PS</sub> belief. An increase in RCJ<sub>PS</sub> was predicted by increased dominance ( $\beta = .582$ ), previous prediction (SEB<sub>PS</sub>,  $\beta = .714$ ) and actual learning performance ( $\beta = .876$ ). All variables were significant predictors ( $p < .05$ ). For the RCJ<sub>PS</sub> model, positive energy and tiredness were not significant factors.

*RQ3. Are distress tolerance or intelligence intervening variables in the relationship between emotion or arousal and learning beliefs?*

Multiple linear regression models were used to examine the effects of intelligence, as measured by the APM, and emotion regulation from the DTS. Multiple linear regression models were rebuilt to include emotion regulation and APM scores for SEB, FOK and RJC. A new, significant regression model was fit to SEB<sub>LF</sub> ( $F_{(8,94)} = 5.98, p < .001$ ) with an  $R^2 = .337$ , indicating the model accounted for about 34.2% of the variance in the SEB<sub>LF</sub> belief. In the updated model, increased SEB<sub>LF</sub> is predicted by increased sadness ( $\beta = .159$ ) and fatigue ( $\beta = .193$ ) and intelligence ( $\beta = .230$ ); it is

decreased by fear ( $\beta = -.167$ ) and tiredness ( $\beta = -.206$ ). There is an interaction between positive energy and regulation (positive energy,  $\beta = 1.21$ ; emotion regulation,  $\beta = .668$ ; interaction,  $\beta = -.642$ ). All factors were significant,  $p < .05$ , except the interaction term ( $p = .057$ ).

Multiple linear regression models were rebuilt for the positive psychology belief outcomes to include emotion regulation and APM scores for SEB, FOK and RJC. There was insufficient evidence for Intelligence and emotion regulation contributing to SEB<sub>PS</sub> or FOK<sub>PS</sub>, therefore there was no change in these models. A new, significant regression model was fit to RCJ<sub>PS</sub> ( $F_{(4,98)} = 10.41, p < .001$ ) with an  $R^2 = .298$ , indicating the model accounted for about 29.8% of the variance in the RCJ<sub>PS</sub> belief. An increase in RCJ<sub>PS</sub> was predicted by increased dominance ( $\beta = .557$ ), previous prediction (SEB<sub>PS</sub>,  $\beta = .649$ ), actual learning performance ( $\beta = .576$ ), and intelligence ( $\beta = .781$ ). All variables were significant predictors ( $p < .05$ ).

*RQ4. Do demographic factors influence the relationship between emotion and learning beliefs?*

Each of the regression models from RQ1 to RQ3 were re-examined with age, year in college, ethnicity, and gender. For the LF models, only RCJ<sub>LF</sub> was influenced by demographic variables. The new RCJ<sub>LF</sub> model was statistically significant ( $F_{(3,99)} = 24.19, p < .001$ ) with an  $R^2 = .423$ , indicating the model accounted for about 42.3% of the variance in the RCJ<sub>LF</sub> belief. The new model showed an increase in RCJ<sub>LF</sub> was still associated with previous prediction (SEB<sub>LF</sub>,  $\beta = 1.11$ ) and actual learning performance ( $\beta = .934$ ) while females were associated with an average additional 2.88 point increase in the number of questions believed to be correct. Therefore, regarding anticipated total

points correct, males ( $M = 6.57, SD = 2.61$ ) tended to guess higher on how many questions that they answered correctly than females ( $M = 6.08, SD = 2.93$ ); however, when controlling for differences in prior guess and actual performance, females tended to guess higher. All variables were significant ( $p < .001$ ). When gender was included in the model, positive energy and tiredness were no longer significant predictors.

For the PS models, only FOK<sub>PS</sub> was modified by a demographic variable, age (standardized). The new model was statistically significant ( $F_{(4,98)} = 16.35, p < .001$ ) with an  $R^2 = .401$ , indicating the model accounted for about 40.1% of the variance in the FOK<sub>PS</sub> belief. For the new model, increased FOK<sub>PS</sub> was associated with decreased fear ( $\beta = -.145$ ) and increased previous prediction (SEB<sub>PS</sub>,  $\beta = .332$ ) actual learning performance ( $\beta = .154$ ) and age ( $\beta = .154$ ). The gender effect seen in RCJ<sub>LF</sub> was not repeated positive psychology models.

*RQ5. Do environmental factors influence the relationship between emotion and learning beliefs?*

Each regression model from RQ1 to RQ4 was tested against competing models with classroom, time of day, and date included as intervening variables. If time was restricted to morning versus afternoon sessions, a single, significant model could be coerced including the variable. Environmental variables were either not significant or accounted for significantly less variance than the prior models.

As a further examination of the environmental data, t-tests were calculated (uncorrected) for effects of the room or time of day on the emotion, performance, and belief variables. Only the effects of room on fear (Basement  $M = 1.89, SD = 1.96$ ; Classroom  $M = 2.96, SD = 3.21$ ;  $t(79.8) = 2.03, p = .045$ ) and hostility (Basement  $M =$

1.11,  $SD = 1.69$ ; Classroom  $M = 2.18$ ,  $SD = 2.95$ ;  $t(76.8) = 2.26$ ,  $p = .028$ ) were significant, and only the time of day effects on SEB<sub>PS</sub> (Morning  $M = 3.93$ ,  $SD = .7$ ; Afternoon  $M = 3.63$ ,  $SD = .65$ ;  $t(47.7) = 2.02$ ,  $p = .049$ ) and PS video sum score (Morning  $M = 38.3$ ,  $SD = 5.7$ ; Afternoon  $M = 35.6$ ,  $SD = 6.3$ ;  $t(55.6) = 2.15$ ,  $p = .036$ ) were significant. There is insufficient evidence against classroom and time of day effects being more than proxies for more salient variables, such as positivity, regulation, and negative arousal.

### **Summary**

Demographics and environment were minimally influential in beliefs about learning performance. It was expected that there would be differential functioning between the two content types; the difference was present and impacted the influence of the independent variables across all constructs. As predicted, participants assumed they would perform better on the positive psychology portion of the study, yet it proved to be more difficult than the logical fallacies learning session. Evidence suggests group differences are less influential than content type on belief formation, both before and after a learning task.

Positive emotion was a consistent predictor across models for SEBs; however, measures of negative emotion and emotion did not contribute to any model unless positive emotion was included as a control variable. This may in part been due to the floor effect and relatively few participants who reported larger scores on the negative measures, but it was further confounded by the inconsistent effects of the subscales that made up the negative emotion scales. For example, sadness tended to predict an increased performance belief while fear tended to predict a diminished one.



Further, intelligence and emotion regulation were significant contributors to belief formation, but more so on post-learning beliefs. Dominance has an unexpectedly strong and limited role in influencing beliefs, but only for the positive psychology learning. It was also unexpected that the only measure on the emotion scales to directly influence FOK was fear, and that any effects arising from emotion on FOK or RJC appeared to be occurring indirectly through the presence of SEB as a predictor. The current study is unable to distinguish if the relationship between emotional states and post-learning beliefs is a direct effect or if they have no effect as once learning beliefs are formed (SEB), the emotional states only serve to maintain the SEB beliefs.

## **Chapter V**

### **Discussion**

#### **Summary of Study**

The current study examined how beliefs about learning are influenced by emotion and intervening variables that may influence that relationship. Measures of general emotion, arousal, regulation, and intelligence were modeled using linear regression to examine their influence on learning beliefs. The sample consisted of 104 UNM students attending a class in either EDPY 303 and EDPY 310. Participants were mostly female, and either Hispanic or White.

Positive and negative emotion, along with arousal, were found to have a strong relationship to pre-learning belief formation. Post-learning beliefs are most strongly predicted by pre-learning beliefs and actual test performance. Fear can influence relative beliefs while dominance is more strongly associated with absolute estimates of performance. Intelligence and distress tolerance are also associated with post-learning beliefs, but their influence appears to be dependent on content type.

Multiple linear regression models suggest a complex relationship between how people perceive learning content and emotional states influences how they form beliefs about their expected and reflective performance. For material that was perceived as more difficult (logical fallacies), higher levels of emotion regulation and intelligence were associated with increased performance beliefs, but not with material that was perceived as easier (positive psychology). However, after participants experienced a greater-than-expected challenge on the positive psychology task, individual's absolute reflective

judgment beliefs became influenced by intelligence and dominance, indicating it is possible an unconscious change in strategy occurred.

**RQ1: *Are emotions associated with how people predict their ability to perform a learning task (SEB)?***

Measures of emotion and arousal accounted for about  $\frac{1}{4}$  of the variance in learning belief predictions (LF  $\approx 21.9\%$ ; PS  $\approx 26.4\%$ ). SEB was positively associated with measures of positive emotion; however, there was a more complex relationship between negative emotion and type of arousal. Negative emotion did not have a significant effect alone, and it was poorly distributed. In addition, individual components of negative emotion had inconsistent effects.

For predicting both learning fallacy and positive psychology learning outcomes, higher positive emotion was associated with predicting a better learning outcome, as was sadness, and fatigue. However, fear and tiredness were associated with lower learning predictions. For positive psychology, both negative arousal and dominance were associated with higher belief predictions, but they were not predictors for SEB<sub>LF</sub>.

Measuring emotion or arousal as a spectrum along a single dimension (as was done with the SAMS assessment) was not a significant predictor of learning beliefs. Study outcome models suggest negative emotion and arousal appear to have an influence on SEB, but that relationship is dependent on the source and subtype for each construct. Most salient was the impact of arousal level. Both positive and negative forms of arousal were consistently associated with learner beliefs.

The models support the hypothesis that different strategies may be used for different content types. Variables present in both models had similar effect size and

direction; however, the models varied as to predictors. Negative emotion measures were sufficiently skewed and with a substantial floor effect that suggests there were insufficient levels of negative emotion within the study group to accurately report on the effects of negative emotion.

***RQ2: Are emotions associated with how learners believe they have performed on a learning task (FOK and RCJ)?***

Participants were asked about how well they believed they had done on logical fallacies and positive psychology learning tasks. They were asked to estimate how well they had done relative to others (FOK) and by total number of correct questions (RCJ). Participants' FOK was predicted by fear, pre-learning belief, and actual performance regardless of content topic, and accounting for about 36% of total FOK variance. Fear was measured as a general state before assessment and was not a product of the learning event itself.

When performance belief was measured as an absolute value (estimated number correct, RCJ), predictor variables were not consistent for the two content types. SEB and actual performance were significant predictors regardless of content, but the RCJ for the logical fallacies content, believed to be more difficult, was associated with positive energy and tiredness, while the positive psychology content belief was better modeled by a positive association with dominance. It appears that the positive psychology content, which was generally found to be harder than expected, appears to have caused learners to fall back on their dominance, or feelings of being in control to inform them on how well they had done on the learning task.

Actual performance predicting both FOK and RCJ reflected a moderate relationship between performance and belief. This relationship suggests that participants generally possessed a moderate level of metacognitive awareness and realistic evaluation of their performance. Participants had some sense of how well they performed, but their post-learning beliefs were still influenced by additional study variables such as initial performance belief and emotional state.

***RQ3: Are distress tolerance or intelligence intervening variables in the relationship between emotion or arousal and learning beliefs?***

Emotion regulation and intelligence were significant predictors with pre-learning beliefs for the logical fallacies content, but not the positive psychology content. Intelligence was positively associated with SEB<sub>LF</sub> while emotion regulation had an interaction with positive emotion. Both factors suggest a level of metacognitive awareness as reinforced by prior learning experience. There was insufficient evidence for emotion regulation interacting with negative emotion measures, and neither intelligence nor emotion regulation influenced post-learning beliefs.

Emotion regulation failed to contribute to any learning belief model for the positive psychology content. Intelligence predicted RCJ<sub>PS</sub>, but there was no evidence to support its influence in SEB<sub>PS</sub> or FOK<sub>PS</sub>. The inconsistencies in models may indicate a weakness in the data, but it may also indicate a difference in how perceived difficulty influences belief development. For material that is perceived to be less difficult, the metacognitive strategy from emotion regulation and intelligence were not influential on SEB learning belief development.

**RQ4: *Do demographic factors influence the relationship between emotion and learning beliefs?***

The effects of gender and age were inconsistent. While gender replaced positive energy and tiredness in the RCJ<sub>LF</sub> model, it failed to contribute to any additional models. Age had a positive association with post-learning outcomes for positive psychology, but not logical fallacy learning beliefs. There was no *a priori* evidence for these demographic relationships and may have been an artifact of random variance. The gender variable could have been a proxy for other variables specific to the small male sample in the study. Age could be an intervening variable for material that was believed to be easy but wasn't. Age may have had a dampening effect, insulating a student's post-learning beliefs.

**RQ5: *Do environmental factors influence the relationship between emotion and learning beliefs?***

There was insufficient evidence that models of learning belief development based on emotion, arousal, dominance, and regulation have additional variance accounted for by adding time of day or learning environment to the model. It would be expected with additional environments or more extreme learning times would not be significant contributors once current model variables were included; however, additional studies would be required to confirm. Time of day and environment may have a direct effect, but their effects are best understood as proxies for emotion and arousal variables.

**Findings and Implications**

Study outcomes suggest support for the hypothesis that positive emotion causes people to overestimate how well they will perform a learning assessment. Similarly,

arousal measures such as tiredness predicted both how well individuals believed they would do and how well they had performed. This finding suggests the outcomes may support an approach versus withdraw theoretical basis for belief formation. Approach versus withdrawal effects of the constructs may account for the opposite effects found within negative emotion and arousal constructs. The positive association with sadness and accuracy could be linked to the somewhat controversial view that depression tends to make people more realistic in their estimates.

The influence of fear and dominance on post-assessment beliefs appear to reflect a possible recency effect on post-assessment processing. The extent to which an individual was feeling in control and successful in recent experience generally appears to have been applied to the specific learning contexts. This may indicate a general effect from self-confidence on post-learning beliefs.

The study findings suggest emotional states and levels of arousal directly influence learning beliefs. These beliefs, as part of student metacognitive processing, may have an undesirable impact on student behavior. If students are made aware of these relationships and given tools to more accurately monitor their progress, the negative impacts could be decreased. This cycle can be most clearly seen in mathematics phobias, where students can underestimate their ability, and, despite a successful test, believe they are performing poorly, thereby creating a chronic state of low SEBs based on emotional valence rather than objective measurement.

Study outcomes are best predicted by cognitive models and research that include bottom-up processing where emotions are the driving cues in rapid, heuristic thinking (de Waal & Ferrari, 2010; Dolcos, Jordan, & Dolcos, 2011b; Immordino-Yang & Damasio,

2007; Phelps & Sharot, 2008). This supports Koriat's (1997) hypothesis that post-learning beliefs are strongly formed from simple heuristic. Koriat calls these emotion based beliefs noetic feelings, and Dokic (2012, p. 302) later calls noetic feelings the "seeds of self-knowledge." It appears then that the seeds of self-knowledge when learning may be sown with speed rather than accuracy.

While Bandura (1997; 2010) suggests physiological states can influence self-efficacy, the researcher of the current study suggests the findings for a complex relationship between negative arousal and belief development indicate that physiological state is insufficient to account for this relationship. It appears that emotion, or the cognitive interpretation of the physiological state, is a better predictor of self-efficacy belief development. This finding supports previous research on emotion and self-efficacy, as does the positive association of positive emotion and self-efficacy (Kavanagh & Bower, 1985). However, current findings diverge from previous research by suggesting a more complex relationship between negative emotions and self-efficacy than has previously been considered. Further, the finding that self-efficacy is an emotion-driven heuristic, may suggest the mechanisms of SEB are similar to FOK and RCJ. Further research is required to examine the extent to which these constructs function similarly and where the points of divergence are.

The Dunning-Kruger effect suggests individuals with the lowest ability are the worst at estimating their ability (Kruger & Dunning, 1999). If the learning beliefs informing metacognitive monitoring are heuristics driven by emotion, then those with the lowest ability may be at increased risk for emotional influence as they are less capable of reflectively monitoring when the accuracy of their estimates have deviated from objective



assessment. Considering the tenacity that an individual tends to trust their beliefs once formed (Loftus, 1975), and it is important researchers and practitioners developing an intervention to improve objective, heuristic thinking, especially when learning novel skills or with individuals with low ability.

### **Limitations**

The current study had multiple limiting factors, primarily resulting from time limitations and the sample, with sample limitations creating the most obvious concern. Participants were all university students, taking the same courses. Therefore, it was limited to adults who were in or interested in an education or services-related field. While any narrow sample raises concerns, the present sample may have additional influences close to the current study, such as increased metacognitive awareness and self-regulation. The sample limitation particularly raises concerns about the generalizability of outcomes.

The limited window in which the study needed to occur (two hours per session) created three additional factors that significantly limited the study. The APM assessment the videos consumed most of the allotted two hours for the study. Had time been less of an issue, additional steps could have been taken to improve the overall validity and generalizability of the outcomes. Specifically, qualitative assessments could have improved the interpretability of outcomes.

The first factor is in regard to the assessments. FOK and RCJ assessments are best performed when follow-up question such as “which questions specifically do you believe you missed” and “how do you feel these questions evaluated your understanding of the material.” This line of questioning would provide additional insight into how the

readers felt about their performance and possibly reveal emotion-based processing that is not easily assessed with Likert scale items. However, as noted by Schraw (2009), no single method or approach to measuring metacognitive monitoring has proven sufficient to form a best practices standard.

The self-efficacy assessments were only a single question in each category. Specific assessments and recommendations for self-efficacy exist in the literature (Pajares, 1996; Pajares, Hartley, & Valiente, 2001). While the recommendation of using a Likert type scale was followed, the use of more questions and those with previously demonstrated psychometric properties would offer an overall stronger assessment and strengthen the ability to draw conclusions from the outcomes.

The second factor was the instructional content. Learning material was presented only as brief videos. To apply outcomes to a general theory of learning, additional features such as classroom interactions, peer discussions, reading, and self-study would need to be included. Similarly, the two content pieces themselves were of a similar type and may not accurately reflect the same processes occurring in different subjects, such as mathematics or art. The method and similarity of instructional delivery raises concerns about the generalizability of study outcomes.

The third, time-limited factor was longitudinal effects and salient behaviors resulting from beliefs formed by emotional states. It appears there is evidence that emotional state influences belief formation; however, a longitudinal study that examined the evidence for these beliefs in student behavior would provide stronger evidence and implications. For example, if a student maintained a positive mood state over a week directly influencing their beliefs in their content understanding, such a belief may have

implications for how much, or how little, the student spends studying in the coming weekend.

### **Future Research**

There are several mood and emotion inducing techniques that have been used successfully in psychology research, spanning multiple paradigms of emotional states (Martin, 1990). There have even been some recent advances in the area using virtual reality (VR) to induce temporary states of emotion needed for research outcomes (Felnhofer et al., 2015). By eliciting the desired mood states with different individuals, especially at multiple data collection points, a far greater level of analysis could occur. Such an approach would allow for inter-individual differences to be examined and compared across individuals.

Many of the limiting factors of the current study could be addressed by a longitudinal study that followed students across multiple grade levels as they progressed through a semester. This approach would allow for multiple emotional states for each individual while looking at performance across multiple subjects. In addition to greater ecological validity, such a study would likely provide more meaningful and domain specific measures of effect size.

Lastly, a better understanding of intervening variables could provide greater insight into possible mechanisms of both belief formation as well as possible actions of remediation. Mindfulness is a well-studied construct directly linked to metacognitive practices and behavioral outcomes from emotional states (Bishop et al., 2004). In addition to being an intervening variable, mindfulness could provide an approach for

students to learn to decrease their awareness of their own internal processes and decrease unwanted effects from strong emotional states when dealing with learning beliefs.

An additional focus for intervening variables could be secondary effects of psychological illness. Behaviors such as ruminating could be examined for effects arising from anxiety and depression, conditions which have strong links to metacognition, behavior, and belief formation, including SEBs (Maciejewski, Prigerson, & Mazure, 2000; Martocchio, 1994; Nolen-Hoeksema, 2000). Either controlling for those factors, or more richly, following individuals with both acute and chronic anxiety related or depressive conditions may provide additional insights into mechanisms of actions. Additional insights may even be gained through a case study approach that examined individual narratives to determine successful strategies employed by students suffering from conditions such Generalized Anxiety Disorder (GAD) as they deal with the impacts of powerful emotional states in relation to their academic beliefs and behaviors.

### **Conclusion**

Despite the limitations of the current study, it begins to fill a gap in the literature on the relationship between emotional states and the formation of learning beliefs. While experienced educators may have an instinct toward much of what is reflected in this study, the study provides research support to those beliefs. The study controlled for key variables that educators are likely to have personal beliefs and experiences with (intelligence, demographics, emotion regulation), and provides additional support for teaching students metacognitive skills and strategies for improving their learning.

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## Appendix A

### Demographics and self-efficacy beliefs questionnaire

What year were you born? \_\_\_\_\_

*Circle One:*

What is your gender: Male Female

Academic progress: Freshman Sophomore Junior Senior

What is your ethnicity:

Hispanic or Latino Black or African American Native American

White Asian Pacific Islander Other

After watching two videos, one on logic and the other on positive psychology, how well do you think you would do on a questionnaire checking your understanding of the content, compared to others?

Questionnaire on a video explaining Logical Fallacies

1	2	3	4	5
Far worse than others	Slightly worse	About the same	slightly better	Much better than others

Questionnaire on a video discussing Positive Psychology

1	2	3	4	5
Far worse than others	Slightly worse	About the same	slightly better	Much better than others

## Appendix B

### Knowledge & Belief Assessments

#### Logical Fallacies

Circle the best answer

1. The statement “He is a wealthy Harvard professor; he can’t really understand what it is like to be poor” is most likely an example of:
  - A. Logical conclusion
  - B. False Dichotomy
  - C. Hasty Generalization
  - D. Ad Hominem
  - E. The Non Sequitur
  
2. The statement “We all know what is best for our school, it is time to take action” is most likely an example of:
  - A. False Dichotomy
  - B. Goal oriented beliefs
  - C. Hasty Generalization
  - D. Consensus based Conclusion
  - E. Ad Hominem
  
3. Opinions expressed as facts and not based on evidence is most likely:
  - A. Democratic speech
  - B. False Dichotomy
  - C. Hasty Generalization
  - D. Ad Hominem
  - E. Faulty Analogy
  
4. “You have to vote in the election or you do not support Democracy” is an example of:
  - A. Deductive logic
  - B. False Dichotomy
  - C. Inductive reasoning
  - D. Hasty Generalization
  - E. Ad Hominem



5. "Marijuana is a gateway drug" is an example of which fallacy:
  - A. False Analogy
  - B. False Dichotomy
  - C. Slippery Slope
  - D. Hasty Generalization
  - E. Ad Hominem
  
6. Attacking someone based on their membership in a religion or political association is:
  - A. Circular Reasoning
  - B. False Dichotomy
  - C. Slippery Slope
  - D. Hasty Generalization
  - E. Ad Hominem
  
7. "The King's word is divine because he was appointed by the gods as their voice" is which type of logical fallacy:
  - A. False Analogy
  - B. Circular reasoning
  - C. Red herring
  - D. Hasty Generalization
  - E. Ad Hominem
  
8. "Everyone is going to go to Florida for spring break so that is the only place you should go" is best fit to which logical fallacy:
  - A. False Analogy
  - B. Bandwagon Fallacy
  - C. Red herring
  - D. Hasty Generalization
  - E. False Dichotomy
  
9. "America, love it or leave it" is which type of logical fallacy:
  - A. False Analogy
  - B. False Dichotomy
  - C. Slippery Slope
  - D. Hasty Generalization
  - E. Ad Hominem

10. “We had 30 inches of snow last month, obviously global warming isn’t real” is which type of logical fallacy:
- A. The non Sequitur
  - B. False Dichotomy
  - C. Slippery Slope
  - D. The Relativist Fallacy
  - E. Ad Hominem
11. Person one says “We are losing our personal freedoms and rights to privacy.” Person two responds with: “We are under terrorist threat; we can’t afford to worry about personal rights.” What type of fallacy is person two using?
- A. Red Herring
  - B. False Dichotomy
  - C. Slippery Slope
  - D. The Relativist Fallacy
  - E. Ad Hominem
12. “Those who can’t do, teach” is an example of which fallacy?
- A. Hasty Generalization
  - B. False Dichotomy
  - C. Slippery Slope
  - D. The Relativist Fallacy
  - E. Ad Hominem
13. “If we have background checks for guns, next we will lose our rights to own guns entirely” is an example of which fallacy?
- A. False Analogy
  - B. False Dichotomy
  - C. Slippery Slope
  - D. The Relativist Fallacy
  - E. ad Hominem
14. “We had 30 inches of snow last month, obviously global warming isn’t real” is which type of logical fallacy:
- A. False Analogy
  - B. False Dichotomy
  - C. Slippery Slope
  - D. The Relativist Fallacy
  - E. Ad Hominem

15. Superstitions are an example of what logical fallacy?

- A. False Analogy
- B. Hasty Generalization
- C. Slippery Slope
- D. The Relativist Fallacy
- E. Ad Hominem

**Out of the 15 questions that were asked, how many do you believe you answered correctly? \_\_\_\_\_**

**How well did you understand the content of Logical Fallacies video?**

**Circle One:** Not at all      Poorly      Average      Well      Very Well

## Appendix C

### Knowledge & Belief Assessment – Logical Fallacies

#### Positive Psychology

For each question, **circle ALL that are true**

1. Why did Dr. Seligman say the state of Psychology was “Good”
  - a. We developed a disease model of psychology
  - b. We have become better at measuring ways of testing psychological illness
  - c. We have developed drugs to treat some psychological illnesses
  - d. Psychology emphasized happiness
  
2. Why did Dr. Seligman say the state of Psychology was “Not Good”
  - a. Psychology didn’t focus on the average or healthy person
  - b. Psychology developed disease models
  - c. We have developed drugs to treat some psychological illnesses
  - d. Too many resources being invested on happiness instead of illness
  
3. Identify all that are recognized as being happy lives:
  - a. A pleasant life, maximizing positive emotion
  - b. A life of hard work
  - c. A life lived engaged, invoking flow frequently
  - d. A life of meaning
  
4. Psychology research shows that interventions are limited in improving a life lived based on seeking excitement and fun because:
  - a. Pursuing fun means you aren’t pursuing meaning
  - b. There are genetic limitations on what you experiencing as pleasure
  - c. We habituate to pleasure
  - d. Pursuing fun comes at the cost of hard work
  
5. Eudemonia, as used in the video, is best described as:
  - a. Satisfaction
  - b. Flow
  - c. Flourishing
  - d. Positive emotions

6. Flow means you are experiencing
  - a. Stopped time
  - b. Engagement
  - c. Joy
  - d. Positive emotions
  
7. Flow means you are experiencing
  - a. Stopped time
  - b. Engagement
  - c. Joy
  - d. Positive emotions
  
8. People who live meaningful lives have in common that they:
  - a. They have a purpose to their life
  - b. They know their future occupations
  - c. Keep a written journal of their plans
  - d. They use their character strengths in their daily lives
  
9. What increases happy emotions and pleasure experiences
  - a. Practicing savoring
  - b. Developing meaning
  - c. Entering into Flow states
  - d. Mindfulness
  
10. Doing a “gratitude visit” is an intervention for:
  - a. Hedonic Pleasure
  - b. Flow
  - c. Life satisfaction
  - d. Increased Meaning
  
11. The disease model refers to
  - a. Psychology has learned to classify mental illnesses
  - b. Psychology that focuses on relieving misery
  - c. Improving happiness decreases disease
  - d. A focus on what is wrong with people without examining living a better life
  
12. Dr. Seligman felt that technology and entertainment can:
  - a. Increase mental illness
  - b. Distract us from living a good life
  - c. Can be designed to improve flow and meaning
  - d. Will improve diagnosis of psychological illnesses

13. With regard to living a good life, seeking positive emotion and pleasure
- Distracts us from living a good life
  - Contributes the most to a good life when there is meaning in life
  - Is the opposite of Flow
  - Is the same as Flow
14. Positive Psychology seeks to:
- Cure mental illness
  - Decrease anxiety and depression
  - Study and identify what makes for a life well lived
  - Seeks to find and teach interventions that make life more enjoyable
15. The speaker directs the viewer to a website where you can take a psychology assessment to tell you about what?
- Your personal character strengths
  - Where you fit in a disease model
  - Your current level of happiness
  - If you are living a good life

**Out of the 15 questions that were asked, how many do you believe you answered correctly? \_\_\_\_\_**

**How well did you understand the content of the Positive Psychology video?**

**Circle One:** Not at all          Poorly          Average          Well          Very Well

## Appendix D

### PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way *right now*. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

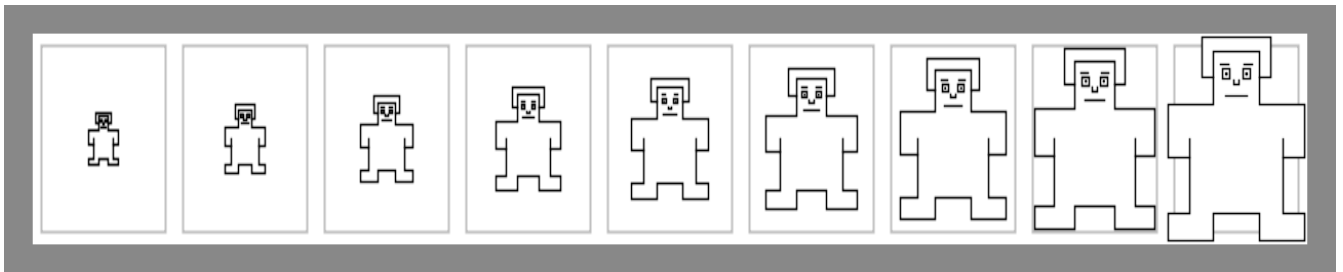
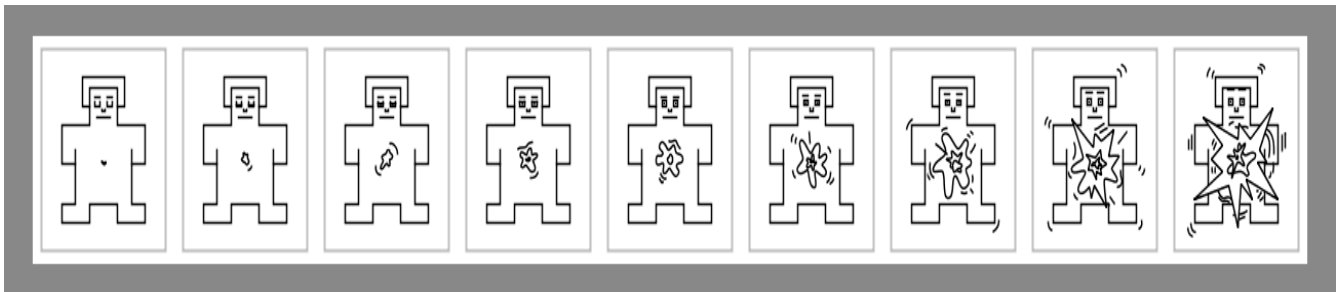
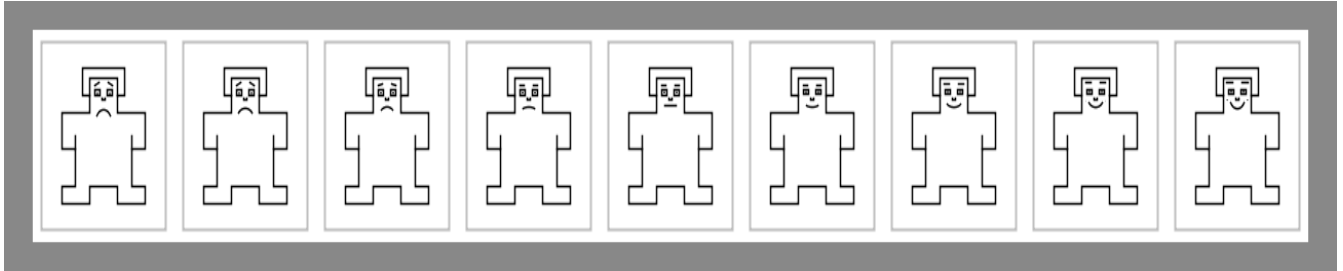
- |                               |                   |
|-------------------------------|-------------------|
| 1. _____ cheerful             | 18. _____ afraid  |
| 2. _____ disgusted            | 19. _____ tired   |
| 3. _____ attentive            | 20. _____ amazed  |
| 4. _____ bashful              | 21. _____ shaky   |
| 5. _____ sluggish             | 22. _____ happy   |
| 6. _____ daring               | 23. _____ timid   |
| 7. _____ surprised            | 24. _____ alone   |
| 8. _____ strong               | 25. _____ alert   |
| 9. _____ scornful             | 26. _____ upset   |
| 10. _____ relaxed             | 27. _____ angry   |
| 11. _____ irritable           | 28. _____ bold    |
| 12. _____ delighted           | 29. _____ blue    |
| 13. _____ inspired            | 30. _____ shy     |
| 14. _____ fearless            | 31. _____ active  |
| 15. _____ disgusted with self | 32. _____ guilty  |
| 16. _____ sad                 | 33. _____ joyful  |
| 17. _____ calm                | 34. _____ nervous |

35. \_\_\_\_\_ lonely
36. \_\_\_\_\_ sleepy
37. \_\_\_\_\_ excited
38. \_\_\_\_\_ hostile
39. \_\_\_\_\_ proud
40. \_\_\_\_\_ jittery
41. \_\_\_\_\_ lively
42. \_\_\_\_\_ ashamed
43. \_\_\_\_\_ at ease
44. \_\_\_\_\_ scared
45. \_\_\_\_\_ drowsy
46. \_\_\_\_\_ angry at self
47. \_\_\_\_\_ enthusiastic
48. \_\_\_\_\_ downhearted
49. \_\_\_\_\_ sheepish
50. \_\_\_\_\_ distressed
51. \_\_\_\_\_ blameworthy
52. \_\_\_\_\_ determined
53. \_\_\_\_\_ frightened
54. \_\_\_\_\_ astonished
55. \_\_\_\_\_ interested
56. \_\_\_\_\_ loathing
57. \_\_\_\_\_ confident
58. \_\_\_\_\_ energetic
59. \_\_\_\_\_ concentrating
60. \_\_\_\_\_ dissatisfied with self



# Appendix E

## SAM



## Appendix F

### 4DMS

#### **Active**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Calm**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Aggravated**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Exhausted**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Energetic**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Peaceful**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Agitated**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

#### **Fatigued**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Lively**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Relaxed**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Hostile**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Tired**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Vigorous**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Serene**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Irritable**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Weary**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Tranquil**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Upset**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Worn out**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

**Uptight**

To what extent have you felt this way generally across all situations over the past six months?

Very slightly or not at all 1 2 3 4 5 Extremely

## Appendix G

### DTS

Please rate each item by selecting one of the five answers for each question. Please answer each statement by circling the number that best applies to you.

	Strongly Disagree	Mildly Disagree	Feel Neutral	Mildly Agree	Strongly Agree
1. Feeling distressed or upset is unbearable to me.	1	2	3	4	5
2. When I feel distressed or upset, all I can think about is how bad I feel.	1	2	3	4	5
3. I can't handle feeling distressed or upset.	1	2	3	4	5
4. My feelings of distress are so intense that they completely take over.	1	2	3	4	5
5. There's nothing worse than feeling distressed or upset.	1	2	3	4	5
6. My feelings of distress or being upset are just an acceptable part of life.	1	2	3	4	5
7. I can tolerate being distressed or upset as well as most people.	1	2	3	4	5
8. My feelings of distress or being upset are not acceptable.	1	2	3	4	5
9. I'll do anything to avoid feeling distressed or upset.	1	2	3	4	5
10. Other people seem to be able to tolerate feeling distressed or upset better than I can.	1	2	3	4	5
11. Being distressed or upset is always a major ordeal for me.	1	2	3	4	5
12. I am ashamed of myself when I feel distressed or upset.	1	2	3	4	5
13. My feelings of distress or being upset scare me.	1	2	3	4	5
14. I'll do anything to stop feeling distressed or upset.	1	2	3	4	5
15. When I feel distressed or upset, I must do something about it immediately.	1	2	3	4	5
16. When I feel distressed or upset, I cannot help but concentrate on how bad the distress actually feels.	1	2	3	4	5