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The effects of math anxiety on consumer price perception and purchase decision

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THE EFFECTS OF MATH ANXIETY ON CONSUMER PRICE PERCEPTION AND PURCHASE DECISION

A Dissertation

by

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ABSTRACT

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Mathematics anxiety is an emotional state resulting in a negative reaction to numerical information and math problems. Therefore, it has been studied by education research to explain its effects on academic performance. However, the marketing literature has failed to notice the role of math anxiety in consumer behavior. As retailers offer various price promotions to increase product sales, buyers need to compare prices and calculate the final price after sales. The success of promotions depends on the way that the sellers frame the promotions, as consumers may react to promotions that offer gains differently than those that reduce their loss. In addition, difficulty of price computation affects consumer response to price promotions since math anxiety limits the capacity of working memory when buyers deal with difficult arithmetic. Subsequently, this study focuses on the interaction effect of math anxiety and promotion framing on consumer price perception by explaining how it creates lower perceived price satisfaction, which in turn decreases perceived emotional value of the product and perceived savings, and leads to lower purchase intention.

To answer research questions, this study developed six hypotheses and used experimental research designs, while measuring math anxiety by the MARS-Brief scale, a shorter edition of the MARS scale. The result of data collected from 890 college students and online consumers supported research hypotheses, showing that math-anxious consumers perceive higher price satisfaction and purchase intention when promotion frames are simpler, e.g., gain-framed promotions, dollar-off discounts, a single discount, and bundles with a single price. Low math anxiety buyers responded positively to complex promotion frames, e.g., reduced loss-framed promotions, percentage-off discounts, multiple discounts, and bundles with a price list of items. The study also found that perceived emotional value and perceived savings mediate the effect of price satisfaction on purchase intention. The study discusses and justifies research findings with regard to existing theories. Finally, implications for marketing practice and directions for future research are provided.

DEDICATION

The completion of my doctoral studies would not have been possible without the love and support of my family. My mother, Shahin Namvari, and my sisters wholeheartedly inspired, motivated and supported me to accomplish this degree. Thank you for your love and patience.

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INTRODUCTION

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Importance of Research

Mathematics anxiety is one of the most discussed topics in the literature of education and psychology. Reports show that American schools have poor performance in teaching math and science, and many students are unable to achieve high grades in math exams and tasks (Ashcraft and Krause, 2007). Around 93% of American adults believe that they have experienced math anxiety to some degree (Blazer, 2011). Jones (2001) in a study of American students found that more than 25% needed help to overcome their math anxiety. In fact, students with high math anxiety usually escape math classes, avoid arithmetical tasks, and achieve lower grades in mathematics (Ashcraft and Kirk, 2001; Hembree, 1990; Ramirez *et al.*, 2013). Therefore, education scholars attempt to find the causes of math anxiety, its consequences, and ways to reduce its harmful effects (Ashcraft and Kirk, 2001).

Math anxiety not only holds back students' academic performance, but also influences other instances of numerical information processing during their after-school life. People may face difficulties when figuring a tip at a restaurant or balancing a checkbook (Ashcraft, 2002; Ashcraft and Moore, 2009). They may have problems in dealing with numbers and mathematics while doing income tax returns, calculating interest on a loan, or deciding on quantities of items to be purchased for a party. Furthermore, consumers frequently face math anxiety when they compare the prices of items they buy or calculate the net price of an item on sale (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013).

Today, marketers use various pricing tactics, such as price promotions, in order to attract customers to their products and services in a competitive market. Nevertheless, the success of such tactics depends on consumers' perception of price and their reactions to what they perceive. Math anxiety is a major factor that can affect the quality of price judgments made by consumers. This is because math anxiety influences their ability to process numerical information (Suri, Monroe and Koc, 2013). For many buyers, computing the net price to pay is an appallingly difficult job. The example of A&W burgers in the 1980s revealed that most American consumers did not realize that a third-pound of beef is larger than a quarter pound of beef. Therefore, they preferred McDonald's burgers as an option with greater savings. In fact, their anxiety toward math resulted in using heuristics, relying on partial information, and making wrong judgments, i.e., 4 is greater than 3 and, thus, 1/3 is smaller than 1/4 (Green, 2014).

Research Gaps

The notion of math anxiety has attracted educational science and psychology researchers. Dreger and Aiken (1957) found that college students express negative emotional responses to arithmetic and have anxiety toward numbers. Therefore, researchers aimed to define and measure math anxiety, and to investigate its effects on students' math performance (see Ashcraft, 2002; Cemen, 1987; Mathinson, 1977; Richardson and Suinn, 1972). However, math anxiety and its impacts on consumer behavior have been underinvestigated by marketing literature. Hence, there is a lack of theoretical conceptualization and empirical investigation regarding the role of math anxiety in consumer perception, evaluation and decision-making. In other words, math anxiety has been overlooked by behavioral analysts (Friman, Hayes and Wilson, 1998).

Similar to marketing literature, behavioral pricing research has not paid enough attention to math anxiety, which is a mental state that is generally observed among the majority of consumers. According to Coulter and Roggeveen (2014), consumers' fluency in processing price information affects their preferences for different price formats during a promotion. As 76% of consumers make their purchase decisions based on price comparisons, it is necessary to understand and explain how math anxiety affects their daily evaluations and choices (Feng, Suri and Bell, 2014). A main weakness of pricing research is that it focuses on cognitive choices and gives less attention to emotional responses. As Thomas (2013) suggests, studying cognitive processes without considering their associated feelings will not lead to a proper understanding of consumer behavior. Indeed, emotional reactions or subjective experiences drawn out by cognitive processes play a vital role in consumers' price evaluations.

Following the study of Groen and Parkman (1972) on the difference between children and adults in the time spent in solving simple math problems, cognitive arithmetic research was founded and researchers conducted empirical studies to examine how math anxiety limits the ability of working memory to retrieve the stored information and process numerical information. They suggested that when people face difficult math problems or dual tasks, reduced capacity of working memory due to math anxiety could inhibit their math performance (Ashcraft and Faust, 1994; Ashcraft and Kirk, 2001). Therefore, Suri, Monroe and Koc (2013) related the inability of consumers in choosing the right price option to their limited capacity of working memory caused by math anxiety. However, they neglected the role of math anxiety in creating negative emotions toward math and numbers. Feng, Suri and Bell (2014) found that math anxious people avoid math computations and, thus, may make suboptimal choices among products. However, they did not explain why this avoidance takes place. Therefore, this study extends the findings of neuroscience and neuroeconomics to behavioral pricing by suggesting that math anxiety creates negative emotions in the brain that result in a lower perceived price satisfaction and the avoidance of price computation. Thus, consumers with high math anxiety have a lower intention to buy products with price formats that need complex arithmetic.

As the first attempt to examine the effects of mathematics anxiety on consumers' price perceptions, researchers investigated the differences in consumer response to promotions framed as dollar-off versus percentage-off considering the fact that not all people have the same need for cognition and, hence, the willingness to calculate the exact sales price can moderate the impact of math anxiety (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013). However, there is no evidence to show how the framing of price promotions influences the way that consumers with high math anxiety will respond to product prices. Therefore, there is a need for further empirical studies about the interaction between math anxiety and different promotion framings.

Purpose of the Dissertation Research

Research Questions

Considering the existing gaps in the marketing and pricing literature, the main objective of this study is to understand and explain the role of math anxiety in influencing consumer purchase decision making. The study aims at answering two main research questions:

RQ 1: How does math anxiety influence consumers' emotional and cognitive perceptions of the price and value that determine their purchase decisions?

Consumers often compare the price of alternative products and services in the market in order to choose the most affordable or desirable option. However, they are mostly unable to recall the exact price of products or process price information while on a shopping trip (Monroe, 1973, 2003). Buyers judge the price based on their subjective perceptions, categorize products into high-priced versus low-priced, and make their purchase decisions if the product is within their acceptable price ranges (Monroe, 1973, 1982; Suri and Monroe, 2001). Based on Prospect Theory, it is also expected that consumers have a tendency to buy the products at a lower price in order to avoid the risk and reduce their monetary loss, as they are more sensitive to the likelihood of loss than gain (Kahneman and Tversky, 1979). However, such a subjective perception sometimes requires price computation and the problem of math anxiety may arise. This means that buyers who are afraid of math or dislike engaging in complex calculations will typically avoid price formats or promotions that need a difficult arithmetic computation. Therefore, they may make suboptimal choices and pay higher prices for a product compared to its alternatives (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013).

This phenomenon may decrease the chance to attract customers to specific promotions or result in losing the market to competitors who offer their products in a simpler price format. Therefore, marketers have to deal with math anxiety and overcome or control its effects. As the math anxiety disorder can create a negative emotional response toward the company's offerings that will reduce consumers' perceptions of price satisfaction, emotional value and monetary savings, and persuade them to stay away from price calculation, marketers design appropriate pricing strategies in order to minimize the negative impact of math anxiety on consumer behavior. They can use alternative price formats and promotion framings to increase purchase intention for high math anxiety consumers.

RQ 2: How do different price promotion frames influence the relationship between math anxiety and price perception, which in turn results in variations in purchase intentions?

Retailers usually use rules of thumb to set the price for products and services. However, buyers will have different perceptions of the price and, thus, setting the right price can increase profitability and help companies to survive (Monroe, 2003). Besides, price presentations and promotion framings can influence consumers' perceptions of product price and value (Cai and Suri, 2007; Thomas and Morwitz, 2005). Promotions tactics refer to temporary reductions in price or increases in volume that are used by marketers to attract price-sensitive consumers and to respond to the loss aversion strategy of buyers (Chen, Monroe and Lou, 1998; Monroe, 2003). However, consumers' response to promotions depends on the framing methods that marketers or sellers apply (Weisstein, Asgari and Siew, 2014). In fact, people often prefer promotions that inspire loss reduction (Yan, Dillard and Shen, 2012). Therefore, discounts are the most favorable promotions for the majority of customers (Diamond and Campbell, 1989; Gamliel and Herstein, 2011). Nevertheless, consumers who suffer from math anxiety may switch to alternative options with simpler frames, if marketers use specific promotion frames that require difficult arithmetic to calculate the net price to be paid after promotion. Therefore, it is important to understand what promotion framings are more appropriate for the consumers with high math anxiety.

The present study considers the reaction of buyers to loss reduction frames, e.g., price discounts, versus promotions perceived as gain, e.g., buy one get one free. In addition, the framings of discounts as dollar-off versus percentage-off, and the use of single versus multiple discounts will be examined. Finally, the study investigates whether offering price bundles by presenting a single price for the bundle can attract highly math-anxious consumers as compared to partitioning the price by showing separate prices for each component of the bundle.

Research Objectives

This study aims at bridging the gap between the findings of education literature about the effects of math anxiety on academic performance and the real world applications of math anxiety on consumer behavior regarding the consumer perception of the product price and value. It is important to understand and explain why some consumers prefer a specific price or promotion framing due to the level of mathematics anxiety. To answer the research questions, this study conducted empirical research by asking customers about their perceptions of the product price and value when marketers offer the product at different promotion frames. This study has two major purposes:

1) To examine the effects of math anxiety on consumers' emotional and cognitive perceptions of the price and value in a competitive market and their ultimate purchase decisions.
2) To investigate the influence of different price promotion frames on the relationship between math anxiety and price perceptions, which determines consumer purchase intention.

Research Contributions

The present study is important because it considers consumers' anxiety toward mathematics as a psychological state that influences satisfaction with the price and intention to purchase products at specific prices, while the literature of marketing and behavioral pricing have overlooked the role of math anxiety. In addition, while two recent studies have initiated investigating the effects of math anxiety on consumer choice and price computation avoidance (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013), this is the first effort to conceptualize the effects of math anxiety on purchase intention through its impact on perceived price satisfaction, perceived emotional value, and perceived savings. Drawing a clear-cut model helps marketers to better understand the role of math anxiety in various aspects of consumer behavior.

The present study applies a quantitative research method in the form of experimental research design to investigate under what type of promotion framings consumers with high math anxiety will have a higher purchase intention due to higher price satisfaction. Therefore, a range of promotional frames is examined through three studies to achieve a deeper understanding of the effects of math anxiety and the different reactions of consumers to price promotions due to their degrees of math anxiety.

Overview of the Dissertation

As Figure 1.1 shows, the present dissertation consists of five chapters, which are organized as follows:

Chapter 1) Introduction: This chapter provides a brief explanation of the research problem, research gaps, research questions and objectives, the importance of study, and the organization of the present study.

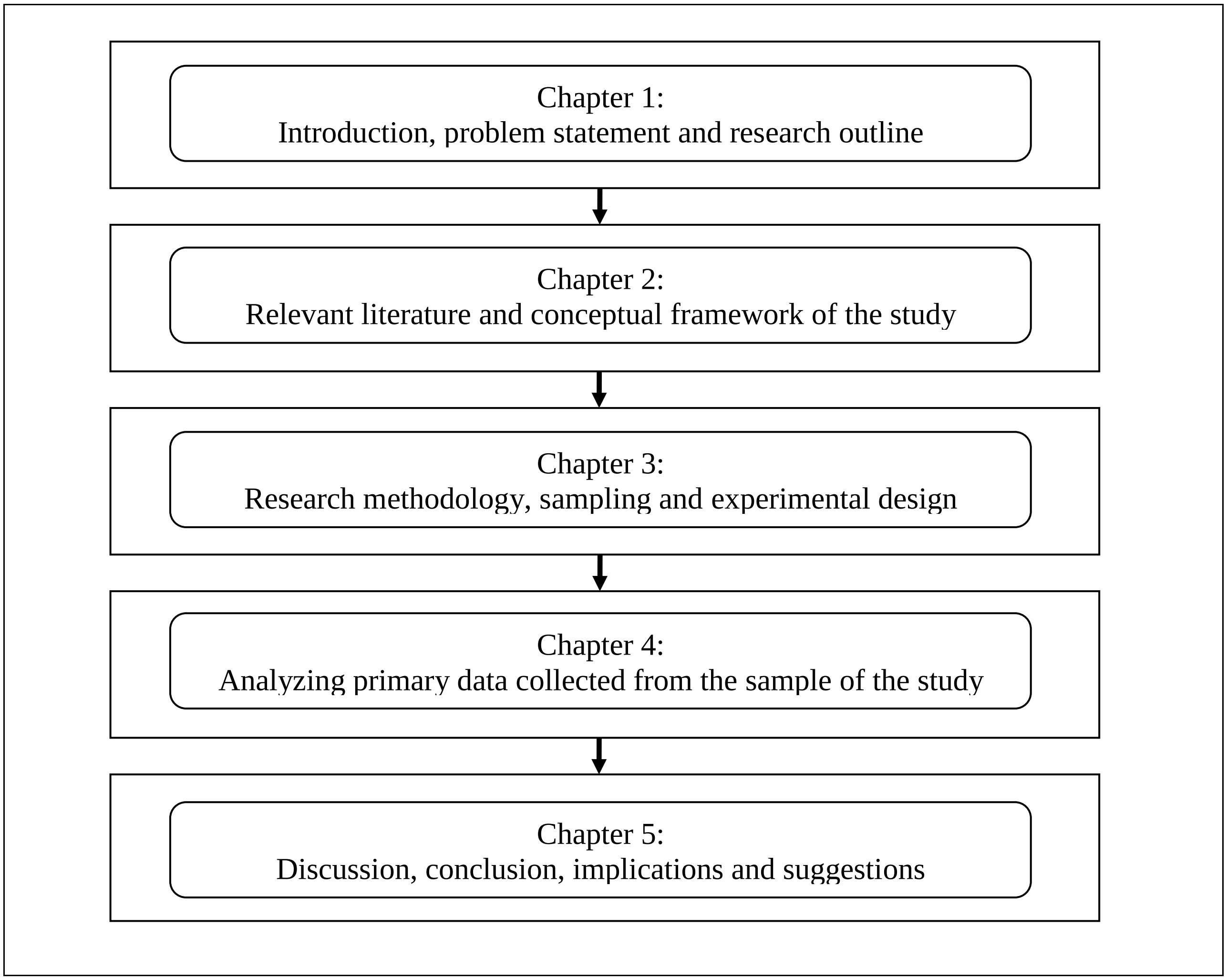
Chapter 2) Literature Review and Conceptual Framework: This chapter provides a definition of math anxiety, and describes the dimensions, antecedents, and consequences of math anxiety from the perspective of educational science and cognitive psychology. Various scales are introduced to measure math anxiety and the remedies for overcoming math anxiety effects. Furthermore, the role of math anxiety in consumer behavior and its relation to consumers' perceptions of product price and value is discussed. Using a critical review approach, the literature is reviewed to develop and clarify research hypotheses regarding the effects of math anxiety on consumers' satisfaction with the price and their behavioral responses to complex prices and promotion frames. Finally, a research framework is designed based on the proposed hypotheses and relationships.

Chapter 3) Research Methods: This chapter describes the experimental research design and the measurement items used to measure each variable reflected by the research framework. It also explains the sampling methods and the desired statistical techniques used for data collection and data analysis. The logic behind selecting such methods is also discussed.

Chapter 4) Analyses and Results: In this chapter, the results of the empirical experiments on the research samples are analyzed. The characteristics of survey respondents, the statistical tests used for examining the validity and reliability of the research instrument, and the hypothesis testing is described in detail.

Chapter 5) Summary and Conclusions: In the final chapter, research findings are justified and discussed with regard to the literature and existing theories. In addition, contributions of the study are explained and the implications for the research and marketers are discussed. Finally, directions and guidance for further studies are provided.

Figure 1.1: Structure of the Dissertation



Summary

A considerable segment of American students and adults suffers from mathematics anxiety, which causes their inability to perform well in their academic studies and life situations in which they deal with numbers and calculations. Although education science has paid great attention to identifying and overcoming this phenomenon, marketing research and behavioral pricing have overlooked the role of math anxiety in consumer behavior. Therefore, this study aims to inspect and explain whether math anxiety affects consumer perception of the price and value that determines purchase intention. It also tests the effects of the interaction between math anxiety and different promotion frames on consumer price perception and purchase decision.

This chapter provided brief information regarding the importance of the study, gaps in the literature, research questions and research objectives. The present research can contribute to the body of marketing science and behavioral pricing by conceptualizing the negative impact of math anxiety on consumer perception of the price, which will lead to a lower purchase intention for the products offered at the price promotions requiring complex calculations in order to realize the final net price after sales. Conducting an empirical study using experimental designs helps to present insightful findings for understanding the role of math anxiety in consumers' purchase behavior. Finally, a brief review of the organization of study and the content of different sections was provided.

CHAPTER II

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Overview

Mathematics anxiety as a psychological phenomenon that hinders the academic achievement of students has attracted researchers' attention since the second half of the 20th Century, while its impact on consumer behavior has been overlooked by the literature. This chapter provides an extensive review of various viewpoints about math anxiety, its nature and definition, its dimensions, antecedents, measurements and cognitive consequences, and its practical remedies. Furthermore, the effects of math anxiety on consumer behavior with the focus on consumers' price perceptions and their reactions to different promotion framings are discussed. Finally, a conceptual framework is developed to explain hypothesized relationships between math anxiety and other variables related to consumers' perception and behavior.

Mathematics Anxiety

The word 'anxiety' originates from the German word 'Angst', which means fear, or the Old French word 'anguisse', which refers to choking sensations in the throat (Sarbin, 1964, 1968). In fact, such intense feelings are formed when people encounter horrific events or things that they extremely dislike (Friman, Hayes and Wilson, 1998). In other words, people show psychological reactions to incidents with uncertain or potentially intimidating consequences. For example, a feeling of dread appears when a person walks across a car-free street (Friman, Hayes and Wilson, 1998). Lewis (1970) defined anxiety as an emotional state strengthened by fear and dread. Anxious people have unpleasant feelings of uncertainty or vulnerability, while they face a threat (May 1977; Hembree, 1990). As Spielberger (1972) stated, anxiety is a process in which people perceive threat from a stressor and react to it.

As Hembree (1990) suggests, anxiety is an omnibus construct with various dimensions. Previous research has identified major forms of anxiety, including test anxiety (Sarason and Mandler, 1952), math anxiety (Dreger and Aiken, 1957), state anxiety (Spielberger, O'Neil and Hansen, 1969), trait anxiety (Spielberger, Gorsuch and Lushene, 1970; Betz, 1978), computer anxiety (Igbaria and Parasuraman, 1989; Suri *et al.*, 2003), Internet anxiety (Joiner *et al.*, 2005), and science anxiety (Bursal and Paznokas, 2010). However, test anxiety and math anxiety are two prominent forms of anxiety in the literature (Hembree, 1990). Test anxiety relates to the stress and negative reactions that people show while taking exams (Burns 2004; Sarason, 1984; Sarason and Mandler, 1952). Students with higher test anxiety have a lower score and inconsistency than those with lower test anxiety. This is because students have task-related drives concerning completing the test successfully as well as self-directed drives, such as increased heartbeat, fear of punishment, embarrassment, and the desire to escape the exam (Beckwith, Iverson and Reuder, 1965; Hembree, 1990; Mandler and Sarason, 1952; Spielberger and Perdue, 1966). Therefore, test anxiety reduces the performance of students (Burns 2004; Chapell *et al.*, 2005). Trait anxiety refers to individual differences in the level of anxiety (Spielberger, Gorsuch and Lushene, 1970; Suri and Monroe, 2001). People who have higher levels of anxiety are less efficient in their mental operations (Suri and Monroe, 2001).

Mathematics anxiety has been considered by researchers as a type of anxiety that influences students' performance in classrooms and during tests when dealing with mathematical problems. However, the scope and effects of math anxiety are much broader. Gough (1954) was the first person who created an awareness of anxiety toward math by reporting her students' emotional reactions to math problems. She called such feelings 'Mathemaphobia', which means fear of mathematics. The first academic attempt to identify math anxiety was made by Dreger and Aiken (1957) who noticed that college students suffer from a disorder of emotional responses to arithmetic and mathematics. They called the syndrome 'number anxiety' and made three general propositions. First, number anxiety is not similar to anxiety in general, though they may somewhat overlap. Second, number anxiety abates academic performance so that students with high number anxiety usually achieve lower grades in mathematics. Third, there is no meaningful relationship between number anxiety and general intelligence. This means that even intelligent persons may face anxiety when dealing with math and computation (see Ashcraft and Moore, 2009).

According to Ashcraft and Kirk (2001), there are two independent streams of research regarding math anxiety. The first line of study defines math anxiety, discusses its dimensions, causes and consequences, and tries to measure levels of math anxiety mainly among students (see Cemen, 1987; Richardson and Suinn, 1972; Wigfield and Meece, 1988). The second research track is cognitive arithmetic, which focuses on the mental process underlying math anxiety. The starting point of this stream was the work of Groen and Parkman (1972) who used multiple models to explain how children and adults solve single-digit addition problems. Both research streams have extensively contributed to the development of math anxiety definitions, theories, models, and scales.

Definitions of Math Anxiety

Mathematics anxiety is defined as an apprehension of mathematics that varies from feeling discomfort when dealing with numerical operations to avoiding mathematics classes

(Mathinson, 1977). According to Richardson and Suinn (1972), math anxiety refers to a feeling that reduces an individual's ability to solve mathematical problems during study or in real life situations, where people need calculation or working with numbers. They may experience math anxiety in classrooms or labs, during mathematics tests, or in practical situations, such as trying to refigure a restaurant bill (Ashcraft, 2002; Ashcraft and Moore, 2009). Furthermore, people may not only have anxiety toward using mathematics, but also negatively react to the content of mathematics (Richardson and Woolfolk, 1980). According to Cemen (1987), math anxiety is a state of tension in which people who need to solve math problems perceive it as a threat to their self-esteem (Rubinsten and Tannock, 2010; Trujillo and Hadfield, 1999). As shown in Table 2.1, there are other definitions for math anxiety suggested by the literature to clarify the concept and scope of this phenomenon.

Table 2.1: Definitions of Mathematics Anxiety in the Literature

Definition	**Author(s)**
The presence of a syndrome of emotional reactions to arithmetic and mathematics	Dreger & Aiken (1957, p. 344)
Feelings of tension and anxiety that impair the ability to manipulate numbers and solve mathematical problems in a wide variety of ordinary life and academic situations	Richardson & Suinn (1972, p. 551)
The general lack of comfort that someone might experience when required to perform mathematically	Wood (1988, p. 11)
A feeling of tension, apprehension, or fear that interferes with math performance	Ashcraft (2002, p. 181)
A person's negative affective reaction to situations involving numbers, math, and mathematics calculations	Ashcraft & Moore (2009, p. 197)
Unhealthy mood responses which occur when some students come upon mathematics problems and manifest themselves as being panicky and losing one's head, depressed and helpless, nervous and fearful, and so on.	Luo, Wang & Luo (2009, p. 12)

Aiken (1970) viewed math anxiety as an emotional, intuitive attitude toward mathematics. However, math anxiety seems to be different from general attitude. In fact, math anxiety refers to strong feelings that students usually show in mathematics classes. These emotions refer to stress, frustration, confidence, or satisfaction (Ma, 1999; McLeod, 1992). According to Buxton (1981), emotional reactions to math problems cause panic, anxiety, embarrassment, or fear (Ma, 1999). People with high math anxiety may also have the feelings of discomfort, vulnerability, tension, or mental incompetence (Richardson and Suinn, 1972; Wood, 1988). Math anxious individuals do not trust their own aptitude to solve math problems and are afraid to apply their math abilities, especially in public (Tobias, 1981).

Mathematics anxiety may cause physical consequences as well. For example, it increases heart rate, blood pressure, or perspiration. It can also lead to difficulty in respiration (Friman, Hayes and Wilson, 1998). People with high math anxiety may also experience a headache, stomachache, vomiting, a dry mouth, or sweaty palms (Fotoples, 2000; Luo, Wang and Luo, 2009). It may also lead to serious emotional disorders, such as a student who cries due to failure to perform math-related tasks (Ashcraft, 2002; Ashcraft and Moore, 2009).

Cemen (1987) argued that math anxiety is a mental state that threatens self-esteem. If an individual has strong self-esteem and a definite level of task-related confidence, he/she can control the anxiety and transfer it into the task. Therefore, anxiety for such a person will lead to better performance. Conversely, if the individual cannot control the anxiety, lower performance will be observed. The problem is that people who cope with math anxiety in the long term may avoid mathematics and believe that math is not useful. This is why math anxious students dislike to prepare or wait for math tests or to take math exams (Brush, 1981). Therefore, math anxiety can be defined as a negative emotional response to math problems by avoiding mathematics, or feeling stressed and nervous while facing math problems (Ashcraft, 2002; Ashcraft and Ridley, 2005; Blazer, 2011; Young, Wu and Menon, 2012).

Dimensions of Math Anxiety

Some researchers have considered math anxiety as a multidimensional construct (see Scarpello, 2005; Wilder, 2013). It may consist of affective components, such as fear or dread, cognitive components, such as worry, and attitudinal elements, such as dislike or hate (Bessant, 1995; Hart, 1989; Ma, 1999; Wigfield and Meece, 1988). As Wigfield and Meece (1988) explained, affective elements have a stronger negative impact on math performance while worry or the cognitive element has a stronger positive effect on the weight children place on math and their efforts to succeed. McLeod (1992) argued that affective reactions to mathematics comprise three elements, including emotion, belief, and attitude. However, emotions have a greater effect on math anxiety than beliefs and attitudes. In addition, it is difficult to measure affective elements since their measurements are less accurate than cognitive components (McLeod, 1992; Scarpello, 2005).

Brush (1978) recognized two dimensions of math anxiety, i.e., problem-solving anxiety and evaluation anxiety. Resnick, Viehe and Segal (1982) identified three categories, including evaluation anxiety, arithmetic computation anxiety, and social responsibility anxiety. The latter refers to feeling responsibility while conducting math tasks in social settings. Plake and Parker (1982) classified math anxiety into learning mathematics anxiety and mathematics evaluation anxiety. Alexander and Cobb (1989) found two dimensions for math anxiety. The first dimension explains anxiety toward math tests and courses, while the second component is anxiety toward numerical tasks. Wilder (2013) also differentiated math test anxiety from numerical task anxiety. However, Baloğlu and Zelhart (2007) argued that math anxiety among students might relate to three different dimensions, including anxiety toward the mathematics test, anxiety toward numerical tasks, and anxiety toward the math course itself. This means that people may fear taking a math exam or answering a quiz with math problems, or face difficulty in dealing with calculations and working with numbers, or have anxiety while taking math-related courses. For example, PhD students may have stress when they take a multivariate analysis course that requires advanced statistical tests and methods.

Antecedents of Math Anxiety

The exact causes of math anxiety are not known yet (Ma, 1999). However, as Cemen (1987) suggested, anxiety may have three types of antecedents, including environmental antecedents, such as social stereotypes and parental support, dispositional antecedents, such as attitude and self-esteem, and situational antecedents, such as the classroom environment. Actually, anxiety is the result of interaction between these antecedents. Previous research shows that intellectual factors, such as learning styles, self-doubt, persistence, and dyslexia or impaired ability to learn or read can result in math anxiety (Harper and Daane, 1998; Trujillo and Hadfield, 1999). In fact, math anxiety will increase if students lack confidence in their ability to deal with math problems. On the contrary, students with higher self-efficiency and confidence may experience lower math anxiety (Luo, Wang and Luo, 2009). In addition, perceived usefulness of mathematics in the student's future life is a psychological cause of math anxiety and math avoidance (Cemen, 1987). If people are not sure about their ability to apply mathematics, they will find negative attitudes toward math (Harper and Daane, 1998). Social influence is also important so that teachers who have high math anxiety may transfer their anxiety to students (Maloney and Beilock, 2012).

Young, Wu and Menon (2012) in a study on the neurodevelopmental origin of math anxiety using functional MRI (fMRI) on children between 7 and 9 years of age found that math anxiety is related to hyperactivity in the right amygdala region of the human brain, which helps people to process negative emotions. They also found that math anxiety is accompanied by an activity decline in the posterior parietal cortex and the dorsolateral prefrontal cortex of the brain, which are involved in mathematical reasoning. Genetic factors may also explain 40% of the variation in math anxiety, whereas the role of the environment is more crucial in the emergence of such a disorder (Wang *et al.*, 2014).

The level of math anxiety may depend on demographic factors, such as gender, age, education, social class, and ethnicity (Ma, 1999; Owolabi, Olanipekun, and Iwerima, 2014). Math anxiety is developed in early childhood and is dominant among younger students (Maloney and Beilock, 2012). Gender difference has been supported by the literature. Some studies found that girls have a significantly higher level of math anxiety (Ashcraft and Faust, 1994; Kumar and Karimi, 2010; Luo, Wang and Luo, 2009; Woodard, 2004). As Wigfield and Meece (1988) suggested, girls show stronger negative emotional responses to math than do boys. However, others found contradictory results regarding the role of gender in math anxiety (Brush, 1978; Goetz *et al.*, 2013). In addition, students in higher levels of education had more worries or cognitive reactions about math. Fray and Ling (1983) examined the effect of personality and personal traits on mathematics attitude. They did not find a gender difference in global attitude toward math, but men showed a greater desire to succeed in mathematics than women did.

Measuring Math Anxiety

One of the main concerns of scholars in the fields of education and psychology is how to assess or measure differences in mathematics anxiety among students and other individuals. Dreger and Aiken (1957) created a Numerical Anxiety Scale by adding three math-related items to the Taylor Manifest Anxiety Scales (TMAS), which consists of 38 items and it was introduced by Taylor (1953) to measure anxiety in general. However, as Table 2.2 indicates, the need for more accurate measures of mathematics anxiety has encouraged researchers to develop various scales. Each scale in turn has been tested in different settings and revised by further studies.

Table 2.2: Math Anxiety Measurement Scales in the Literature

Measurement Scale	**Items**	**Likert Scale**	**Researcher(s)**
Mathematics Anxiety Rating Scale (MARS)	98	5-point	Richardson & Suinn (1972)
Mathematics Attitude Scales (MAS)	120	5-point	Fennema & Sherman (1976)
Mathematics Attitude Inventory (MAI)	48	4-point	Sandman (1974, 1980)
Mathematics Anxiety Scale (MAS)	10	5-point	Betz (1978)
Mathematics Anxiety Questionnaire (MAQ)	22	7-point	Meece (1981)
Mathematics Anxiety Rating Scale for Adolescents (MARS-A)	98	5-point	Suinn & Edwards (1982)
Mathematics Anxiety Rating Scale Revised (MARS-R)	24	5-point	Plake & Parker (1982
Mathematics Anxiety Rating Scale for Elementary Students (MARS-E)	26	5-point	Suinn, Taylor & Edwards (1988)
Revised Mathematics Anxiety Rating Scale (sMARS)	25	5-point	Alexander & Martray (1989)
Mathematics Anxiety Scale for Children (MASC)	22	4-point	Chiu & Henry (1990)
Brief Mathematics Anxiety Rating Scale (MARS-Brief)	30	5-point	Suinn & Winston (2003)
Abbreviated Mathematics Anxiety Scale (AMAS)	9	5-point	Hopko *et al.* (2003)
Mathematics Anxiety Scale-Revised (MAS-R)	14	5-point	Bai *et al.* (2009)

The first actual math anxiety measurement was introduced by Richardson and Suinn (1972) as the Mathematics Anxiety Rating Scale (MARS), which consists of 98 items. It required respondents to rate how anxious they would feel in formal and informal situations on a 5 point Likert scale. The situations varied from taking a quiz in a math class to calculating a dinner bill at a restaurant. The MARS was objective and relied on psychometric data with a high two-week test-retest reliability (.85). Thus, it soon became the commonly used measurement scale for math anxiety (Ashcraft and Moore 2009; Capraro, Capraro and Henson, 2001). Researchers have widely used the MARS in their studies on math anxiety (Ashcraft and Faust, 1994; Brush, 1978; Faust, Ashcraft and Fleck, 1996; Suinn *et al.*, 1972). Brush (1978) found that higher scores of math anxiety on the MARS belonged to students who had less experience with high school math, took fewer calculus courses or had lower grades in math. Afterward, the researchers created various versions of the MARS for specific groups under study, e.g., MARS-A for adolescents (Suinn and Edwards, 1982) and MARS-E for elementary school students (Suinn, Taylor and Edwards, 1988).

Capraro, Capraro and Henson (2001) in a study of 67 articles that applied the MARS for measuring math anxiety found that this scale showed high reliability across different studies. However, using such a lengthy questionnaire was time consuming, arduous, and awkward to score because the scores ranged from 98 to 490 (Ashcraft and Moore 2009). Therefore, researchers decided to create abbreviated versions and instruments with a better accuracy. The first attempt was made by Plake and Parker (1982) who suggested a revised MARS scale (MARS-R) with 24 items. However, this scale showed a poor fit to data collected from college students (Hopko *et al.*, 2003).

Alexander and Martray (1989) introduced the sMARS or the A-MARS as an abbreviated version of the MARS using 25 items. It is also called the Revised Mathematics Anxiety Rating Scale or RMARS (Bowd and Brady, 2002; Baloğlu and Zelhart, 2007). The sMARS is easier to administer and strongly correlates with original MARS (.97). Therefore, researchers have replaced the MARS with the sMARS or RMARS in their recent studies (Ashcraft and Kirk, 2001; Baloğlu and Zelhart, 2007; Bowd and Brady, 2002; Feng, Suri and Bell, 2014; Hopko *et al.*, 1998; Sheffield and Hunt, 2006; Suri, Monroe and Koc, 2013). Núñez-Peña *et al.* (2013) generated a Spanish version of the sMARS to test on Hispanic students. In addition, Suinn and Winston (2003) created a brief version of the MARS called MARS-Brief with 30 items in order to help researchers measuring math anxiety. It has a high reliability of $\alpha = .90$. This new scale has been validated by some studies (Wilder, 2013).

Sandman (1974, 1980) created a Mathematics Attitude Inverntory (MAI) scale to assess the individual's attitude toward math. The MAI consists of 6 sub-scales with a total of 48 items. Another attitudinal scale was introduced by Fennema and Sherman (1976) as the Mathematics Attitude Scales (MAS) including 10 scales of 12 items each, from which six statements were positive and six were negative. It was used by further studies (Zakaria and Nordin, 2008). Betz (1978) adapted one of the scales with only 10 items and called it the Mathematics Anxiety Scale (MAS). It was revised by Bai *et al.* (2009) and the new scale included 14 items. Another revised scale is the Abbreviated Math Anxiety Scale (AMAS) developed by Hopko *et al.* (2003) as an adapted version of the MARS-R to be used for examining math anxiety among high school students. This short scale consists of only 9 items and shows a two-week test-retest reliability of .85. It also explains 70% of the variance regarding math anxiety. The AMAS was recently used by researchers in their study on math anxiety (Maloney *et al.*, 2010; Maloney, Ansari and Fugelsang, 2011).

Cognitive Consequences of Math Anxiety

Confounding Effects of Math Anxiety and Math Ability. An important point in studying mathematics anxiety is to differentiate math anxiety as an affective reaction from math competence or math ability as a cognitive capacity. Math ability refers to "superior knowledge of and skill in using mathematical rules" (Suri, Monroe and Koc, 2013, p. 276). According to Menon (2010), math skills are vital cognitive aptitudes that children should master. This is achieved and improved through education over time. A student with high math competence is able to easily process numbers, solve math problems, achieve higher scores on math tests and succeed in math courses. Therefore, math competence can increase math performance or math achievement (Ashcraft, 2002; Ashcraft and Kirk, 2001).

Unlike math ability, the literature proposes that mathematic anxiety negatively influences math performance, so that students with low math anxiety have a higher math achievement, whereas highly math-anxious people will show a lower performance in dealing with math or solving math problems (Hembree, 1990). Previous research provided empirical support for the effect of math anxiety on math performance among elementary students (Ramirez *et al.*, 2013; Rubinsten and Tannock, 2010; Suinn, Taylor and Edwards, 1988), high school students (Devine *et al.*, 2012; Karimi and Venkatesan, 2009; Kumar and Karimi, 2010), college students (Ashcraft and Faust, 1994; Betz, 1978; Brush, 1978; Fray and Ling, 1983; McMullan, Jones and Lea, 2012), and adults (Quilter and Harper, 1988).

The evidence shows that students with high math anxiety do not register for elective math courses, achieve lower grades in math exams, and show lower math achievement (Ashcraft and Kirk, 2001). However, some studies did not find a significant relationship between math anxiety and math achievement (see Ashcraft and Kirk, 2001; Faust, Ashcraft and Fleck, 1996; Sherman and Wither, 2003). This is because a third factor, such as cognitive style (Hadfield and Maddux, 1988), mathematics efficiency (Adams and Holcomb, 1986), or working memory (Ashcraft and Kirk, 2001) intermediates the relationship. In addition, Ma (1999) argued that the effect of math anxiety on math achievement depends on social and academic characteristic of students.

Although math anxiety may lead to poor math achievement or performance, its effect on math ability or the capability to deal with the numerical computation and arithmetic is not supported (Rubinsten and Tannock, 2010). The meta analysis made by Hembree (1990) showed that there is a negative correlation of -.31 between math anxiety and math competence. This is because high math anxious people have lower motivation to do well in arithmetic and show slower learning in math (Ashcraft, 2002; Ashcraft and Krause, 2007). They do not select college majors that require mathematics, e.g., economics and finance, and avoid career paths that involve math (Ashcraft and Moore, 2009). However, if there is a constant relationship between math anxiety and math ability across all degrees of problem difficulty, confusion will occur and researchers cannot relate differences in math performance to either of the two factors (Ashcraft and Kirk, 2001). Indeed, using math ability requires retrieval of math skills from long-term memory. However, this retrieval is necessary for the taught problems, while solving untrained problems, such as dealing with complex prices on daily purchases, needs arithmetic operations based on working memory. Therefore, math anxiety has a higher influence than math ability in such situations (Suri, Monroe and Koc, 2013). Therefore, it is necessary to investigate the process of numerical problem solving through working memory.

Math Anxiety and Working Memory. Groen and Parkman (1972) in a comparative study found that adults spend a shorter time to solve addition problems than children do because they use a memory look-up process at the same time to retrieve information, but sometimes they go back to the counting process they used during their childhood. Therefore, working memory (WM) plays a vital role in solving problems related to mathematics. This study was the first attempt in cognitive arithmetic, which tries to explain the mental process underlying math operations that facilitate access to mathematics knowledge in memory (Ashcraft, 1992, 1995). Further research confirmed that the complexity of arithmetic and math problems increases the demand on working memory for problem solving. In fact, working memory will be more involved if the operands or the numbers in a math or arithmetic problem are larger (Ashcraft and Krause, 2007).

Working memory is a part of the human memory architecture that enables people to perceive, store, attend to and retrieve information (McCabe *et al.*, 2010). It provides cognitive resources to store information, while it processes new information that is used in other cognitive tasks (Borella and de Ribaupierre, 2014). Working memory is different from short-term memory and facilitates cognitive performance (Owens *et al.*, 2008). It allows people to temporarily store and manipulate information related to a specific task in the prefrontal cortex of their brain (Ashcraft and Kirk, 2001; Suri, Monroe and Koc, 2013). People need to retrieve math knowledge from long-term memory by means of working memory when they are involved in solving complex arithmetic problems. Therefore, the ability to answer difficult math problems depends on the capacity of working memory (Ashcraft and Kirk, 2001; Faust, Ashcraft and Fleck, 1996; Geary and Widaman, 1992; Hitch, 1978; Ramirez *et al.*, 2013).

Previous studies show that there is no significant difference in math performance between individuals with different levels of math anxiety when people face simple addition (e.g., 7 + 9) or multiplication (e.g., 6 × 8). However, when they solve more difficult arithmetic problems, such as two-column addition (e.g., 27 + 18), multiplication problems (e.g., 9 × 16) that require carry operation, or subtraction problems that involve a borrowing operation (e.g., 81 - 37), the likelihood and the speed of finding the correct answer will be different (Ashcraft, 2002; Ashcraft and Faust, 1994; Ashcraft and Kirk, 2001; Ashcraft and Krause, 2007). For example, high math anxiety people spend three times longer than low anxiety individuals do to find the correct answer for such math problems (Ashcraft and Kirk, 2001). Based on the numerical distance effect (NDE), the response time decreases when the numerical distance between two numbers is larger (e.g., 2 vs. 9). Thus, it is more difficult for math anxious people to differentiate numbers with higher proximity (Maloney, Ansari and Fugelsang, 2011). Additionally, high math anxiety leads to more mistakes and errors in calculations (Ashcraft and Faust, 1994). This may refer to a classic trade-off between speed and accuracy so that when highly math-anxious people face difficult arithmetic, they sacrifice accuracy and try to get rid of the problem faster no matter what the result will be (Ashcraft, 1992; Ashcraft and Kirk, 2001; Suri, Monroe and Koc, 2013).

A major point is that the frequency of facing complex math problems decreases when the problem size increases. In other words, people are less likely to deal with larger and complicated arithmetic problems in their daily life. Therefore, they may not keep information related to such problems in their long-term memory or may not be able to retrieve it successfully. Moreover, people will have longer reaction times (RT) if they face math problems with large numbers (Ashcraft, 1992; Ashcraft and Krause, 2007). Furthermore, if people deal with dual tasks, solving difficult math problems will disrupt working memory and reduce its ability to recall letters. This means that working memory is unable to make accurate calculations while involving multiple tasks, and the likelihood of making errors increases (Ashcraft and Kirk, 2001; Beilock and Carr, 2001; Suri, Monroe and Koc, 2013). For example, Ashcraft and Faust (1994) found that math anxiety scores among college students were higher when they took computerized tests than the standard paper-and-pencil exams. This is because computer anxiety or worry about the online environment increases tension and disrupts performance (Ashcraft and Krause, 2007).

The Processing Efficiency Theory (PET) of Eysenck and Calvo (1992) explains that anxiety causes worry, which has two main effects. First, worry reduces the capacity of working memory to store and process information for a simultaneous task. Second, it reduces the individual’s efforts to improve performance. This is because people focus on their invasive concerns that divert attentional resources to task-irrelevant thoughts and reduces the available resources of working memory. Thus, performance will drop off (Derakshan and Eysenck, 2009; Eysenck and Calvo, 1992; Owens *et al.*, 2008). Therefore, people with high math anxiety will demonstrate lower math performance when the task demands high involvement of working memory (Ashcraft, 1995, 2002; Hopko *et al.*, 1998). Sheffield and Hunt (2006) found an interaction effect of (task × memory load × math anxiety) on math performance. When math tasks are related, digits are similar or numerical proximity is high, the retrieval process in memory will be facilitated (Campbell, 1990; Campbell and Clark, 1988). Furthermore, anxiety weakens processing efficiency more than performance effectiveness (Eysenck and Calvo, 1992).

Eysenck *et al.* (2007) introduced the Attentional Control Theory, which explains that anxiety can disrupt the balance between two attentional systems, i.e., the goal driven system directed by goals, expectations and knowledge, and the stimulus-driven system directed by emotions. This means that anxiety reduces the efficiency of goal-directed attentional system and increases the influence of the stimulus-driven system. This causes poor cognitive performance while people pay attention to threatening stimuli, such as fear and worry (Coombes *et al.*, 2009; Derakshan and Eysenck, 2009; Eysenck *et al.*, 2007). In addition, people with a processing goal have a higher need to use cognitive resources (Suri, Monroe and Koc, 2013). However, math anxiety results in their fear of math-related tasks and reduces math performance by diverting attention to irrelevant tasks.

The Inhibition Theory provides another explanation for the effect of math anxiety. This theory assumes that when a person performs a mental task that requires a minimal mental effort, he/she will experience a series of irregular states of attention and interruption, which are unobservable or hardly noticeable to the subject. The inhibitory mechanism suppresses attention to control the negative effect of distracter or irrelevant stimuli on task-relevant goals and reduces the activities of concerns that are not related to the task (Connelly, Hasher and Zacks, 1991; Hasher and Zacks, 1988). This refers to the concept of executive functioning (EF), including control functions for inhibiting prevalent responses and regulating working memory performance

(McCabe *et al.*, 2010). Cognitive inhibition helps select relevant tasks to be performed regarding the limited resources of working memory (Borella and de Ribaupierre, 2014). People perform their tasks with high accuracy when this mechanism is functioning well. However, irrelevant tasks will consume working memory capacity and will result in poor performance on the main task if inhibition is not operating efficiently. Therefore, higher levels of math anxiety may cause a failure in the inhibition mechanism and disruption of working memory (Hopko *et al.*, 1998).

Reducing Math Anxiety

As stated earlier, mathematics anxiety reduces math performance through declining math competence and consuming working memory capacity (Ashcraft and Kirk, 2001). In addition, math anxiety develops during childhood and in math classes, when students may experience low math ability, limited working memory capacity, public embarrassment, and harsh reactions of teachers or parents (Ashcraft and Krause, 2007; Ashcraft and Moore, 2009; Scarpello, 2007). Such experiences lead to emotional responses that create difficulties in dealing with numbers and arithmetic in both education and real world scenarios (Ashcraft, 2002).

Mathematical literacy is considered a civil issue because heterogeneity in math ability and math performance increases social and economic inequality (Bai *et al.*, 2009; Schoenfeld, 2002). A study by Jones (2001) revealed that at least 25% of American students are in need of help to overcome their high level of math anxiety (Sheffield and Hunt, 2006). Therefore, the US government enforced the “No Child Left Behind (NCLB) Act” in 2002 that put pressure on students and teachers to attain the educational standards for math proficiency and to diminish the gap in achievement (Bai *et al.*, 2009). As both teachers and parents play a vital role in creating students’ math anxiety, researchers aim at providing them with guidelines to reduce math anxiety and its effects (Blazer, 2011). Table 2.3 summarizes major remedies suggested by the literature.

Table 2.3: Solutions to Overcome Math Anxiety Effects

Solutions/Suggestions	**Researcher(s)**
Identifying math anxious students	Betz (1978); Maloney & Beilock (2012)
Creating a positive learning environment	McMullan, Jones & Lea (2012)
Using supportive teachers	Ashcraft & Krause (2007); Mathison (1977)
Educating teachers about math anxiety	Harper & Daane (1998)
Using technology in the classroom	Blazer (2011)
Using creative teaching styles	Harper & Daane (1998)
Applying systematic desensitization	Hembree (1990); Wang *et al.* (2014)
Developing positive attitudes toward math	Blazer (2011)
Applying cooperative learning techniques	Lavasani & Khandan (2011)
Relaxation techniques	Hembree (1990); Sheffield & Hunt (2006)
Controlling negative emotions	Maloney & Beilock (2012)
Providing parental support	Blazer (2011)
Recognizing gender differences	Devine *et al.* (2012)

Previous research shows that using knowledgeable and confident teachers with low math anxiety will help to reduce math anxiety among students (Bursal and Paznokas, 2010; Cavanagh, 2007). Brush (1981) suggested that teachers should maximize students' understanding of math courses by selecting appropriate explanations, create lesson plans that easily connect subjects to new topics, and welcome any question that helps clarify math problems. Therefore, a good teacher makes math classes less horrifying for students and changes their attitudes toward math into positive. Cooperative learning through assigning students into groups in math classes also decreases anxiety toward math (Lavasani and Khandan, 2011; McMullan, Jones and Lea, 2012). Teachers should make students view a math test as a challenge rather than a risk (Maloney and Beilock, 2012). In addition, schools must pay more attention to the math education of girls, as they have shown a higher degree of math anxiety while their potential performance is similar to boys. This is because they have lower confidence about their math ability (Devine *et al.*, 2012; Goetz *et al.*, 2013).

According to Blazer (2011), to reduce math anxiety among students, teachers should develop strong skills and a positive attitude toward math, relate math problems to real life, encourage critical thinking and active learning, accommodate students' diverse learning styles, place less emphasis on correct answers and computational speed, organize students into cooperative learning groups, support and encourage students, avoid using math as punishment, and avoid situations that cause embarrassment in public. They should also use technology in the classroom, use concrete materials, prepare students for high-stakes testing sessions, use various assessment tools, and dismiss destructive, popular misconceptions. Parents should have realistic expectations, monitor children's math progress, and provide support and encouragement. They have to demonstrate positive uses for math instead of expressing negative attitudes about math. Students can also decrease their math anxiety if they practice math every day, use decent study techniques, avoid reliance only on memory, study in accordance with their own learning style, practice relaxation techniques, focus on past achievements, and ask for help when needed.

Hembree (1990) suggests that reducing students' math anxiety needs not only classroom intervention and change in the curriculum, but also psychological treatments outside the classroom, such as relaxation techniques and group counseling. Although the literature has found various remedies for math anxiety in an educational environment, there is a lack of knowledge about the practical methods to overcome consumers' math ability, especially when they deal with numerical computations. Feng, Suri and Bell (2014) suggested that using classic background music with a slow tempo can reduce the negative effects of math anxiety while consumers deal with prices that need complex computations. However, not all stores use background music and it does not seem to be a practical approach for online sellers. Indeed, marketers need to study the effects of math anxiety among consumers and find realistic strategies to deal with it.

The Role of Math Anxiety in Consumer Behavior

Although the literature has extensively studied the role of math anxiety in students' math performance and academic progress, it has overlooked behavioral consequences of math anxiety for consumers in today's markets. Previous research shows that almost 93% of Americans have experienced some degree of mathematics anxiety (Blazer, 2011; Sun and Pyzdrowski, 2009). In fact, most people encounter anxiety regarding arithmetic and math computations during daily purchases. For example, they may feel nervous "when trying to balance a checkbook or figure a tip on a restaurant bill when others are watching" (Ashcraft and Moore, 2009, p. 197).

According to classic economic theory, people make choices among alternative products and services based on a cognitive trade-off between the benefits or utility that they obtain and the costs that they have to pay in order to own or use them. This trade-off is a rational process that determines the value of products perceived by consumers (Monroe, 2003; Suri *et al.*, 2003). However, the fact is that consumers do not have access to perfect information and are not able to perfectly process product and price information (Monroe, 2003). In addition, buyers often make their purchase decisions under time pressure (Suri and Monroe, 2003) or anxiety (Suri and Monroe, 2001). The type of anxiety that affects consumers' evaluations and decision-making may vary from trait anxiety (Suri and Monroe, 2001) to computer anxiety (Suri *et al.*, 2003) in the online environments to math anxiety, which is observed both at brick and mortar stores and during online shopping (Suri, Monroe and Koc, 2013).

As Cemen (1987) stated, during cognitive evaluations, people decide how to deal with anxiety. In fact, mathematics anxiety as an unpleasant feeling in which individuals' fear of doing the calculations will affect their cognitive assessments and choices, especially through reducing the capacity of working memory (Ashcraft and Kirk, 2001). Consumers deal with a variety of prices in a competitive market. They often need to calculate price differences between available alternatives to make a purchase decision (Monroe, 2003). Therefore, it is important to understand and explain how math anxiety alters consumer choices and preferences regarding products that are offered at different prices. However, there is a gap in the marketing literature considering the impact of math anxiety on consumer behavior. According to Friman, Hayes and Wilson (1998), research in behavioral analysis has failed to notice the effect of anxiety on emotions and its importance in forming behavior. Only in the last two years have a few articles been published regarding the role of math anxiety in behavioral pricing.

Suri, Monroe and Koc (2013) examined the effects of math anxiety on consumers' preference for price promotion formats. More specifically, they studied how math anxiety leads to suboptimal choices between price promotions presented as a dollar-off discount and those offered as a percentage-off discount. They found that such an effect depends on the motivation of consumers to process information. Feng, Suri and Bell (2014) extended this study to find a way to reduce math anxiety during shopping trips. They found that consumers would face lower math anxiety if stores use background music with a slow tempo. Coulter and Roggeveen (2014) discussed the way consumers process the numerical information related to a price promotion. They found that deal processing fluency increases when price numbers are multiples of one another. However, they did not directly refer to the effect of math anxiety.

The present study will be the first attempt to conceptualize the effects of math anxiety on both consumers' perception of price and value. The purpose is to understand and explain how different levels of math anxiety determine purchase decisions and to investigate how consumers respond to different price and promotion framings based on their degree of math anxiety. Therefore, we now turn to the conceptual basis of the study.

Math Anxiety and Consumer Price Perception

According to Monroe (2003), price is the only marketing mix element that helps firms to capture value in terms of profits. From the customers' perspective, price is an extrinsic cue used to evaluate product value and make a choice or purchase decision. However, the consumer is the one who gives meaning to price and other product cues through the perceptual process (Monroe, 1973). Neoclassical economic theory assumes that price is an indicator of the purchase costs and consumers have perfect information about prices in the market. Thus, they choose the best product mix appropriate for their budget. However, buyers usually do not have perfect price consciousness. They do not properly remember prices or process price information in daily purchase situations (Monroe, 1973; Monroe and Lee, 1999; Monroe and Petroshius, 1981).

There is a difference between the objective or actual price that is set by sellers and the price perceived by consumers. Actual price is subjectively judged by consumers in the form of perceived price (Jacoby and Olson, 1977; Monroe, 1973; Zeithaml, 1988). Buyers label the price as high versus low. Therefore, they categorize products and services based on their price levels into high-priced versus low-priced, or expensive versus inexpensive (Monroe, 1982, 2003). As Cooper (1969) suggests, perceived price varies across consumers, products, situations, and time. It depends on consumer income level, prior experience with the product, and the reference price that is used for comparison (Monroe, 2003; Winer, 1986). The psychophysics of prices explains that buyers perceive price differentials and price changes relative to the range of prices for each product category (Kamen and Toman, 1970). Therefore, they purchase those products that are priced within their acceptable price ranges (Monroe, 1973, 1982, 2003; Monroe and Cox, 2001; Monroe and Petroshius, 1981; Suri and Monroe, 2001).

People frequently compare various prices of the available options in the market in order to make a desired choice (Monroe, 2003; Suri and Monroe, 2001). In fact, price comparison is a social norm that consumers cannot avoid. Transaction Utility Theory suggests that people prefer to purchase products at lower prices because when they buy a product that is cheaper than its alternatives their perception of savings will increase and they can gain the benefits they expected from using the product while paying a lower monetary price (Chen, Monroe and Lou, 1998; Darke and Chung, 2005; Monroe, 2003; Monroe and Chapman, 1987; Thaler 1980).

Prospect Theory suggests that people are more sensitive to loss than gain. In addition, they face financial risks when they perceive products as high-priced. Therefore, they follow a price aversion strategy in which they avoid buying expensive products to minimize the expenses or loss (Kahneman and Tversky, 1979; Thaler, 1980, 1985). However, consumers do not always respond to prices based on rationality, but they may select products that create higher emotional value. This is why they will not necessarily pick the products with the lowest prices or buy the cheapest alternatives (Monroe, 2003).

A major factor that may lead to difficulty in making a right decision is anxiety, which affects consumers' ability to process price information (Suri and Monroe, 2001). Moreover, given the fact that prices are numbers and processing the numerical information or evaluating price differentials requires mathematic computations, buyers with high math anxiety may make sub-optimal choices and pay a higher monetary price for a product (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013). According to Suri, Monroe and Koc (2013), people with superior math knowledge often retrieve solutions to math problems from long-term memory. However, untrained math problems, such as price differential processing, require arithmetic calculations through working memory. Therefore, consumers usually compare and judge different sales prices in daily purchase situations using limited cognitive resources of their working memory. Consequently, math anxiety reduces their ability to process price formats or promotion frames accurately and make the right choices.

Suri and Monroe (2001) applied the Cue-Utilization Theory of Easterbrook (1959), which assumes that when the level of anxiety or arousal increases, consumers will use a lower number of cues to process information resulting in a poorer mental performance. Moreover, facing time pressure will minimize consumers' ability to compare prices and decide on acceptable prices. During online shopping, another type of anxiety, i.e., computer anxiety, will affect the trade-off between price and value so that people with greater computer anxiety will give more weight to higher price as the indicator of higher value, and thus, they may purchase products that are at higher prices. This means that high anxious individuals employ fewer cues to evaluate quality, or rely only on price as the criterion for product quality (Suri *et al.*, 2003). Nevertheless, Jones, Childers and Jiang (2012) argued that people with high math anxiety have a tendency to buy products under promotion. However, they found evidence for this only among highly math-anxious women.

According to Monroe (2003), prices are numerical information that is perceived by consumers through a numerical cognition process, which requires three types of operations. First, a number transcoding and calculation process in which consumers should be able to mentally manipulate sequences of words or symbols according to fixed rules (e.g., calculating the difference between gas prices of $2.98 and $3.08). Second, enumeration or quantification processes in which individuals need capability to determine measurable quantity of a perceived set of items through counting, subitizing, or estimation (e.g., $8.00 + $5.00 = $13.00). Third, approximation and processing quantities in which people try to convert Arabic numerals (e.g.,

$8.00, $7.00, $5.00) or verbal numerals (e.g., three hundred dollars) into an internal magnitude representation in their minds. Consumers are often weak in processing information. Consumers often process the numerical quantities similar to physical magnitudes, such as weight or size. This means that they encode a number as a nominal representation. For example, 18 can be considered as a young (age), cold (temperature), light (weight) or cheap (price). In fact, buyers encode price information automatically despite the particular number that is encoded.

People are generally weak in processing price information, especially because they need mathematics ability to calculate and estimate the price magnitude and variances (Monroe, 2003). A comparative study of adults in 20 countries showed that 29% of Americans were only able to do basic arithmetic tasks and could not perform computations that require two or more steps (Green, 2014). Time pressure will also reduce their ability to correctly process prices (Suri and Monroe 2003). Therefore, buyers usually use a heuristic view in which they ignore some parts of information and try to simplify their choices by focusing on those pieces that are easily processed. In fact, they prefer to use decision shortcuts and reach choices that may not be optimal or rational (Cheng and Monroe, 2013; Thomas, 2013; Thomas and Morwitz, 2009).

A major example of the weak numerical processing of American consumers occurred in the early 1980s. After McDonald’s successfully introduced its Quarter Pounder hamburgers in 1972, the A&W fast-food restaurant chain released a new hamburger to compete with McDonald’s. A&W offered its Papa Burgers with 1/3 pound of beef patty. The new hamburger had more meat than the McDonald’s Quarter Pounder and, thus, was less expensive. It was also preferred by customers in taste tests. However, the consumer market did not favor the product despite a media advertising campaign. In consumer focus groups, most American customers thought that they were being overcharged by A&W. They were not willing to pay a similar price for the A&W burgers with a third of a pound of beef compared to a quarter-pound of beef at McDonald's. Surprisingly, it was because the "4" in "1/4" is larger than the "3" in "1/3". Hence, they misunderstood the value of one-third (Green, 2014). This example shows how math anxiety due to difficulty with a basic fraction task leads to a major failure in quantity computation and price comparison. Indeed, people focus on small pieces of information or shortcuts to simplify their arithmetic tasks. A main reason for using decision shortcuts is that consumers have a lower motivation to process price information (Suri, Kohli and Monroe, 2007). Therefore, heuristic judgments and subjective feelings play a vital role in shaping consumer behavior. From the seller perspective, knowing this fact may lead to higher profits, e.g., a fast food chain might make millions of dollars of profits by selling burgers with 1/5 pound of beef. However, from the buyer perspective, being able to realize price differences and do better at math will lead to greater savings (Adventuresinfrugal, 2014).

Paying is a painful experience and consumers aim at reducing this pain by saving money through choosing a more affordable option. However, cognitive feelings and processing fluency may affect the accuracy of choices. In other words, when computing the difference between the two prices is easy for consumers, they may perceive a larger difference between the two prices. Conversely, perceiving price differentials will be more problematic when people face difficult calculations. Such difficulty may influence consumers' subjective price judgments (Thomas, 2013; Thomas and Morwitz, 2009).

Therefore, consumers with high math anxiety may prefer product prices that are explained in simpler formats rather than those that require complex price computations. In other words, math anxiety influences consumer choice between alternatives with different prices (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013).

Math Anxiety Effects on Price Satisfaction and Purchase Intention

Marketers try to deliver higher value to keep their customers satisfied and loyal (Matzler, Würtele and Renzl, 2006). However, from the consumer perspective, value is the extent of satisfaction they experience for the price they pay (Shifflet and Bhatia, 1997). Therefore, the concept of price satisfaction has a close relationship with consumer value perception. Price satisfaction refers to the level of consumers' perceived satisfaction or dissatisfaction with the overall price (Matzler, Renzel and Faullant, 2007). Companies such as AT&T and McKinsey and Co often assess customer product satisfaction independently from their perceived price satisfaction (Cao, Gruca and Klemz, 2003).

Transaction utility theory states that consumers generally seek products that are offered at lower prices than their alternatives because they like to gain the highest possible utility at the lowest possible price. Shopping at lower prices creates a psychological satisfaction resulting from making a profitable price deal (Thaler, 1983). However, satisfaction with the price is a broader concept that results from consumer perception of price-quality ratio, price fairness, price reliability, price transparency, and relative price. Price transparency was defined as "clear, comprehensive, current and effortless overview about a company's quoted prices" (Matzler, Renzel and Faullant, 2007, p. 395). When price complexity is high and the net price to be paid after promotion is not clear or easy to calculate, price transparency will be reduced and, therefore, consumers will perceive lower price satisfaction.

The effect of math anxiety on price satisfaction is a natural brain reaction. Neuroscience has studied the regions in the human brain that helps people to perceive the value of objects. This research stream is called "Neuroeconomics" and suggests that individuals' feelings about different stimuli are formed in the ventromedial prefrontal cortex (vmPFC), which is a small area between the eyes at the front of the brain (Winecoff *et al.,* 2013; Yeager-Duke, 2013). Goel and Dolan (2001) discovered in a study of humor that the vmPFC is involved in reward processing and facilitates people's responses to emotional stimuli generating positive feelings. However, as Young, Wu and Menon (2012) explained, the prefrontal cortex also helps people to process negative emotions, e.g., math anxiety. In fact, individuals regulate their negative emotions, such as perceived fear, by converging activation within a subregion of the vmPFC (Diekhof *et al.*, 2011). This means that math anxiety is able to make a reappraisal in people's emotions about a numerical stimulus, such as price.

Consumers who experience high math anxiety will perceive negative emotions if they face prices and promotions that are explained in complex formats or require compound calculations. Consequently, they may find the price unfair or unreliable. This may lead to lower satisfaction with the price and avoiding to deal with such prices. Moreover, the nervous tension due to math anxiety does not allow consumers to calculate the exact price and they will feel high uncertainty about the worth of the product. When consumers perceive high risks considering product choice, they will be less satisfied with the price and, therefore, they will demonstrate a lower purchase intention (Xia and Monroe, 2004). Nevertheless, not all prices generate the same response from buyers. Thus, it is important to understand which price formats or promotion framings are perceived by consumers as complicated and create negative feelings resulting in inferior price satisfaction.

The Moderating Effects of Price Presentation and Framing

According to Nagle (1984), pricing is an art and setting a right price needs talented and creative managers. Although retailers often follow rules of thumb in setting product prices, previous research has shown that consumers react differently to the way that sellers present the price. Therefore, using inappropriate price formats may endanger firms' survival and profitability (Gabor and Granger, 1964, 1979; Monroe, 2003). The pricing literature suggests that the way that marketers present prices or frame promotions affects buyers' perceptions of the product price and value (Cai and Suri, 2007; Larson, 2014; Thomas and Morwitz, 2005; Weisstein, Asgari and Siew, 2014). This fact will be more crucial considering the existing differences between consumers based on the level of math anxiety. As Jones, Childers and Jiang (2012) suggest, math anxiety and promotion format together affect the buyers' purchase behavior.

Math Anxiety and Promotion Framing

Marketers use sales promotions in order to arouse purchase intentions among consumers (Chen, Monroe and Lou, 1998; Gamliel and Herstein, 2011). Two thirds of marketers use promotion as a component of their marketing strategies (Palazón and Delgado, 2009). According to Weisstein, Asgari and Siew (2014), marketers can influence consumers' cognitive judgments and price perceptions through different promotion framings. In fact, framing helps a seller to communicate different values to buyers and affect their product or brand choice.

Prospect theory of Kahneman and Tversky (1979) suggests that people judge prices based on a reference point and consider deviations from that reference point as gain versus loss. In addition, they are more sensitive to loss than gain. Therefore, promotions that demonstrate a higher loss aversion will be more attractive than those that express higher gains (Kahneman and Tversky, 1979; Lowe, 2010; Monroe, 2003). According to Yan, Dillard and Shen (2012), consumers who fear monetary loss avoid higher prices due to the behavioral inhibition system (BIS) and prefer the price offers that show loss reduction over those that are framed as a gain. Furthermore, when a promotion is explained as a reduced price (e.g., discount), buyers can easily integrate it with the reference price and judge the price difference. However, it is difficult for them to integrate value-added or non-monetary promotions that are framed in units other than money (e.g., free gift) with the reference price. Therefore, buyers categorize discounts as reduced loss and the free product as gain (Campbell and Diamond, 1990; Diamond and Campbell, 1989; Gamliel and Herstein, 2011).

Mental accounting explains that consumers evaluate promotions with a similar nominal value differently due to their perception of loss versus gain (Chen, Monroe and Lou, 1998; Diamond, 1992; Sinha and Smith, 2000; Thaler, 1985). In fact, framing of a promotion can affect the way that consumers process price information (Chen, Monroe and Lou, 1998; Lowe, 2010; Stibel, 2005). For example, price discounts may infer lower quality for consumers, whereas free gifts or extra products do not create such a negative inference (Chandran and Morwitz, 2006). Moreover, promotion framing influences consumers' perceived savings and purchase intentions (Bayer and Ke, 2013; Gendall *et al.*, 2006; Xia and Monroe, 2009).

The effectiveness of promotion framing depends on consumers' personal characteristics (Palazón and Delgado, 2009). For example, price-sensitive consumers prefer products that are sold with discounts over the ones that come with free gifts (Weisstein, Asgari and Siew, 2014). This is because they perceive a higher value with price reductions than free gift promotions (Sinha and Smith, 2000). However, there is no evidence showing that this response holds true for highly math-anxious people. The question is whether high math anxiety consumers react more to gain frames or reduced loss frames.

As Suri, Monroe and Koc (2013) explained, math anxiety as an emotional state can intervene in rational decision-making and lead to sub-optimal choices. Therefore, low and high math anxiety consumers may respond differently to promotion framing based on gain versus reduced loss frame. Although buyers who receive free gift promotions need to recall more information regarding the monetary value of the promotion than those who are exposed to price discounts (Chandran and Morwitz, 2006), the difficulty of computing discounts will also matter. According to Feng, Suri and Bell (2014), consumers with high math anxiety will avoid complex price computations. Consequently, they are more likely to perceive greater negative emotions with percentage-off discounts compared to products offered with free gifts, regardless of the real value of the promotion. In contrast, low math anxious buyers will prefer a percentage-off discount if it gives them more opportunity to save.

Moreover, free gifts may increase uncertainty about the product or brand performance or quality (Raghubir, 2004). However, people who make decisions based on affect or emotions (e.g., high math anxious consumers) will embrace uncertainty and will show a higher purchase intention (Laran and Tsiros, 2013). As a result, math anxious consumers may perceive higher price satisfaction and purchase intention with a promotion framed as gain, while low math anxiety buyers are more likely to choose a reduced loss frame.

Free gift promotions may be framed as extra product promotions and matching discounts. Davis and Millner (2005) examined consumers' reactions to promotions framed as price rebates versus matching discounts. They defined matching discounts as promotions in which consumers can receive higher quantities of products for the same price, e.g., buy one get one free or buy two get one free. The study found that consumers preferred matches to rebates, as they follow a rebate aversion strategy. However, only 30% of the respondents realized that the effective prices to be paid are equal and even 11% thought that the two promotion frames will result in different prices. This shows that they had difficulty in computing the monetary sacrifice to be made and found matching discounts more affordable. In addition, Shampanier, Mazar and Ariely (2007) argued that people usually overreact to free products and the choices that reduce the price. This is because the free content of a price offer creates a psychological state. Sometimes, consumers pick the alternatives with higher prices and free components (Nicolau, 2012). Thus, matching discounts may convince buyers that they gain a free product, while they consider other monetary discounts as a reduction in losses.

However, as Prospect Theory suggests, most consumers should prefer discounts that decrease the perception of loss rather than increasing gain. This contradiction can be addressed through math anxiety so that people with a high level of math anxiety will feel higher price satisfaction when they face promotions framed as matching discounts, e.g., buy one get one free, compared to the discounts that require price computations, e.g., dollar-off and percentage-off discounts. In contrast, low math anxiety consumers have less difficulty with price calculations and may prefer discounts that help them reduce their monetary sacrifice. Consequently,

H1: (a) When a promotion is framed as buy one get one free, compared to percentage-off framing with the same economic value, consumers with high math anxiety will perceive higher price satisfaction and purchase intention.

(b) When a promotion is framed as percentage-off, compared to buy one get one free framing, consumers with low math anxiety will perceive higher price satisfaction and purchase intention.

Math Anxiety and Discount Framing

Discounts or price reductions are major promotion frames used to increase sales by stimulating consumer motivation to purchase products and services (Mobley, Bearden and Teel, 1988). This is because people in their search behaviors are usually looking for prices that are framed as discounts (Bayer and Ke, 2013). Consumers perceive higher transaction value when the product price is reduced by discounts, though it can negatively influence perception of product quality (Darke and Chung, 2005). However, it is important to realize how to communicate price reduction to buyers (Monroe and Della Bitta, 1981).

Through attribute framing, marketers frame a single attribute, such as a price discount in a similar manner through using different semantic cues or phrases in their ads or promotional offers (McKechnie *et al.*, 2012). They may present a price discount in absolute terms (dollars-off) or relative terms (percentage-off). However, consumers perceive price reductions differently when the savings are framed in absolute terms versus relative forms depending on product price levels, discount size, and brand (Chen, Monroe and Lou, 1998; Gendall *et al.*, 2006; McKechnie *et al.*, 2012). For example, buyers who have a higher need for cognition will prefer discounts in relative forms because they enjoy engaging in complex arithmetic calculations (Kim and Kramer, 2006).

Math anxiety may influence consumers' preference for different discount framings. Suri, Monroe and Koc (2013) found that math anxious people would prefer price discounts presented in dollars-off to percentage-off formats. However, they argued that this effect is significant only if consumers have high motivation to process information. This may suggest that when the price level is high and consumers have higher motivation to calculate the final price exactly, they may be affected by their math anxiety and select simpler price formats. This may result in sub-optimal choices. Feng, Suri and Bell (2014) found that consumers with high math anxiety selected an expensive product with $-off discount over a cheaper product with %-off discount. This is because they are not able to easily calculate the percentage discount. Therefore, they prefer dollars-off discounts regardless of the real value of the discount. In other words, consumers favor offerings where they can easily process numerical information unless they have the motivation to seek greater economic value (Coulter and Roggeveen, 2014). In the case of low-priced products, consumers may have lower motivation to calculate the final price and even high math anxiety buyers may pick percentage-off deals. Therefore,

H2: (a) For high-priced products, when a price discount is framed as dollar-off, compared to the percentage-off with the same economic value, high math anxiety consumers will perceive higher price satisfaction and purchase intention.

(b) For high-priced products, low math anxiety consumers will show no significant difference in perceived price satisfaction and purchase intention for dollar-off and percentage-off discounts.

(c) For low-priced products, when price discount is framed as percentage-off, compared to the dollar-off, low math anxiety consumers will perceive higher price satisfaction and purchase intention.

(d) For low-priced products, high math anxiety consumers will show no significant difference in perceived price satisfaction and purchase intention for dollar-off and percentage-off discounts.

Marketers sometimes combine two or more discounts together in order to offer a greater promotion to consumers and persuade them to purchase (Cai and Suri, 2007). They use the term 'stackable discounts' when multiple discounts are applied to the same product (Cai and Suri, 2009). The literature on the mental accounting accuracy and Prospect Theory suggests that multiple discounts are more desirable than one single discount and result in loss reduction (Kahneman and Tversky, 1979; Thaler, 1985). Indeed, consumers perceive higher transaction value when a product's price is discounted twice or more.

Multiple discounts require compound price computations to estimate the total amount of discounts. For example, if a product originally has a 20% discount and the seller offers an additional 10% discount, consumers need to use percentage, multiplication and fractions. In this case, the final discount is equal to 1- (1- 20%) × (1- 10%) = 28%. Doing such price calculations is difficult for many consumers. Therefore, they will use heuristics to simplify arithmetic (e.g., 20% + 10% = 30%). This means that they will show an upward bias with perceived savings and purchase intentions when multiple discounts are offered compared to a single discount with identical value, e.g., 28% discount (Cai and Suri, 2007, 2009; Chen and Rao, 2007). However, a U-shaped effect will appear if marketers apply numerous discounts to a product, so that consumers will place a lower value on multiple small discounts (Cai and Suri, 2007).

Calculating the actual amount of multiple discounts requires using a high capacity of working memory and attention to computation. According to Cai and Suri (2009), when buyers pay full attention to multiple discounts, they will perceive higher savings and value than a single discount with a similar economic value due to systematic computational error and mental accounting principles. However, when consumers pay less attention to multiple discounts, the anchoring-and-adjustment and numerosity cue heuristics will cause lower perceived value than a single discount of equal economic value. The anchoring-and-adjustment heuristic suggests that buyers perform only a few steps of calculation and their final estimation of the price is affected by the anchor. For example, in case of multiple 20% and 10% discounts, they estimate the final discount as a number close to 20%. The numerosity cue heuristic explains that consumers divide multiple discounts into separate units and perceive them as smaller than a single discount.

The main reason for using heuristics is a high level of math anxiety among buyers. In fact, math anxiety can alter the effect of multiple discounts on consumers’ perception of value so that people with high math anxiety may perceive higher price satisfaction with a single discount than multiple discounts that require complex computation. Consequently, they may prefer to purchase products that are sold with a single discount (Cai and Suri, 2007, 2009). In contrast, low math anxiety buyers will more likely be satisfied with multiple discounts. Therefore,

H3: (a) When a product is offered with a single discount, compared to multiple discounts with the same economic value, high math anxiety consumers will perceive higher price satisfaction and purchase intention.

(b) When a product is offered with multiple discounts, compared to a single discount with the same economic value, low math anxiety consumers will perceive higher price satisfaction and purchase intention.

Math Anxiety and Price Bundle Framing

Price bundling is a common pricing tactic in which marketers offer two or more products in a single package or bundle for a particular price (Guiltinan, 1987; Monroe, 2003; Schmalensee, 1982, 1984; Stremersch and Tellis, 2002; Yadav and Monroe, 1993). For example, McDonald's Dinner Box is a new promotional offer in which consumers can buy two Big Macs, two regular cheeseburgers, 10-piece Chicken McNuggets, and four small fries for only $9.99, while it helps them to save 45% because it is $8 cheaper than purchasing the items individually. McDonald's also offers other meal bundles, such as the Mickey D's Value Pack and a World Cup promotion called the Ole Box (Smith, 2014). Airlines offer vacation packages, including air travel tickets, lodging and airport transport or car rentals (Guiltinan, 1987). Other examples of bundles may include hotel weekend packages, opera season tickets, movie distribution, computer software, Internet services, personal computers, printer and ink, luggage sets, car wash and cleaning, health club subscription, and executive MBA programs (Bar-Gill, 2006; Guiltinan, 1987; Stremersch and Tellis, 2002).

The practice of selling products as a package is known as commodity bundling in which a firm adopts a pure bundling strategy by selling products only in a package, or uses a mixed bundling strategy by selling the same products either individually or together in a package (Adams and Yellen, 1976; Gilbride, Guiltinan and Urbany, 2008; Salinger, 1995; Schmalensee, 1982; Sharpe and Staelin, 2010; Stremersch and Tellis, 2002; Tellis, 1986). Service providers may also offer two or more services together as a bundle, or give the customer an option to buy one or more of the services individually or to purchase the service bundle (Guiltinan, 1987).

According to Adams and Yellen (1976), commodity bundling helps marketers save production and transaction costs, avoid price discrimination and gain greater profits (Adams and Yellen, 1976). Nagle (1984) considers product bundling as a tactic for price segmentation. Guiltinan (1987) explained that service firms apply service bundling to stimulate consumer demand and achieve cost economies. Moreover, bundling can reduce consumers' perceptions of risk when they face new high-tech products and stimulate the sales of such items (Sarin, Sego and Chanvarasuth, 2003). Bundling can also create an entry barrier for new entrants into the market, e.g., online sellers of informational goods, even when the entrant offers high quality or low-priced products (Bakos and Brynjolfsson, 2000).

Selling unbundled products is profitable when their demands are independent. Pure or indivisible bundling can decrease buyer heterogeneity when there is asymmetric demand or the demand for one product is higher than for the other (Schmalensee, 1984; Tellis, 1986). However, mixed bundling will be more profitable than pure bundling if consumers place a very high value on one of the items in the bundle while they perceive the other items as less valued (Adams and

Yellen, 1976). This is because those who perceive a higher value only in one item can choose to buy the unbundled product at a premium price, whereas other customers prefer purchasing the bundle to attain greater savings (Guiltinan, 1987; Schmalensee, 1984). Indeed, sellers charge the value-sensitive segment with premium prices and achieve a higher sales volume of the less valued products to price-sensitive consumers. Furthermore, manufacturers sometimes buy a complementary product made by their competitors to sell with their own product in a pure bundle as a profitable tactic (Nagle, 1984; Schmalensee, 1982). Pure bundling is crucial when the products are perishable, e.g., food items or theater seats. However, pure bundling will be considered illegal if it is a tying contract, in which the primary product is sold only with a secondary or tie-in item, while they are not related (Stremersch and Tellis, 2002; Tellis, 1986).

Marketing researchers have studied the requirements for optimal bundling, consumer evaluation of bundles, and pricing and promotion strategies concerning product bundles. However, there are many ambiguities and shortcomings in the literature about the domain of bundling, its legal aspects and optimal conditions (Linthorst, Telgen and Schotanus, 2008; Stremersch and Tellis, 2002). In addition, there is confusion between price bundling and product bundling. According to Stremersch and Tellis (2002), product bundling requires integrating two or more products and services at any price. By integrating products, marketers combine the different functions of the bundled products in a single package and provide consumers with added value. For example, buying an insurance package provides better coverage, a mutual fund reduces investment risk, following exercise programs and diets leads to better weight loss performance, and using integrated stereo systems creates the sense of compactness. In contrast, price bundling refers to situations in which retailers sell two or more distinct products in a package at a discount. Price bundles do not create any added monetary benefit for consumers, and thus, sellers need to offer discounts to encourage people to buy. A combo meal, a luggage set or a season ticket for the opera are examples of price bundles. However, it is important to understand how consumers respond to different price bundles.

Mixed bundling itself has two forms. First, in mixed-leader bundling the seller discounts the price of one of two products while selling the other product at the regular price. Second, in mixed-joint bundling the seller sets a single price for two or more products that are sold together. However, the price of the bundle is lower than the sum of the price of individual items, or $P_{A+B} < P_A + P_B$ (Guiltinan, 1987; Monroe, 2003). There is an optimal price bundling in which the bundle price is greater than the sum of two prices. Nonetheless, such an optimal mixed bundling is a practical tactic only if the seller can convince buyers not to purchase the products separately (Salinger, 1995). Mixed-joint bundling has two forms as well. The integrated form requires offering the bundle with a single price, whereas the segregated joint bundle comes with separate discounted prices for each item (Gilbride, Guiltinan and Urbany, 2008). Framing the price of bundles or presenting bundles with different price formats is an important determinant of the success of bundling (Gilbride, Guiltinan and Urbany, 2008).

According to Bar-Gill (2006), price misperception is one of the major factors that affect consumers' responses to bundles. In fact, bundling is a response to price misperception. Many consumers underestimate the total price they should pay for a bundle due to lack of information. If consumers perceive the price of bundled products as lower than unbundled alternatives, bundling will be the only possible way to survive in the market. However, this is not the only implication of price misperception. Consumers may have different perceptions of bundle prices when sellers present prices in different ways. Therefore, behavioral pricing has given attention to consumers' perceptions of bundle prices. This helps to understand the mechanism of bundling from a buyer's perspective, while economic theories focus on the perspective of firms or sellers (Linthorst, Telgen and Schotanus, 2008; Sharpe and Staelin, 2010). As Sharpe and Staelin (2010) explored, bundles are viewed by consumers as promotions and, thus, increases price sensitivity in the long term. Therefore, framing bundle prices are as important as other price promotion framings.

A major concern for marketers is to find out which strategy works better - using a single price for a bundle or presenting a list of separate product prices. Prospect Theory of Kahneman and Tversky (1979) argues that people perceive different stimuli as positive deviations (gain) or negative deviations (loss) from a reference point. Therefore, they will look at monetary prices as losses, while perceiving discounts as gains or loss reductions. In addition, they are naturally more sensitive to losses than gains. Furthermore, the Mental Accounting Theory of Thaler (1985) suggests that multiple gains are more rewarding than a single gain, and multiple losses are more punishing than a single loss. Therefore, marketers can optimize bundles by incorporating all price information in a single bundle price instead of presenting a list of separate product prices (Stremersch and Tellis, 2002). This is why Gilbride, Guiltinan and Urbany (2008) found that the integrated form of mixed bundling in which sellers offer the bundle with a single price has the highest ability to stimulate buyers' purchase intention. In addition, retailers can separate the bundle discount in multiple savings in order to segregate gains for consumers and increase their purchase intentions, while presenting a discount as a single saving is less appealing (Stremersch and Tellis, 2002).

When marketers offer a bundle by presenting a list of separate product prices, consumers have to calculate the final price by adding the price of different items. This task will be difficult for buyers who suffer from math anxiety if they need to use complex computations. As each item has a separate price, estimating the final price requires consuming working memory to do mental arithmetic (Hitch, 1978). Thus, buyers use heuristics, such as anchoring and adjustment, to simplify computations when combining separate prices of the bundle items. Indeed, they may overweight the anchor (e.g., the price of the primary product) and make inadequate upward adjustments in the prices of secondary products. Therefore, consumers' recall of total costs may not be equivalent to combined prices of the items.

This is similar to partitioned prices in which people may fail to exactly calculate the sum of base product price and its surcharges (Morwitz, Greenleaf and Johnson, 1998). However, unlike partitioned prices, they will not focus only on the base price because separate prices are not for a single product. This means that consumers with high math anxiety will have a higher estimation of the price of a bundle when marketers use a list of separate prices rather than a single price. Therefore, the evidence shows that consumers usually prefer bundled prices to partitioned prices (Sheng, Bao and Pan, 2007).

A justification for this phenomenon is that when consumers are exposed to a single price for the bundle, they can integrate the reference prices of two or more items and evaluate the bundle price on such a basis. However, it will be difficult for them to assess the value of the bundle when the items have separate prices (Gilbride, Guiltinan and Urbany, 2008). This fact will be more crucial for consumers who suffer from math anxiety. As Bar-Gill (2006) suggests, overestimating the bundle price will result in underconsumption. Consequently, using a single price for the products in a bundle will be desirable when the majority of consumers have high math anxiety. This will not affect those buyers who have lower degrees of math anxiety, as they may prefer a list of bundle items' prices to calculate the actual savings they will achieve. Hence,

H4: (a) When a price bundle is offered with a single bundle price, compared to a price list of bundle items with the same economic value, high math anxiety consumers will perceive higher price satisfaction and purchase intention.

(b) When a price bundle is offered with a price list of bundle items, compared to a single bundle price with the same economic value, low math anxiety consumers will perceive higher price satisfaction and purchase intention.

The Mediating Effect of Perceived Emotional Value

Consumers' decision to choose a product among multiple alternatives and to make a purchase is fundamentally influenced by their perception of value (Monroe, 1973, 1979; Zeithaml, 1988). Economic theory assumed that firms create value for consumers by offering products that satisfy their needs. However, Vargo and Lusch (2004) argued that firms could only make value propositions, while customers perceive and determine the value of goods and services. By definition, perceived value is "a consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" (Zeithaml, 1988, p. 14). In other words, perceived value has been conceptualized as a unidimensional concept based on a rational, cognitive trade-off between perceived quality, or utility and perceived price, or monetary sacrifice (Monroe, 2003; Tellis and Gaeth, 1990; Zeithaml, 1988). However, the current marketing literature considers perceived value as a multidimensional concept, which is complex and highly emotional (Sánchez-Fernández and Iniesta-Bonillo, 2007).

As Hirschman and Holbrook (1982) suggested, cognitive decision-making is independent from the emotional choice. Some consumers make their choices based on their emotional desires rather than utilitarian motivations. The Theory of Consumption Values introduced by Sheth, Newman and Gross (1991) assumes that consumer choice is affected by five independent consumption values, including: (1) functional value, which refers to the perceived utility that a product creates for consumer by performing utilitarian functions; (2) social value, which denotes the social image and sense of belonging that a product creates for consumers; (3) epistemic value, which depends on the ability of a product to arouse curiosity; (4) conditional value, which refers to the perceived utility of a product due to specific situations or conditions; and (5) emotional value, which is the perceived utility that buyers obtain when a product stimulates affective states. The latter is related to consumer feelings, aesthetics, and emotions associated with the product (Pura, 2005; Sheth, Newman and Gross, 1991; Sweeney and Soutar, 2001; Williams and Soutar, 2000).

As stated earlier, neuroeconomics has found that feelings about different stimuli are formed in the ventromedial prefrontal cortex (vmPFC) of the brain. Such affects shape their perceived emotional value concerning the objects or products. Winecoff *et al.* (2013) studied the role of the vmPFC in processing appetitive stimuli that motivate behavior. They found that the vmPFC becomes more active when a person perceives greater positive feelings. However, the vmPFC's function is beyond responding to rewards and positive stimuli. This region of the brain is in charge of value trade-offs. This means that the vmPFC helps people to process the cognitive trade-off between the reward and utility they receive from a product and what they pay for it. At the same time, emotions enter such a trade-off. Using fMRI, Winecoff *et al.* (2013) showed that when participants did not regulate their affect and let the good feelings flow, their vmPFC worked harder, but once they practiced reappraisal or changed their feelings about the stimuli, the vmPFC's activity was weakened. Therefore, if a person reappraises his/her emotion, the response to stimuli will change (Winecoff *et al.*, 2013; Yeager-Duke, 2013).

The findings of neuroeconomics reveal that math anxiety is formed in the same place that emotional value is perceived. When people who suffer from math anxiety perceive negative feelings and lower satisfaction with a specific price or promotion frame, they may place a lower value on the product. In fact, math anxiety not only affects the assessment of the price, but also the perception of product emotional value. In other words, consumers may perceive lower emotional value if they deal with prices and promotions that require complex calculations. This may influence their product choice as well.

According to Sheth, Newman and Gross (1991), perceived emotional value influences consumer choice behavior. Moreover, emotional value affects behavioral intentions (Lee, Lee and Choi, 2011). Feng, Suri and Bell (2014) found that consumers with higher math anxiety would express higher avoidance of choices that require complex price computations. However, they overlooked the role of emotional value. This means that buyers may refuse to purchase the products with complex prices due to negative emotions about the product. Consequently, we assume that consumer satisfaction with the price influences purchase intention through its effect on perceived emotional value. Thus,

H5: The effect of perceived price satisfaction on purchase intention is mediated by consumers' perceived emotional value.

The Mediating Effect of Perceived Savings

The Transaction Utility Theory of Thaler (1983) explains that consumers usually seek the products that are less expensive than their alternatives because they like to save more and gain the highest possible utility at the lowest possible price. Shopping at lower product prices increases buyers' perceived transaction value, which is a psychological satisfaction resulting from making a profitable price transaction. In addition, they may perceive higher perceived acquisition value, as they gain their expected benefits from the product while make a lower payment. Therefore, the likelihood of purchasing the product will considerably increase (Darke and Chung, 2005; Dodds, Monroe and Grewal, 1991; Grewal, Monroe and Krishnan, 1998; Lichtenstein, Netemeyer and Burton, 1990; Monroe, 2003; Monroe and Chapman, 1987; Thaler 1983, 1985, 2008; Xia and Monroe, 2009).

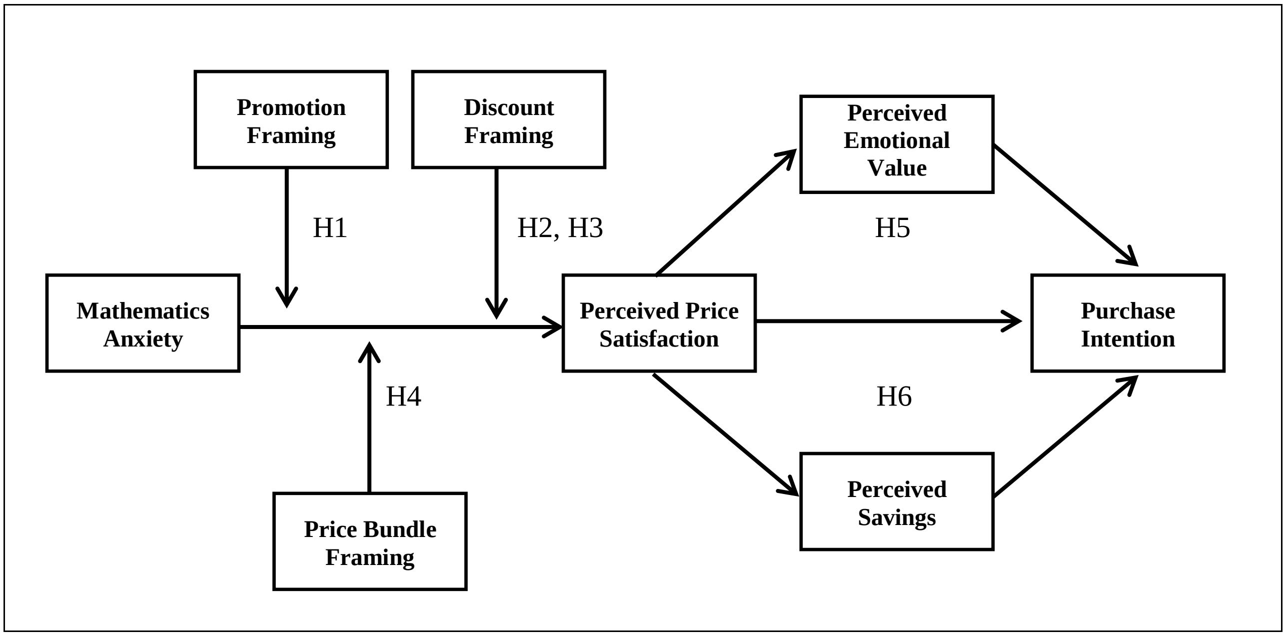
According to Xiao and Noring (1994), promotions allow consumers to buy products at lower prices and perceive greater savings. A promotion that affords consumers higher savings and lower monetary sacrifice will attract them to make a purchase (Weisstein, Asgari and Siew, 2014). When consumers are dissatisfied with a specific price promotion because it is difficult to understand or calculate the final payment or the amount of savings is vague, they will perceive lower savings and have less motivation to buy the product. This is true for high math anxiety individuals who react negatively to complex price formats. In other words, satisfaction with the price may influence consumers' purchase intention through determining their perception of savings. Therefore,

H6: The effect of perceived price satisfaction on purchase intention is mediated by consumers' perceived savings.

The Conceptual Model of the Study

Figure 2.1 illustrates the hypothesized relationships between different variables in the study. As the model shows, math anxiety influences consumers' perceived price satisfactions and purchase intentions considering two assumptions: first, the interaction between math anxiety and each moderating variable, and second, the intermediary role of perceived emotional value and perceived savings in the relationship between price satisfaction and purchase intention.

Figure 2.1: Conceptual Framework of the Study



Obviously, like every conceptual framework, the hypothesized relationships in this model need empirical support to provide a proper explanation for the effects of math anxiety on price perceptions and consumer behavior.

Summary

This chapter summarized and criticized the literature concerning mathematics anxiety as an emotional state that affects not only students' performance in math-related classes and exams, but also consumers' ability to process price information and make desired purchase decisions in a competitive market in which numerous options are offered at different prices. The first section concentrated on defining and analyzing math anxiety as a psychological phenomenon with affective, physical and cognitive consequences. Then, math anxiety was related to consumers' price perceptions and their subsequent responses.

The second section discussed the role of three types of contextual factors that interact with math anxiety in its effect on price satisfaction, which is the affective reaction when facing complex prices, and purchase intention. The first factor refers to promotion framing saying that when marketers frame a promotion as gain, e.g., buy one get one free, consumers' response will be different than when they frame the promotion as reduced loss, e.g., price discounts. The second factor is the way that marketers frame price discounts themselves. If discounts are framed as percentage-off, highly math-anxious people may negatively respond to it and perceive lower price satisfaction than with dollar-off discounts. Besides, offering multiple discounts on a product may create different responses than selling the product on a single discount. The third factor is price bundling in which sellers offer two or more products together for a single price or with a discount on separate prices. Implementing price bundling may create different responses among consumers due to their level of math anxiety.

The conceptual framework of the study also indicates that consumers' perceptions of emotional value and perceived savings can partially mediate the effect of perceived price satisfaction on purchase intention. Perceived emotional value is the affective judgment regarding the product value, while perceived savings reflect the cognitive assessment of deal value based on the price that buyers pay for a product compared to regular prices and the price of alternative options. Finally, a model or pictorial representation of the hypothesized relationships was developed and it will be put to the test in the next stage of the study.

CHAPTER III

RESEARCH METHODS

Overview

The present study aims at investigating how and to what extent consumers' mathematics anxiety influences their perceptions of product prices as numerical information, and determines their purchase intentions, especially when it results in different perceptions of product value. In addition, it intends to understand why some consumers respond negatively to some prices or promotion framings, and thus, prefer an alternative product at a higher price. This chapter explains the research methodology that was used to test the hypotheses developed in order to explicate the role of math anxiety in consumer behavior. Such a methodology determined the design to be used for conducting the research, what sample to be selected for data collection, what studies to be designed to test the research hypotheses, what scales to be used to measure each variable of interest, and what statistical techniques to be used to validate and analyze the data collected from the research sample.

Research Design

As stated in Chapter 1, this study aims to answer two questions: (1) how does math anxiety influence consumers' emotional and cognitive perceptions of price and value that determine their purchase decisions?, and (2) how do different price promotion frames influence the relationship between math anxiety and price perception, which in turn results in variations in purchase intentions? Six hypotheses were developed to provide a framework for explaining the effects of math anxiety on consumer price perception and purchase behavior. Hence, consumers are the unit of analysis in this study.

The present study used a set of scenario-based experiments to observe the differences among various groups of consumers. This approach helps to implement manipulations, control variables, and reduces the time allocated to each scenario (Bitner, Booms and Tetreault, 1990). This study followed a between group factorial design, in which each group of respondents is exposed to specific levels of a manipulation. Such a design allows the researcher to observe interaction effects or differences between two groups in terms of the effect of independent variables (Campbell and Stanley, 1963; Malhotra, 2015; Visawanathan, 2005). Like other experimental designs, this research created a control group and randomly assigned different treatments to research samples (Kerlinger and Lee, 2000; Malhotra, 2015; Rosenthal and Rosnow, 1991; Visawanathan, 2005).

As Table 3.1 reveals, previous research has applied experimental designs to study the variables investigated by this study. The goal of experimental research is to sketch valid conclusions about the impact of independent variables on the respondent groups, and to generalize the research findings to a larger population of interest (Malhotra, 2009). Furthermore, an experiment is a means to find correlations between variables and recognize confounds or the third-party variables, which affect these relationships (Shadish, Cook and Campbell, 2002). In experiments, researchers can control the effects of extraneous variables by assigning predetermined stimuli to respondents (Kerlinger and Lee, 2000; Malhotra, 2009, 2015). This study examines the effect of math anxiety on consumers' satisfaction with the price and purchase intentions, while controlling for the effects of math ability and demographic factors, such as age, gender, education, and income. Therefore, using scenario-based experiments and manipulation seems to be practical and reasonable.

Table 3.1: The Use of Experimental Design in Studying the Research Variables

Construct	**Researchers**
Mathematics anxiety	Ashcraft & Faust (1994); Ashcraft & Kirk (2001); Bursal & Paznokas (2010); Faust, Ashcraft & Fleck (1996); Goetz *et al.* (2013); Hopko *et al.* (1998); Lavasani & Khandan (2011); Maloney *et al.* (2010); Ramirez *et al.* (2013); Sheffield & Hunt (2006); Young, Wu & Menon (2012)
Price Satisfaction	Xia & Monroe (2004)
Perceived value	Agarwal & Teas (2001); Babin & Babin (2001); Tellis & Gaeth (1990); Weisstein, Asgari & Siew (2014)
Perceived Savings	Weisstein, Asgari & Siew (2014)
Purchase intention	Chatterjee (2001); Weisstein, Asgari & Siew (2014); Xia & Monroe (2004); Zhuang *et al.* (2010)
Price framing	Yan, Dillard & Shen (2012)
Promotion framing	Darke & Chung (2005); Diamond (1992); Gamliel & Herstein (2011, 2012, 2013); Lowe (2010); Sinha & Smith (2000)
Discount framing	Bayer & Ke (2013); Chen, Monroe & Lou (1998); Choi & Mattila (2014); McKechnie *et al.* (2012)
Price bundle Framing	Bertini & Wathieu (2006); Gilbride, Guiltinan & Urbany (2008); Hamilton (2006); Love (2012); Sharpe & Staelin (2010); Sheng, Bao & Pan (2007)

This study assumes that math anxiety influences consumers' perceived price satisfaction (PPS) as a determinant of purchase intention (PI), while interacting with different contextual factors. Study 1 examines the interaction effect of promotion framing expecting that highly math-anxious people express higher PPS and PI when promotions are framed as gain, e.g., buy one get one free. In contrast, low math anxiety consumers will show higher PPS and PI if promotions are framed as reduced loss, e.g., price discounts. Study 2a extends the effects of framing to the format of discounts saying that discounts that are framed as dollar-off will lead to higher PPS and PI than percentage-off discounts when consumers have high math anxiety. However, discount framing does not influence responses of low math anxiety people. This effect depends on price level so that it only refers to high-priced products, while for low-priced products, low math anxiety consumers prefer percentage-off discounts and high math anxious people will show no difference in their PPS and PI.

Study 2b predicts that when the level of math anxiety is high, single discounts will increase PPS and PI, but for low math anxiety consumers, multiple discounts will lead to higher PPS and PI. Finally, Study 3 predicts that high math anxiety will lead to higher PPS and PI if buyers are exposed to a single bundle price, whereas low math anxious people will show lower higher PPS and PI when bundle prices are presented as a list of separate product prices. Table 3.2 summarizes the expected results of each study and helps to realize the hypothesized effects in a more concrete manner. The present research also controls for the effects of math ability, math fluency, and gender difference as alternative reasons for variations observed in buyers' price perception and their purchase decisions. This will help to improve the robustness of the findings.

Table 3.2: Proposed Interaction Effects of the Study

Studies	H_j	Moderators	Perceived Price Satisfaction		Purchase Intention	
			High Anxiety	Low Anxiety	High Anxiety	Low Anxiety
Study 1	H1	Buy 1 get 1 free Discount in %	Higher Lower	Lower Higher	Higher Lower	Lower Higher
Study 2a (High price)	H2	Discount in dollars Discount in %	Higher Lower	No difference No difference	Higher Lower	No difference No difference
Study 2a (Low price)	H2	Discount in dollars Discount in %	No difference No difference	Lower Higher	No difference No difference	Lower Higher
Study 2b	H3	Single discount Multiple discounts	Higher Lower	Lower Higher	Higher Lower	Lower Higher
Study 3	H4	Single bundle price Separate prices list	Higher Lower	Lower Higher	Higher Lower	Lower Higher

Sample Description

As the target population of the study refers to general consumers, sampling is the only meaningful method to collect data and observe differences in consumer responses (Malhotra, 2009). The important point is that the sample of the study should fall within a sampling frame, which reflects the characteristics of the target population (Burns and Bush, 2014; Malhotra, 2015). In this research, the sampling frame requires us to select individuals who: (1) are consumers of goods and services, (2) have different degrees of mathematics anxiety, (3) have been already exposed to various prices and promotion formats, (4) are of both genders, and (5) have different levels of math ability. Therefore, the study adopted a nonprobability sampling method based on convenience sampling in which the respondents are selected from those who are easily accessible for investigation (Burns and Bush, 2014; Malhotra, 2009, 2015). In fact, social and behavioral sciences often avoid random sampling and focus on volunteer participants, though it may cause volunteer bias in the results (Rosenthal and Rosnow, 1991). Therefore, this research primarily used samples of college students to collect data and test the hypotheses, while a sample of non-university consumers was used for Study 3.

The majority of studies regarding math anxiety and its cognitive effects have targeted student samples, such as elementary school students (Ramirez *et al.*, 2013; Suinn, Taylor and Edwards, 1988; Wigfield and Meece, 1988), high school students (Goetz *et al.*, 2013; Karimi and Venkatesan, 2009; Kumar and Karimi, 2010; Lavasani and Khandan, 2011; Sherman and Wither, 2003), and college students (Ashcraft and Faust, 1994; Ashcraft and Kirk, 2001; Betz, 1978; Bursal and Paznokas, 2010; Hopko *et al.*, 1998; Maloney *et al.*, 2010; McMullan, Jones and Lea, 2012; Sheffield and Hunt, 2006). This is because students are the ones who frequently deal with math problems in the classroom and exams (Ashcraft, 2002; Sheffield and Hunt, 2006; Woodard, 2004). However, using a student sample to study consumer behavior has limitations because it cannot be a good representative of the target population. Therefore, pricing research needs to go beyond student samples and include consumers to increase generalizability and external validity of the findings (see Kerlinger and Lee, 2000). Hence, Suri, Monroe and Koc (2013) extended their sample in one of their studies to participants from an online panel (i.e., Amazon Turk) in order to include general consumers. Nevertheless, Feng, Suri and Bell (2014) only used undergraduate student samples for their study on the role of background music in reducing the effects of math anxiety on price perception.

In the present research, data were collected from samples of undergraduate students from the College of Business Administration (COBA) at the University of Texas–Pan American (UTPA), a public university in South Texas with an enrollment of 21,042 students in fall 2014. The COBA has around 3,000 undergraduate and 400 graduate students. Given that 55% of the students are female, a relative majority of female participants is expected. However, an effort was made to have a fairly equal ratio of males and females in order to control the effect of gender difference, especially because previous research has shown a higher math anxiety level among girls compared to boys (Devine *et al.*, 2012; Goetz *et al.*, 2013; Karimi and Venkatesan, 2009; Kumar and Karimi, 2010; Woodard, 2004). Participants were rewarded extra credit points for taking part in the study.

To calculate the desired sample size, we considered that the number of cells in each experiment is 2 x 2 = 4 scenarios, and the minimum number of the sample for each cell is 20 respondents. Therefore, a sample of more than 80 students is required for every study. Moreover, for study 2a, which has a 2 x 2 x 2 = 8 design, a sample greater than 160 respondents is required. In addition, it is desirable to maintain an equal number of participants in each cell (Hair *et al.*, 2010). The experiment scenarios and survey questionnaire were published online on Qualtrics, an online survey designing website certified by the university. The link was emailed to students through instructors and they were asked to read the scenarios and answer the questions.

A week prior to this, participants took a math anxiety test through the MARS-Brief scale. Participants were asked to answer a set of math questions in a pen-and-paper format. This is because we want to control for the effect of computer anxiety. In the studies in which consumers were the sample, the survey was published on Qualtrics and the link was posted on Amazon Turk in order to collect data from respondents who were willing to participate, and each respondent was awarded $1.00 cash to participate in the experiment.

Pretest for Product Selection

Before starting experiments and data collection, a pretest was conducted in order to choose the most relevant products to be used in each experiment. The logic behind it is to reduce the error variance due to selecting inappropriate products or unrealistic scenarios. Previous research has used different products for experiments. For example, Suri, Monroe and Koc (2013) used a photo printing service for an experiment and clothing apparel for another. Feng, Suri and Bell (2014) asked participants to choose between a hotel room and camping gear for their first experiment, while they offered a shopping list, including four items of stationary or personal care in their second and third studies. This research also aims at selecting familiar products that participant may have already experienced purchasing them at different price formats.

The pretest for product selection was conducted in November 2014 using undergraduate students of the College of Business Administration. Students were asked to provide a list of five items that they have purchased in store and online during the last six months, excluding groceries and foodstuffs (see Appendix A). The results showed that the major items they had purchased in the store included clothing, bags, personal care products, laptops, and cars. They had also paid for services such as dining, haircut, printing, healthcare and car wash in store or on site. In addition, participants had bought various items online, such as textbooks, music and DVDs, video games, headphones, digital cameras, jewelries, and flight tickets. We also asked them to recall prices they paid for those items in their most recent purchase experience. This helped us to design experiments that are more relevant to the real world experiences of students. They might be exposed to different promotion frames or price bundles. Therefore, their experience would be useful.

Measurements of Study

Measurement is a vital aspect of every empirical research that should be determined before starting data collection. Measurement requires setting rules to assign symbols to objects in order to provide a numerical representation of the quantities of attributes, or classify the objects into different categories based on a given attribute (Nunnally and Bernstein, 1994; Visawanathan, 2005). A measurement describes or quantifies the amount of some property or characteristics of an object (Burns and Bush, 2014; Malhotra, 2015). These properties may be objective, e.g., age, income and gender, or subjective, such as a consumer's attitude, perception or intention (Burns and Bush, 2014).

As this study aims to investigate consumer perception and behavioral intention to purchase products, variables are mostly assessed through interval scale measures that are used to rate subjective properties. Such measurement items help to compare differences between objects, as there is equal distance between each level of rating. For example, in a Likert scale, each rating has one unit distance with the other rating (Burns and Bush, 2014; Malhotra, 2015). The present research used a seven-point Likert scales to measure each variable item related to dependent variables, whereas the MARS-Brief survey used a five-point Likert scales to assess math anxiety. Each construct was measured by a summated scale of multiple measurement items after validating through statistical tests, such as factor analysis (Hair *et al.*, 2010).

Independent Variables

In this study, math anxiety is the main independent variable that causes changes in dependent variables related to consumer price perception and purchase intention. To measure math anxiety, researchers have developed various measurement scales described in Chapter 2. The recent studies regarding the role of math anxiety in pricing have applied the sMARS that was introduced by Alexander and Martray (1989) as an abbreviated version of the Mathematics Anxiety Rating Scale or the MARS (see Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013). This 25-item scale has been shown to be a multidimensional scale, including mathematics test anxiety, mathematics course anxiety and numerical task anxiety (Baloğlu and Zelhart, 2007; Bowd and Brady, 2002).

To determine whether this scale is appropriate for this study, a pilot test was conducted using 191 college students at UTPA in November 2014 to compare the sMARS with another brief version of the MARS introduced by Suinn and Winston (2003) as MARS-Brief comprising 30 items. As Appendix 2 reveals, the result of pilot test of 171 participants (college students) showed that the MARS-Brief has higher validity and reliability (see Appendix B). While the MARS-Brief consists of two dimensions, the sMARS should be measured by three distinctive dimensions or factors and has a less meaningful structure. Therefore, the study adopted the MARS-Brief to assess the degree of math anxiety among participants.

Other independent variables of the study refer to moderating factors that interact with math anxiety in the research framework, i.e., promotion framing, discount framing and price bundle framing. Each one of these factors is primed in two different facets. Promotion framing in study 1 was primed as buy one get one free compared to the percentage-off discounts resembling the study of Sinha and Smith (2000). Discount framing in study 2a was primed as dollar-off discounts versus percentage-off discounts (see Chen, Monroe and Lou, 1998; Choi and Mattila, 2014; McKechnie *et al.*, 2012), while considering different product price levels. However, in Study 2b, multiple discounts were compared to a single discount following the experiments of Cai and Suri (2009), and Chen and Rao (2007). Price bundle framing in study 3 was primed as a single bundle price versus a list of the separate prices for each item (see Bertini and Wathieu, 2006; Gilbride, Guiltinan and Urbany, 2008; Love, 2012; Sharpe and Staelin, 2010). Such a binary framing helps to observe differences between groups of respondents in terms of price perception. Appendix C shows the scenario used for the pilot test regarding Study 2a.

Dependent Variables

Dependent variables of the present research include perceived price satisfaction (PPS), perceived emotional value (PEV), perceived savings (PS), and purchase intention (PI). As Table 3.3 shows, perceived price satisfaction was measured through a four-item scale used by Xia and Monroe (2004). This measurement indicated high scale reliability in the pilot test ($\alpha = .90$). Perceived emotional value was measured using a five-item scale developed by Sweeney and Soutar (2001) who conducted a study to validate dimensions of perceived value based on the Theory of Consumption Values. This measurement showed a high scale reliability ($\alpha = .93$). Perceived savings was measured through a three-item scale developed by Biswas and Burton (1993, 1994). This scale indicated high reliability as well ($\alpha = .81$). Finally, purchase intention was measured by a four-item scale used by Dodds, Monroe and Grewal (1991). The reliability of this measurement was $\alpha = .92$.

Table 3.3: Measurement Scales of Dependent Variables

Constructs and Measurement Items	Source
Perceived Price Satisfaction (α = .90)	Xia & Monroe (2004)
The total amount I have to pay for (this item) at this store is	
Acceptable	
Fair	
Reasonable	
I am satisfied with the total amount I have to pay for (this item).	
Perceived Emotional Value (α = .93)	Sweeney & Soutar (2001)
(This item) would give me pleasure.	
(This item) would make me feel good.	
(This item) is one that I would feel relaxed about using.	
(This item) is one that I would enjoy.	
(This item) would make me want to use it.	
Perceived Savings (α = .81)	Biswas & Burton (1993, 1994)
The amount of money that I will save on (this item) is a lot.	
The amount of discount implied in the offer is considerable.	
The amount of discount that is offered on (this item) represents a great savings.	
Purchase Intention (α = .92)	Dodds, Monroe & Grewal (1991)
The likelihood that I would purchase (this item) is high.	
If I were going to buy such a product, I would consider buying (this item) at the price shown.	
The probability that I would consider buying (this item) is high.	
My willingness to buy (this item) is high.	

Extraneous Variables

According to Burns and Bush (2014), extraneous variables in causal or explanatory research refer to the factors that may influence dependent variables, but are not considered as independent variables of the study. Researchers control the effect of such variables by adding them to analysis as a covariate in order to make sure that the variation in the dependent variable does not relate to them. For example, researchers have considered math ability as a covariate for math anxiety. Math ability refers to superior mathematical knowledge and expertise in applying mathematical rules. This means that people with higher math ability may be able to retrieve information from working memory more easily. Therefore, difficulty in doing arithmetic tasks may relate to the lack of math ability or math competence (Ashcraft and Kirk 2001; Suri, Monroe and Koc, 2013). To measure math ability, Suri, Monroe and Koc (2013) asked respondents to answer 40 computational problems on Wide Range Achievement Test, 3rd edition (WRAT3), which is a commonly used instrument designed to evaluate a person's basic academic coding skills that are required to learn reading, spelling, and arithmetic. Since such abilities are the basis of academic achievement, psychologists employ the WRAT3 to appraise individual differences in academic performance for both children and adults (Snelbaker *et al.*, 2001).

Feng, Suri and Bell (2014) used math fluency measures to assess math ability. They defined math fluency as an individual's ability to quickly retrieve math facts and solve math problems. To measure math fluency, they asked respondents to answer the addition and subtraction subtests from the Kit of Factor-Referenced Cognitive Tests developed by French, Ekstrom and Price (1963), while each subset included 60 problems and participants should solve them in two minutes. The total number of correct answers given reveals the degree of math fluency of each respondent.

This study also aims to test the effect of math ability and math fluency on consumer price perception as covariates of math anxiety. Therefore, the pilot test applied different scales to find out which scale works well in practice. To measure math fluency, the newer version of the Kit of Factor-Referenced Cognitive Tests of Ekstrom et al. (1976) was used. The scale included addition, subtraction, multiplication, and division subtests as well as 10 problems from the arithmetic aptitude test and 10 problems from the mathematics aptitude test subsets. In addition, the Basic Math Skills Quiz of Johnson and Kuennen (2006) that was modified by Lunsford and Poplin (2011), including 20 basic mathematical and statistical problems was tested to evaluate the strength of each scale. However, the results of the pilot test show that the math fluency test, based on the Kit of Factor-Referenced Cognitive Tests, is a better measurement for both math fluency and math ability, whereas the Basic Math Skills Quiz is more appropriate for high school students and, thus, is not sufficient to assess math ability among college students. Therefore, the variance in this test is not enough to show individual differences in math ability. Finally, we decided to use the set of 20 questions related to arithmetic and mathematic aptitude as the math ability test and a set of 80 math operations for math fluency test (see Appendix D).

Other control variables that are used as covariates in studying math anxiety may include demographic factors, such as gender, age, income, and education. Gender was measured as male versus female. Previous studies found that the degree of math anxiety is higher among girls (Ashcraft and Faust, 1994; Kumar and Karimi, 2010; Luo, Wang and Luo, 2009; Woodard, 2004). In addition, Wigfield and Meece (1988) argued that girls show a higher level of negative emotion toward mathematics. Therefore, it seems that gender can be a covariate for math anxiety and cause differences in perceived price satisfaction and purchase intention. Age, education and income were measured in this study only to assess respondent characteristics, not as a covariate.

Research Experiments

Study 1: Interaction between Math Anxiety and Promotion Framing

To test the interaction effects of math anxiety and promotion framing on the dependent variables (H1a and H1b), Study 1 applied a 2 × 2 between-subjects factorial design with two math anxiety levels (low versus high) and two promotion frames (buy one get one free versus percentage-off discount). Subjects were assigned randomly to one of the 4 conditions (i.e., high math anxiety × buy one get one free, high math anxiety × percentage-off discount, low math anxiety × buy one get one free, and low math anxiety × percentage-off discount).

These experimental designs help control and test the effects of different combinations of math anxiety and promotion framing. Respondents were requested to carefully read the scenario (see Appendix E), actively engage in the situation created, and express their real perception in order to have realistic results. The study emphasized that there is no wrong or right answer. Based on each scenario, respondents rated their level of price satisfaction, perceived emotional value, perceived savings, and purchase intention. As stated earlier, one week prior to the experiment, participants took a math anxiety survey using the MARS-Brief scale and a math ability test to be rated for their math anxiety and math ability levels.

Study 2a: Interaction between Math Anxiety and Discount Framing

This study performed an experiment to test the interaction effects of math anxiety, discount framing and product price level on the dependent variables (H2a, H2b, H2c, and H2d). A 2 × 2 × 2 between-subjects factorial design with two math anxiety levels (low versus high), two discount frames (dollar-off discount versus percentage-off discount), and two product price levels (low-priced versus high-priced) was used. Subjects were assigned randomly to one of the eight conditions (i.e., high math anxiety × dollar-off discount × high-priced product, high math anxiety × percentage-off discount × high-priced product, low math anxiety × dollar-off discount × high-priced product, low math anxiety × percentage-off discount × high-priced product, high math anxiety × dollar-off discount × low-priced product, high math anxiety × percentage-off discount × low-priced product, low math anxiety × dollar-off discount × low-priced product, and low math anxiety × percentage-off discount × low-priced product). Conducting these experiments indicates the effects of different combinations of math anxiety, discount framings, and price levels (see Appendix 5). The same process explained in study 1 was applied. However, a math fluency test was taken to assess the respondents' degrees of math ability.

Study 2b: Interaction between Math Anxiety and Multiple Discounts

To test the interaction effects of math anxiety and the number of discounts offered on the dependent variables (H3a and H3b), Study 2b applied a 2 × 2 between-subjects factorial design with two math anxiety levels (low versus high) and two discount frames (a single discount versus multiple discounts). Participants were assigned randomly to one of the 4 conditions (i.e., high math anxiety × a single discount, high math anxiety × multiple discounts, low math anxiety × a single discount, and low math anxiety × multiple discounts). Such a design helps to observe differences between high and low math anxiety consumers in terms of price satisfaction and purchase intention when dealing with single versus multiple discounts (see Appendix 5). Gender difference is tested as the covariate. A similar two-week test was conducted to collect data.

Study 3: Interaction between Math Anxiety and Price Bundle Framing

Study 3 examines the interaction effect of math anxiety and price bundle framing on the dependent variables (H4a and H4b) via an experiment (Appendix 5). A 2 × 2 between-subjects factorial design with two math anxiety levels (low versus high) and two price bundle frames (a single bundle price versus a list of separate product prices) was applied. Subjects were assigned randomly to one of the 4 conditions (i.e., high math anxiety × a single bundle price, high math anxiety × a bundle price list, low math anxiety × a single bundle price, and low math anxiety × a bundle price list). This study reveals the effects of the different combinations of math anxiety and bundle frames. The data were collected from actual consumers through Amazon Turk, while the subjects participated in an online survey. The gender difference was the covariate and the math ability test was not taken, as doing a two-week experiment online was not practical.

Statistical Techniques

Examining Scale Validity

Scale validity indicates the extent to which differences in the measured scale scores disclose actual differences among items related to a latent or underlying construct. When a measurement scale has perfect validity, the measurement error will be zero (Malhotra, 2009). Measurement error refers to any systematic or random deviation from the true value of a factor or construct. It is almost impossible to have a zero measurement error in a study related to social sciences (Visawanathan, 2005). Therefore, it is necessary to make sure that the adopted measurement scales have a high level of validity. Generally, scale validity is divided into internal validity and external validity. Internal validity explicates to what extent the research instrument can measure what it is supposed to measure. The external validity points out to what extent the results of data analysis related to the sample can be generalized to the target population (Cooper and Schindler, 2006; Kerlinger and Lee, 2000; Malhotra, 2009; Yin, 2009).

In an experiment or causal research, "internal validity is concerned with the extent to which the change in the dependent variable was actually due to the independent variable", while "external validity refers to the extent that the relationship observed between the independent and dependent variables during the experiment is generalizable to the real world" (Burns and Bush, 2014, p. 83-84). In order to increase generalizability of research findings, the researcher should select the sample carefully to include respondents who represent the primary characteristics of the target population (Malhotra, 2009). For example, while previous research shows that the majority of people suffer from mathematics anxiety, selecting a sample of math majors at Harvard to study the effects of math anxiety will not have a desirable external validity.

Researchers classify internal validity into three types, including content validity, criterion validity, and construct validity. Content validity shows how well a scale or instrument measures what it has to measure. This means that each construct or factor should include all items required to define it (Cooper and Schindler, 2006; Malhotra, 2009). To increase the content validity of the measurement scales used in this study, scales were exactly adopted from the literature and the questionnaire was checked and confirmed by committee members who have more expertise in conducting empirical studies. Criterion validity is only applicable in explanatory or causal studies to assess how well the measures used for predicting an outcome or estimating the continuation of a specific behavior within a time frame will work (Cooper and Schindler, 2006; Yin, 2009). However, as this study is not longitudinal research, there is no need to evaluate criterion validity.

Construct validity investigates which construct is measured by each measurement item. This requires assessing the correlation between factors and items in a research instrument. Actually, each measurement item should load on the right factor (Malhotra, 2009). To examine the construct validity, a researcher must check two types of validity: first, convergent validity, which explains to what extent the measurement item correlates or converges with other items of the same construct; and second, discriminant validity, which shows whether a measurement item is correlated with measures of other irrelevant constructs (Visawanathan, 2005). In other words, convergent validity refers to the ability of measurement items to create a meaningful scale for assessing a construct, and discriminant validity refers to the fact that constructs or factors should not overlap each other.

To test the construct validity of a scale, an Exploratory Factor Analysis (EFA) is conducted, in which all items used to measure the independent and dependent variables are placed in a matrix and classified into different factors or dimensions. If an item has no significant correlation with any of the factors, or has a high correlation with more than one factor, it must be deleted (Cooper and Schindler, 2006; Kerlinger and Lee, 2000; Malhotra, 2009).

Factor analysis enables the researcher to classify items adequately and reduce unobserved variables. However, factor analysis is applicable only if the sample size is greater than 50. Additionally, factor analysis will lead to desirable results if the number of respondents is at least five times more than the total number of items or variables (Hair *et al.*, 2010). To avoid any confusion in findings, following the literature, this study performed a separate factor analysis of the math anxiety scale, which consists of 30 items. Moreover, another EFA test was applied for 16 items measuring the dependent variables of the study. Therefore, it is possible to conduct a desirable factor analysis with a sample of at least 150 respondents.

Examining Scale Reliability

Scale reliability shows whether a scale is able to provide consistent results if the measurement is repeated. This means that random error in a reliable scale should be close to zero (Malhotra, 2009, 2015). In other words, respondents will select similar answers when they respond to an identical question again (Burns and Bush, 2014). Although reliability is a necessary condition for scale validity, it is not sufficient because there may be always some systematic error (Malhotra, 2009, 2015).

The most commonly-used test to examine scale reliability is the internal consistency test that helps to assess the reliability of a summed scale where several items are summed to form a total score, which measures a construct or a dimension. Any item that is not considered reliable must be excluded from the measurement scale (Cooper and Schindler, 2006; Kerlinger and Lee, 2000; Malhotra, 2007).

Cronbach's alpha is widely used by researchers to test the internal consistency of a set of items forming a scale (Hair *et al.*, 2010; Malhotra, 2009). According to Malhotra (2009), Cronbach's alpha is the average of all feasible split-half coefficients that result from different ways of splitting the items of the scale. This coefficient varies between 0 and 1. A scale is reliable when alpha is greater than .6 and there is no item with an inter-item correlation of less than .3. However, Hair *et al.* (2010) believe that scale reliability in descriptive and explanatory research requires an alpha greater than .7. If the reliability is low, the researcher can add more items to the scale (Rosenthal and Rosnow, 1991). Consequently, present research calculated Cronbach's alpha to test the reliability of scales, while a minimum of .7 for alpha was considered acceptable.

Examining Mediation Effects and Observing Main Relationships

To observe the relationships between dependent variables and examine the hypothesized mediating effects (H5 and H6), this study applied a structural equation model (SEM) for each experiment using the AMOS software. The SEM examines the structure of interrelationships that is expressed in a series of equations similar to a series of multiple regressions. However, using the SEM method provides more adequate results than regression, as it considers all the relationships including mediating effects at the same time. The structural model helps to test the hypotheses developed based on the research model. A regression analysis employs simple and multiple calculations to predict *Y* from *X* values (Cooper and Schindler, 2006). Through regression, researchers inspect the existence of a significant linear relationship between an independent variable (*X*) and a dependent variable (*Y*). It also evaluates the strength of the relationship and verifies its form, predicts the values of the dependent variable, and controls the effect of other variables (Burns and Bush, 2014; Malhotra, 2009; Rosenthal and Rosnow, 1991).

The SEM method requires designing and calculating two distinct models, i.e., a measurement model for Confirmatory Factor Analysis (CFA) and a structural model for hypothesis testing. A major advantage for the SEM models is to have goodness-of-fit (GOF). This study used a combination of absolute and incremental fit indexes to evaluate the model fit in each experiment. Based on criteria for goodness-of-fit, the measurement model has a good fit if χ^2 is significant and CMIN/DF is less than 3, the comparative fit index (CFI) and the Tucker-Lewis Index (TLI) are above .92, the non-normed fit index (NFI) is close to 1, the standardized root mean square residual (SRMR) is less than .09, and the root mean square error of approximation (RMSEA) is less than .08 (Hair *et al.*, 2010).

As the conceptual model of the study reveals, it is assumed that math anxiety influences consumers' purchase intentions through their price satisfaction, Additionally, it is expected that perceived emotional value and perceived savings play a mediating role in the relationship between price satisfaction and purchase intention. Furthermore, the four studies of this research aim to examine such mediating effects. Therefore, it is necessary to run a mediation analysis test.

The most commonly used method for testing meditation effects was introduced by Baron and Kenny (1986), and requires a three-step process to examine (a × b), (b × c), and (a × c) relationships. However, such a method has been recently criticized for having methodological flaws (Zhao, Lynch and Chen, 2010). Therefore, the bootstrapping method of Preacher and Hayes (2004, 2008) is used to examine the indirect effect (a × b). The bootstrapping method conducts multiple regression analyses to evaluate each component of the conceptual model (Weisstein, Asgari and Siew, 2014). The result of such a method is more exact and reliable than the sequential method of Baron and Kenny (1986). The SEM model is also able to examine the mediating effects through calculating direct and indirect effects between variables. To provide the accuracy suggested by Preacher and Hayes (2004), the study conducted bootstrapping with 5,000 samples and followed the same statistical logic. This helps to achieve reliable results.

Examining Interaction Effects

As the experimental research designs of the research are based on 2 × 2 between-subjects factorial design in Study 1, 2b and 3, and a 2 × 2 × 2 design in Study 2a, the main facet of data analysis is to investigate the differences between means of two groups of respondents, i.e., treatment group versus the control group. Therefore, the analysis of variance (ANOVA) is used for "investigation of the differences between the group means to ascertain whether sampling errors or true population differences explain their failure to be equal" (Burns and Bush, 2014, p. 339). Variance is the average of the square of the deviations from the mean of all the values. A small variance shows that the data is clustered around the mean, while large variances indicate scattered data points (Malhotra, 2015). ANOVA employs the *F* test to examine variance or the significant difference between the means of any two groups in a research sample (Burns and Bush, 2014; Malhotra, 2009, 2015; Rosenthal and Rosnow, 1991). If the significance level of the *F* test is less than .05, there will be a significant difference between the two groups and the interaction effect will be supported (Burns and Bush, 2014).

This study investigates the interaction effects of math anxiety with moderating factors, including promotion framing, discount framing and price bundle framing, on consumers' price perceptions and purchase intentions. Therefore, it will apply ANOVA and MANOVA as a necessary procedure that helps not only test the significance of differences between treatment and control groups in each scenario, but also observe the effects of extraneous variables. Analysis of ANOVA tables enables the study to provide empirical support for hypotheses 1 to 4 concerning the interaction effects.

Summary

This chapter discussed the methodology used to collect, validate, and analyze data in order to examine the hypothesized relationships indicated in the conceptual framework of the study. Initially, the logic behind using experimental research designs was explained. As this study is an explanatory research that aims at answering why and how questions, adaptation of experimental designs helps to establish causal relationships and investigate how math anxiety can result in different behavior among consumers concerning price perception and purchase decision, while considering being exposed to various price formats and promotion framings. The sample of the study mainly includes college students from the College of Business of the University of Texas-Pan American. Therefore, the scenarios shown to students were realistic and relevant to their regular purchase experiences. In addition, a sample of general consumers was used in Study 3 in order to increase the external validity of the study.

This study employed different measurement scales to measure independent variables, dependent variables, and extraneous variables. To assess math anxiety, the MARS-Brief scale with 30 items was used in all studies, as it showed a better performance during the pilot test compared to the sMARS scale. Moderating variables were measured using binary or categorical measures. Dependent variables were measured through the seven-point Likert scales that were tested by the pilot study and showed high scale reliabilities. For testing math ability as a covariate, two scales were tested and the Kit of Factor-Referenced Cognitive Tests provided a more useful instrument for evaluating individual differences.

The present research includes three experimental studies using a 2 × 2 between-subjects factorial design so that respondents were randomly assigned to one of the four possible conditions in each scenario. In addition, Study 2a has a 2 × 2 × 2 design with eight conditions.

Such experimental designs help to observe and confirm the differences between high math anxious and low math anxious respondents with respect to moderating factors. The last section of the chapter explained different statistical techniques used to examine the validity and reliability of the research scales, the interaction effects of math anxiety and moderating factors, the relationships between dependent variables, and the hypothesized mediating effects. This requires conducting EFA, reliability test, ANOVA, and SEM models with bootstrapping.

CHAPTER IV

ANALYSIS AND RESULTS

Overview

As the purpose of this research is to examine the effect of math anxiety on consumer purchase decision, while being exposed to different promotion or discount frames, an experimental research design was used for each one of the four studies described earlier. The present chapter demonstrates the results of data analysis based on the experiments conducted on both college students and actual consumers. Data were collected from the research samples in April and early May 2015. The chapter consists of two main sections. The first section provides a summary of descriptive data about the research participants. In addition, it explains the results of statistical tests used to examine the validity and reliability of the research instruments. The second part analyzes the data to determine whether research hypotheses are empirically supported or not. Therefore, the result of each study is explained in detail to justify the findings.

Preliminary Analyses

Characteristics of the Respondents

Participants of this research include two distinctive samples. The first group consists of 644 college students of UTPA who participated in three studies. The second group consists of 246 consumers who participated in an online experiment. Table 4.1 indicates the demographic characteristics of the total 890 respondents of the research. There is a relatively equal gender distribution in the total sample, as 50.7% of respondents were female and 49.3% male. However, Study 1 showed the highest ratio of male participants (53.6%) and study 2b demonstrated the highest ratio of female respondents (57.4%). The equal number of male and female participants helps reduce gender bias in the results, especially because previous research suggests a significant difference between the level of math anxiety among females and males. The majority of participants (i.e., 84%) were between 18 and 34 years old. This ratio varies from 67% among the consumer sample to more than 90% among the student sample. In contrast, while 11% of consumer respondents were above 50 years old, no one of the college students was that old.

The education level also shows a difference between the student samples and the consumer sample that is expected. In fact, consumers show a broader diversity in their education level than college students. In total, 10.1% of the respondents had only a high school education or even less, while 76% had earned a college education, 11.6% got a bachelor's degree and 2.3% held a master's degree or PhD. Distribution of income demonstrates a lower income among students, as expected. More than 76% of college students had an annual income of less than $25,000, 16% an income level between 25 and 50 thousand dollars per year due to their part time or full time jobs, and only 8% had a higher income. Among consumers, 46.3% had a very low income of less than $25,000, whereas 19.1% revealed an annual income above $50,000.

The difference between the three student samples related to Study 1, 2a, and 2b refers to the fact that data was collected from a number of undergraduate classes at different levels of study from freshmen to senior students. Therefore, a slight difference in age, the level of education expressed, and the level of income is observed. However, it does not explain any significant differences that potentially influence the results of the study or create a bias in research findings. This provides a reliable source for analysis. The difference between the student and consumer samples also shows the reliability of research sampling that fits the reality.

Table 4.1: Characteristics of the Research Participants

Demographics	Study 1		Study 2a		Study 2b		Study 3		Total	
	F_x	%	F_x	%	F_x	%	F_x	%	F_x	%
Gender:										
Male	104	53.6	140	48.6	69	42.6	126	51.2	439	49.3
Female	90	46.4	148	51.4	93	57.4	120	48.8	451	50.7
Age:										
18-34 years	169	87.1	272	94.4	142	87.7	165	67.1	748	84.0
35-49 years	25	12.9	16	5.6	20	12.3	54	22.0	115	12.9
50-64 years	0	.0	0	.0	0	.0	24	9.8	24	2.7
65 years or older	0	.0	0	.0	0	.0	3	1.2	3	.3
Education:										
High school or less	22	11.3	25	8.7	7	4.3	36	14.6	90	10.1
Some college	164	84.5	254	88.2	134	82.7	124	50.4	676	76.0
Bachelor's degree	8	4.1	9	3.1	21	13.0	65	26.4	103	11.6
Master/PhD	0	.0	0	.0	0	.0	21	8.5	21	2.3
Income:										
Below $25,000	149	76.8	234	81.3	108	66.7	114	46.3	605	68.0
$25,000-$49,999	29	14.9	40	13.9	34	21.0	85	34.6	188	21.1
$50,000-74,999	10	5.2	2	.7	11	6.8	32	13.0	55	6.2
$75,000 or more	6	3.1	12	4.2	9	5.6	15	6.1	42	4.7
Total participants	194	100.0	288	100.0	162	100.0	246	100.0	890	100.0

Scale Validity and Reliability

In this study, three major questionnaires were designed to measure (1) the level of math anxiety, (2) the ability of respondents to solve math problems, and (3) the perceptions of the respondents about the price and value of the products and their decision to make a purchase. The first questionnaire was the MARS-Brief including 30 items introduced by Suinn and Winston (2003). An exploratory factor analysis (EFA) was conducted for each study in order to confirm the structure of the MARS-Brief instrument and to reduce irrelevant items. To measure math ability as a covariate, a questionnaire with 20 arithmetic and mathematical problems was used in Study 1 and another questionnaire including 80 mathematical operations were used in Study 2a. However, as these questions have right and wrong answers, and each question is completely independent of other questions, there was no need for a factor analysis. Finally, a survey questionnaire with 4 constructs and 16 items were used to measure the dependent variables of the study as well as control variables. Although most items had been widely used in previous research, a separate EFA was conducted for each study to confirm the structure of the scale.

To run the EFA test, the principal component analysis (PCA) with Varimax rotation was used. According to Hair *et al.* (2010), the first condition for running a factor analysis is that the number of observations or responses must be larger than the number of items used in data collection. Moreover, the desired results will be achieved when the sample of the study is at least 5 times larger than the number of items. Accordingly, this study is able to provide desirable EFA findings because, firstly, the least number of participants in this research belongs to Study 2b with 162 respondents, and secondly, the number of items in math anxiety questionnaire is 30 items and the main survey questionnaire has 16 items.

To test the structure of the math anxiety instrument, an a priori criterion was used in which the number of factors for each construct was fixed based on the literature. As Wilder (2013) suggested, the MARS-Brief instrument consists of two factors or dimensions, including math test anxiety and numerical (task) anxiety. Therefore, the extraction was fixed for two factors. The results support the structure examined by Suinn and Winston (2003), and Wilder (2013). As Table 8 summarizes, the Kaiser-Meyer-Olkin (KMO) measure for all studies was above 0.5 and Bartlett’s Test of Sphericity shows significant Chi-Squares. Therefore, sampling adequacy is acceptable and the EFA model can be used for analysis. In addition, all the studies demonstrated a consistent factor structure with no loadings less than .50 after using an orthogonal rotation method based on varimax rotation. The anti-image matrix showed that all loadings were greater than .50 and all communalities were greater than .30. Therefore, there was no need to delete an item from the scale, while 15 items loaded on each factor in the scale (See Appendix F).

To evaluate the construct validity of the math anxiety instrument, three major tests were conducted. As Hair *et al.* (2010) explained, an instrument has convergent validity if standardized regression weights or factor loadings (λ) are greater than .50, the average variance extracted ($AVE = \sum(\lambda^2)/n$) is greater than .50, and the construct reliability ($CR = [(\sum\lambda)^2/((\sum\lambda)^2+\sum(1- \lambda^2))]$) is greater than .70. Table 8 and Appendix 6 indicate that all items show a factor loadings above .50. In addition, both factors have an AVE above .50 and CR above .70. Therefore, the math anxiety scale has convergent validity. To test discriminant validity, the inter-construct correlation (IC) between common factors or latent variables was examined. The AVE for each factor should be greater than all the squared inter-construct correlations (SICs) estimates with other factors. The analysis of the four experimental studies shows that all SICs are smaller than AVEs (see Appendix G). Therefore, the math anxiety scale has discriminant validity and factors will not cause a high multicollinearity problem. The third test relates to nomological validity. In fact, all correlations between factors in the inter-construct correlation matrix should be positive and significant. Therefore, the math anxiety scale shows nomological validity since both factors have positive and significant correlations with each other (see Appendix G). The high correlation between the two factors allows the study to consider math anxiety as a formative variable.

To examine the reliability of the math anxiety scale, the Cronbach's alpha method was calculated for each factor. As Table 4.2 shows, the factors in all four studies have a Cronbach's alpha greater than .70. Thus, the internal consistency in measurement is confirmed. In addition, all items significantly contributed to the coefficient alpha in the related factors, as the corrected item-total correlation for each item was greater than 0.5. Therefore, no item was excluded from the measurement scale and the MARS-Brief or math anxiety instrument with 30 items in 2 factors demonstrated an acceptable reliability (see Appendix F).

Table 4.2: Summary of Factor Analysis Results for the Math Anxiety Instrument

	Items	Study 1	Study 2a	Study 2b	Study 3
KMO		.94	.94	.92	.95
Chi-Square		5881.67	7919.62	4954.30	8321.23
P-Value		< .001	< .001	< .001	< .001
Total variance explained		64.90%	61.03%	65.12%	68.92%
F1: Math Test Anxiety	15				
AVE		.57	.59	.61	.66
CR		.95	.95	.96	.97
Alpha (α)		.96	.96	.96	.97
F2: Numerical Task Anxiety	15				
AVE		.60	.53	.60	.55
CR		.96	.94	.96	.95
Alpha (α)		.96	.95	.96	.96

A similar process was conducted to test the validity and reliability of the survey instrument used to measure dependent variables. As Appendix H indicates, using an a priori criterion, the structure of the instrument in all the studies was the same with 16 items formed in 4 factors. All items showed an anti-image loading of greater than .50 and communalities greater than .30. Moreover, there were no factor loadings less than .50 after using varimax rotation. Therefore, all items were retained for further analysis. Table 4.3 shows that KMO in three studies is greater than .90, which is desirable and reflects sampling adequacy. The reliability test also shows that all factors have a Cronbach’s alpha greater than .70, and each item has an item-total correlation above .50. Hence, no item was excluded.

The main survey questionnaire has convergent validity because first, the factors in each study showed an AVE > .50, factor loadings > .50, and CR > .70 (see Table 4.3). As Appendix I demonstrates, the AVE of each factor was greater than all the squared inter-construct correlations in the inter-construct correlation matrix. Therefore, the scale has discriminant validity. In addition, each factor has a positive significant correlation with other factors. This supports the nomological validity of the measurement scales in the main survey instrument.

Table 4.3: Summary of Factor Analysis Results for the Main Survey Instrument

	Items	Study 1	Study 2a	Study 2b	Study 3
KMO		.91	.89	.90	.90
Chi-Square		3320.54	3768.09	2456.66	3791.85
P-Value		< .001	< .001	< .001	< .001
Total variance explained		85.27%	79.73%	82.44%	82.65%
F1: Perceived Price Satisfaction	4				
AVE		.70	.73	.63	.65
CR		.90	.92	.87	.86
Alpha (α)		.94	.92	.93	.93
F2: Perceived Emotional Value	5				
AVE		.74	.75	.75	.74
CR		.93	.94	.94	.93
Alpha (α)		.95	.94	.94	.92
F3: Perceived Savings	3				
AVE		.69	.69	.66	.71
CR		.87	.87	.85	.88
Alpha (α)		.91	.85	.91	.91
F4: Purchase Intention	4				
AVE		.58	.62	.57	.66
CR		.85	.86	.84	.88
Alpha (α)		.93	.89	.91	.94

Manipulation Checks

As already stated, we did not manipulate mathematics anxiety, but the level of math anxiety among the participants or the research sample was measured by a self-report survey based on a five-point Likert scale. Therefore, each respondent is assigned a value between 0 and 5 in terms of math anxiety. However, for the purpose of testing the interaction effects, respondents were divided into two equal groups of high versus low math anxiety individuals. To split the sample of each study, a median was calculated for each group who were exposed to one of the scenarios. Table 4.4 indicates the median of math anxiety and the total number of respondents in each cell.

Table 4.4: Categorization of the Research Sample in Terms of Math Anxiety

Experiments	Scenario	Number of Participants	Median of Values	Level of Math Anxiety	
				Low	High
Study 1	1	97	2.6000	49	48
	2	97	2.7333	48	49
Study 2a	1	72	2.7667	36	36
	2	72	2.7000	36	36
	3	72	2.7500	36	36
	4	72	2.8500	36	36
Study 2b	1	81	2.7000	40	41
	2	81	2.7333	41	40
Study 3	1	123	2.4333	62	61
	2	123	2.4667	61	62

To check the classification for math anxiety and confirm that there is a meaningful difference between groups of respondents, mean comparison through one way ANOVA was conducted. In study 1, participants' level of math anxiety was significantly different between the high and low math anxiety respondents ($M_{\text{High}} = 3.46$, $M_{\text{Low}} = 1.92$; $F = 411.06$, $p < 0.001$), showing a successful categorization of math anxiety groups. In study 2a, there are two distinct math anxiety groups as well ($M_{\text{High}} = 3.46$, $M_{\text{Low}} = 2.00$; $F = 618.31$, $p < 0.001$). In study 2b, there is a significant difference between high and math anxiety groups ($M_{\text{High}} = 3.38$, $M_{\text{Low}} = 1.97$; $F = 248.92$, $p < 0.001$). Finally, one way ANOVA shows a considerable between groups difference in study 3 ($M_{\text{High}} = 3.32$, $M\text{Low} = 1.73$; $F = 596.66$, $p < 0.001$), confirming that manipulation was successful.

Promotion framing was manipulated in study 1 by giving a group of respondents a scenario in which they are exposed to a buy one get one free promotion, while the other group receive a price discount with equivalent economic value. In study 2a, discount framing was manipulated by offering a dollar-off discount to a group and a percentage-off discount to another group. In addition, half of the respondents were exposed to high-priced products, whereas the other half were shown a scenario with low-priced products from the same category. In study 2b, half of the respondents received an offer with a single discount, but the others were given multiple discounts. The analysis shows a meaningful difference between the two scenarios in terms of perceived savings ($M_{Single\ Discount} = 5.10$, $M_{MultipleDiscount} = 4.60$; F = 5.62, $p < .05$). Price bundle framing was manipulated by giving two different scenarios so that a group of respondents was shown a scenario in which the bundle offer includes a list of separate prices of the bundle items, while other respondents received a bundle offer in which a single bundle price was used. There was a difference between the two groups in terms of perceived savings ($M_{ListBundlePrice} = 4.37$, $M_{SingleBundlePrice} = 3.76$; F = 11.56, $p < 0.01$).

Another manipulation check was to examine the difficulty of price formats or promotion frames manipulated. In study 1, the respondents were asked to estimate the final price they have to pay for each item. The results show a significant difference between correct responses in the two scenarios ($M_{buy1get1free} = .59$, $M_{percentage\text{-}off} = .33$; F = 13.76, $p < 0.001$), showing that percentage-off discounts are more difficult to calculate. In Study 2a, the respondents were asked to estimate the final price they have to pay for the product after discount. However, the results did not show a significant difference between correct responses in the two groups ($M_{DollarOff} = .58$, $M_{PercentageOff} = .51$; F = 1.40, $p = .24$). This refers to the fact that participants in Study 2a were exposed to two types of products, i.e., high-priced versus low-priced. Therefore, computing the final price may be easier for low-priced products, regardless of the discount frame. Similarly, the respondents in study 2b were asked to estimate the final price after discount and the analysis shows a significant difference between the two groups in terms of correct answers ($M_{Single\ Discount} = .70$, $M_{MultipleDiscount} = .52$; F = 5.99, $p < .05$). Finally, the respondents in study 3 were asked to estimate the amount that they could save by purchasing the bundle offered. However, there was no significant difference between the correct estimates of the two groups ($M_{ListBundlePrice}$ = .56, $M_{SingleBundlePrice}$ = .59; F = .15, p = .70), also the number of correct answers is slightly greater when a single price is given for the bundle.

Hypotheses Testing

Data Analysis Study 1

Study 1 examines the premise that when sellers frame a promotion is framed as buy one get one free, consumers who have high math anxiety will show higher perceived price satisfaction and purchase intention compared to promotions framed as a percentage-off discount. In contrast, consumers who have low math anxiety will perceive higher price satisfaction and express greater purchase intention if they are exposed to a percentage-off discount. To test such an interaction effect (H1), an experiment was conducted in which 194 college students participated (97 participants in each scenario, 48 to 49 cases in each cell).

A 2 x 2 MANCOVA test with math ability as a covariate was applied. The results showed that the covariate did not have a significant effect ($F(4, 189) = 1.69$, $p = .15$). Thus, it was removed from the analysis. The multiple analysis of variance showed a main effect of math anxiety ($\lambda = .94$; $F\ (3, 190) = 3.01$, $p < .05$), and an interaction effect ($\lambda = .89$; $F\ (3, 190) = 5.53$, $p < .001$). Subsequent ANOVA showed a significant main effect of math anxiety on perceived savings ($F(3, 190) = 7.06$, $p < .01$), and purchase intention ($F(3, 190) = 6.20$, $p < .05$), and a significant interaction effect on perceived price satisfaction ($F(3, 190) = 14.97$, $p < .001$), perceived emotional value ($F(3, 190) = 7.92$, $p < .01$), perceived savings ($F(3, 190) = 12.32$, $p < .01$), as well as purchase intention ($F(3, 190) = 19.78$, $p < .001$).

As Table 4.5 summarizes, when a promotion is framed as buy one get one free, compared to a percentage-off discount, consumers with high math anxiety perceived a significantly higher price satisfaction ($M_{buy1get1free}$ = 5.43, $M_{percentage\text{-}off}$ = 4.67; $F(1, 95) = 6.75$, $p < .05$) and higher purchase intention ($M_{buy1get1free}$ = 5.07, $M_{percentage\text{-}off}$ = 3.83; $F(1, 95) = 14.73$, $p < .001$), supporting H1a. In contrast, when a promotion is framed as a percentage-off discount, compared to buy one get one free, low math anxiety consumers perceived a higher price satisfaction ($M_{percentage\text{-}off}$ = 5.30, $M_{buy1get1free}$ = 4.57; $F(1, 95) = 8.49$, $p < .01$). This also explains a significant difference in purchase intention for the choices offered between percentage-off discount or buy one get one free promotions among low math anxiety consumers ($M_{percentage\text{-}off}$ = 4.28, $M_{buy1get1free}$ = 3.47; $F(1, 95) = 6.07$, $p > .05$). This supports H1b. Figure 4.1 illustrates the interaction effects on the dependent variables of the study.

Figure 4.1: Interaction Effects of Math Anxiety and Promotion Framing

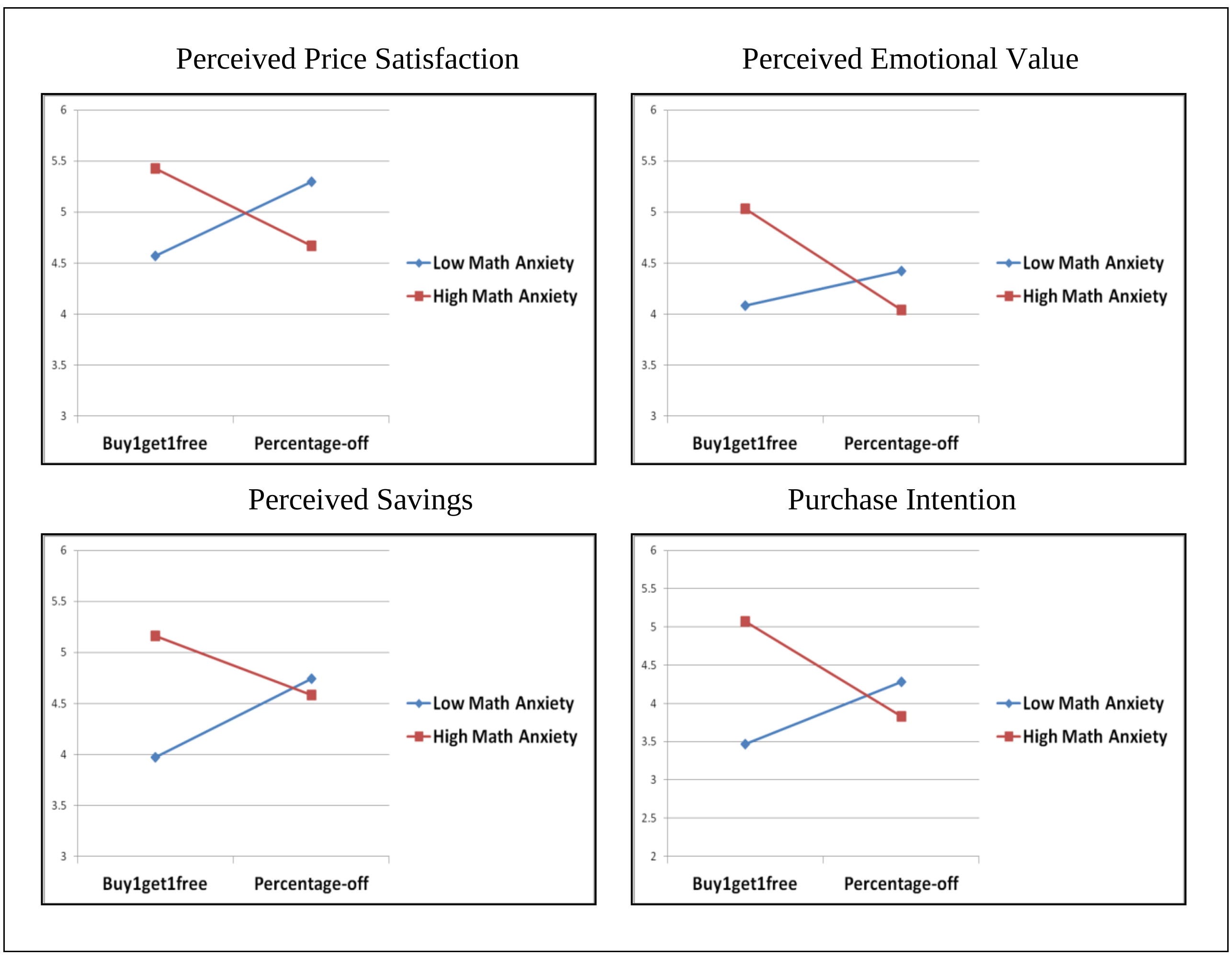


Table 4.5: Means and Standard Deviations of Interaction Effect (Study 1)

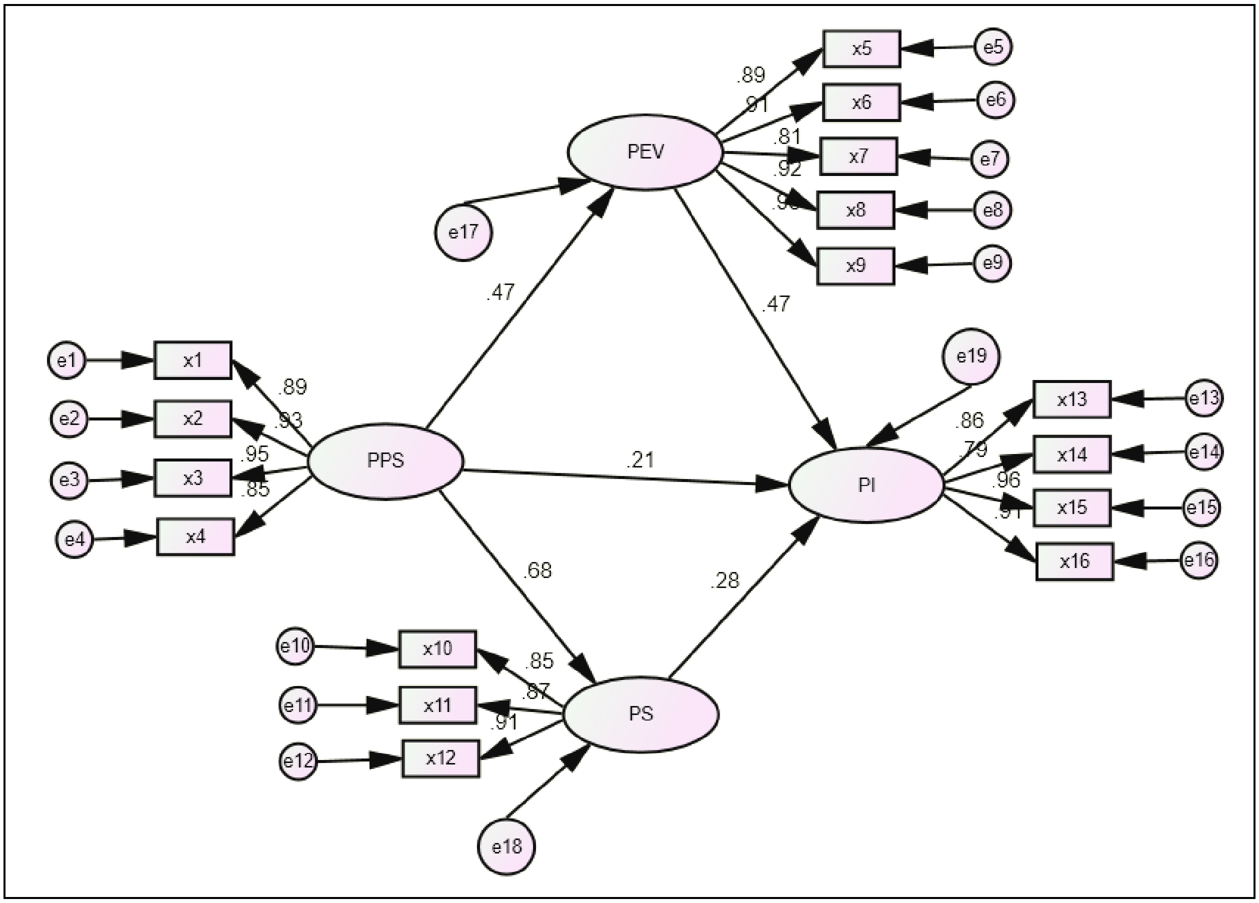
Manipulations	Promotion Framing	Dependent Variables			
		Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention
Low math anxiety	Buy 1 Get 1 Free	4.57 (1.36)	4.08 (1.49)	3.97 (1.41)	3.47 (1.69)
	Percentage-off discount	5.30 (1.11)	4.42 (1.89)	4.74 (1.34)	4.28 (1.53)
High math anxiety	Buy 1 Get 1 Free	5.43 (1.24)	5.03 (1.39)	5.16 (1.32)	5.07 (1.33)
	Percentage-off discount	4.67 (1.62)	4.04 (1.77)	4.58 (1.32)	3.83 (1.80)

To investigate the relationships between the dependent variables of the study and examine the mediating hypotheses suggested in Chapter 2, a structural equation model (SEM) was applied using AMOS. Appendix J indicates the measurement model of the study, which is used for confirmatory factor analysis (CFA). The structure of factors is similar to the EFA model that was explained earlier. The model's goodness-of-fit (GOF) is acceptable because χ^2 is significant and CMIN/DF is 3.17, comparative fit index (CFI) is .94, non-normed fit index (NFI) is close to 1 (NFI = .91). However, the root mean square error of approximation (RMSEA) is above .08 (RMSEA = .11). As Figure 4.2 illustrates, a structural model was created to test the main effects between dependent variables of the study. Table 4.6 shows that the relationships between dependent variables in the structural model are positive and significant.

Table 4.6: Structural Model Estimates for Hypotheses Testing (Study 1)

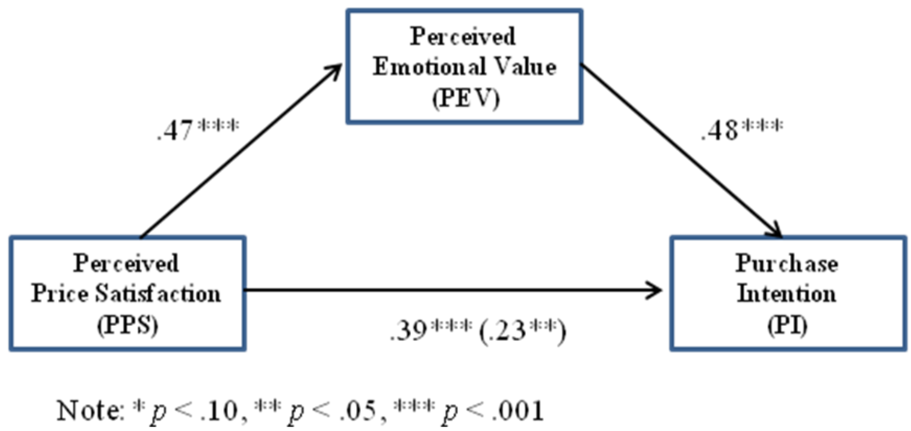
Relationships	Path Coefficient (B)	Standard Error (S.E.)	t-value	Significance (*P*)	Standardized (B)
PPS → PI	.24	.09	2.66	< .010	.21
PPS → PEV	.55	.08	6.53	< .001	.47
PPS → PS	.68	.07	9.76	< .001	.68
PEV → PI	.46	.06	7.41	< .001	.47
PS → PI	.33	.09	3.79	< .001	.28

Figure 4.2: The Structural Model of Study 1



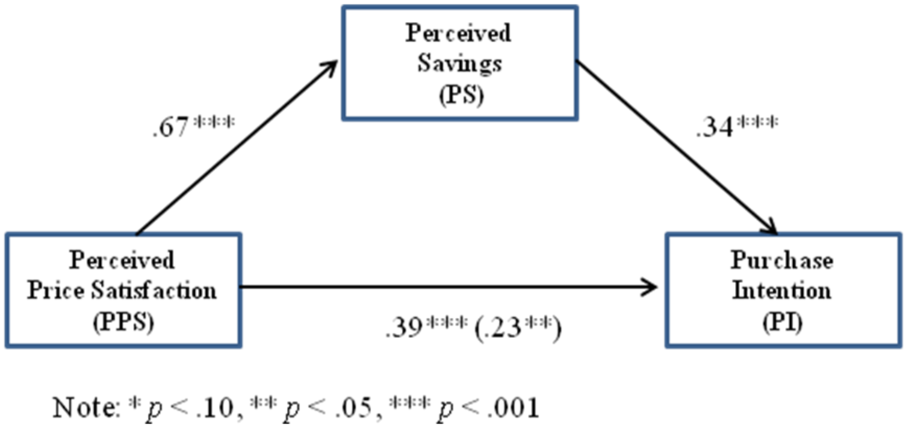
Hypothesis 5 predicted that the perceived emotional value mediates the effect of perceived price satisfaction on purchase intention (PPS → PEV → PI). To test such a mediating effect, the structural model was repeated excluding perceived savings. In addition, bootstrapping with 5,000 samples was conducted in order to provide an accurate indirect effect similar to the bootstrapping method of Preacher and Hayes (2004). The result of mediation analysis showed that, first, the indirect effect of price satisfaction on purchase intention was significant ($\beta = .23$, $p < .01$). Second, perceived price satisfaction positively affected the perceived emotional value ($\beta = .47$, $t = 6.47$, $p < .001$). Finally, a significant positive effect of perceived emotional value on purchase intention was observed ($\beta = .48$, $t = 7.44$, $p < .001$). In addition, while entering mediator to the model, the direct effect of perceived price satisfaction on purchase intention remained significant (β = .39, t = 6.06, p < .001). Therefore, a partial mediating effect is observed, supporting H5. Figure 4.3 exemplifies the results and the relationships among the variables.

Figure 4.3: Mediating Effect of Perceived Emotional Value (Study 1)



According to H6, perceived savings mediate the effect of perceived price satisfaction on purchase intention (PPS → PS → PI). Similarly, to examine this mediating effect, the structural model was repeated excluding perceived emotional value, while bootstrapping was conducted. The result of mediation analysis showed a significant indirect effect of price satisfaction on purchase intention (β = .23, p < .01). Moreover, perceived price satisfaction positively influenced perceived savings (β = .67, t = 9.71, p < .001), whereas perceived savings had a significant positive effect on purchase intention (β = .34, t = 3.88, p < .001). When the mediator entered the model, the direct effect of perceived price satisfaction on purchase intention was still significant (β = .39, t = 4.49, p < .001). Therefore, perceived savings partially mediates the relationship between perceived price satisfaction and purchase intention. This provides support for H6. Figure 4.4 demonstrates the results of the mediation test.

Figure 4.4: Mediating Effect of Perceived Savings (Study 1)



Data Analysis Study 2a

Study 2a investigates the interaction effect between math anxiety and discount framing. It assumes that when the product price level is high, if sellers present a price discount as dollar-off, high math anxiety consumers will show higher price satisfaction and purchase intention for a product compared to a percentage-off discount. However, we expect that consumers with low math anxiety will express no difference between percentage-off and dollar-off discounts in terms of perceived price satisfaction and purchase intention. When the product has a low price level, if sellers present a price discount as a percentage-off, low math anxiety consumers will perceive higher price satisfaction and purchase intention compared to the dollar-off discounts. However, there will be no difference between the two discount frames for high math anxiety consumers. To examine the hypothesized interaction effect (H2), an experiment was conducted in which 288 college students participated (72 participants in each scenario, 36 cases in each cell).

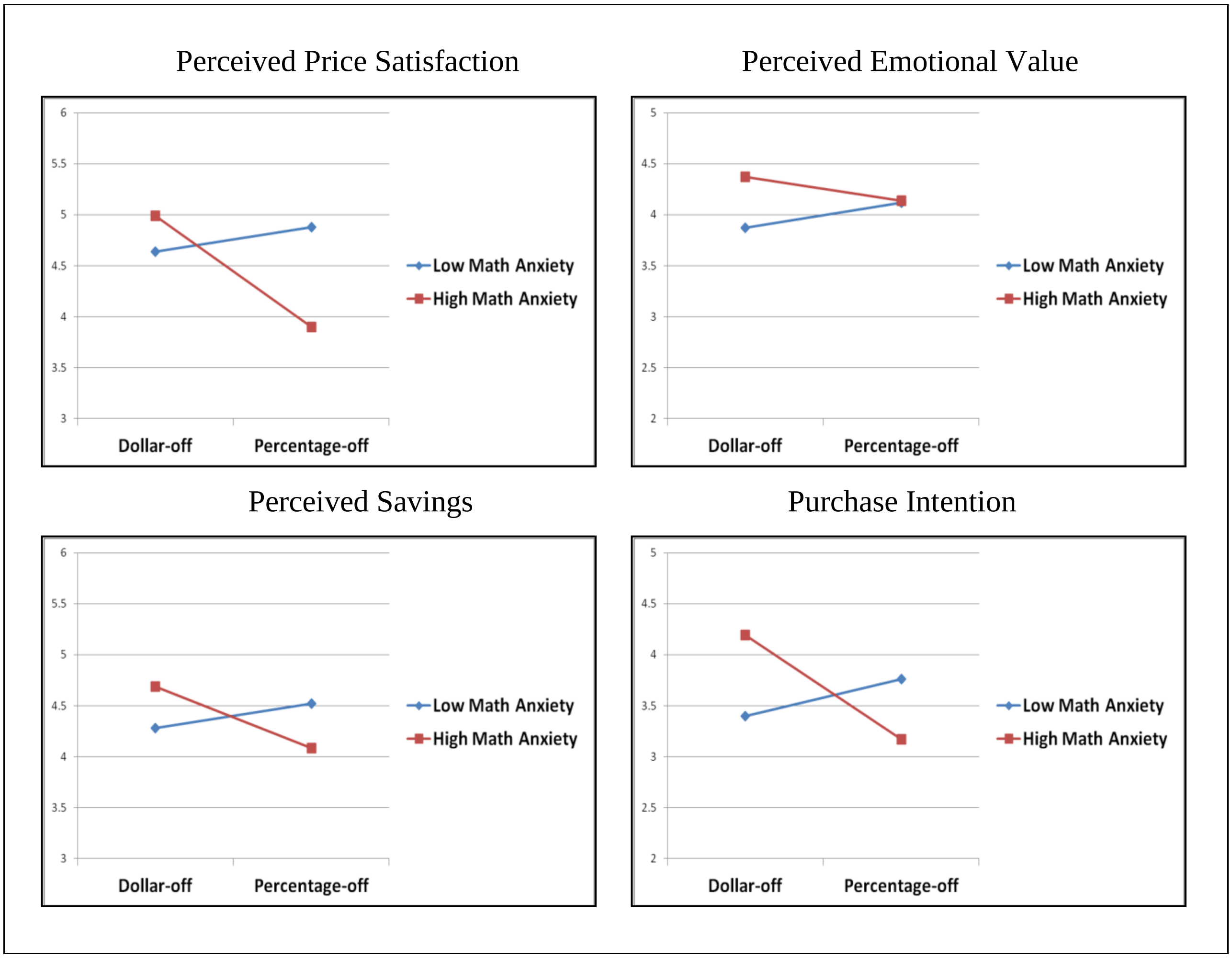
A 2 x 2 x 2 MANCOVA with math fluency as a covariate was conducted to examine this interaction effect (H2). The results showed that the covariate did not have a significant effect ($F(8, 279) = .74$, $p = .57$). Therefore, it was removed from the analysis. The MANOVA results explain that the main effect of math anxiety ($\lambda = .97$; $F(7, 280) = 1.95$, $p = .10$), and interaction effect (λ = .98; F (7, 280) = 1.24, p = .30) were not significant. Subsequent ANOVA showed an insignificant main effect of math anxiety on perceived price satisfaction (F(7, 280) = .72, p = .40) and purchase intention (F(7, 280) = 1.60, p = .21). However, the interaction effect on perceived price satisfaction (F(7, 280) = 3.52, p < .10), and purchase intention (F(7, 280) = 3.04, p < .10) was marginally significant. Therefore, it is important to understand why the study did not find a significant effect in a 2 x 2 x 2 scenario.

For high-priced products, the study found a significant interaction effect of math anxiety and discount framing (λ = .91; F (3, 140) = 3.42, p < .05). Table 4.7 indicates that when the product is perceived by consumers as high-priced, if sellers frame a discount in absolute terms, i.e., dollar-off, instead of a relative term, i.e., percentage-off, high math anxiety consumers perceived a significantly higher price satisfaction ($M_{\text{dollar-off}}$ = 4.99, $M_{\text{percentage-off}}$ = 3.90; F(3, 140) = 12.31, p < .01), and showed a higher purchase intention ($M_{\text{dollar-off}}$ = 4.19, $M_{\text{percentage-off}}$ = 3.17; F(3, 140) = 10.58, p < .01). Therefore, H2a is supported. In contrast, when a discount is framed as percentage-off, compared to the dollar-off discounts, consumers with low math anxiety showed no significant difference in perceived price satisfaction ($M_{\text{percentage-off}}$ = 4.88, $M_{\text{dollar-off}}$ = 4.64; F(3, 140) = .83, p = .37) and purchase intention ($M_{\text{percentage-off}}$ = 3.76, $M_{\text{dollar-off}}$ = 3.40; F(3, 140) = 1.18, p = .28). This provides empirical support for H2b (see Figure 4.5).

Table 4.7: Means and Standard Deviations of Interaction Effect (Study 2a-High-priced)

Manipulations	Promotion Framing	Dependent Variables			
		Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention
Low math anxiety	Dollar-off discount	4.64 (1.30)	3.87 (1.53)	4.28 (1.34)	3.40 (1.46)
	Percentage-off discount	4.88 (.86)	4.12 (1.39)	4.52 (1.13)	3.76 (1.41)
High math anxiety	Dollar-off discount	4.99 (1.08)	4.37 (1.23)	4.69 (1.28)	4.19 (1.33)
	Percentage-off discount	3.90 (1.52)	4.14 (1.52)	4.08 (1.29)	3.17 (1.32)

Figure 4.5: Interaction Effects of Math Anxiety and Discount Framing (High-priced)



For low-priced products, the results did not demonstrate a significant interaction effect of math anxiety and discount framing (λ = .99; F (3, 140) = .31, p = .87). As Table 4.8 shows, when the respondents were offered a low-priced product with a dollar-off discount, compared to a percentage-off deal, respondents with low math anxiety did not express a significant difference in perceived price satisfaction ($M_{\text{percentage-off}}$ = 4.86, $M_{\text{dollar-off}}$ = 4.59; F(31, 71) = .67, p = .42) and purchase intention ($M_{\text{percentage-off}}$ = 3.57, $M_{\text{dollar-off}}$ = 2.95; F(1, 71) = 2.37, p = .13). Therefore, the study failed to provide empirical support for H2c.

The study also did not observe a significant difference between the responses of high math anxiety respondents to percentage-off and dollar-off discounts in terms of perceived price satisfaction ($M_{\text{dollar-off}}$ = 4.72, $M_{\text{percentage-off}}$ = 4.81; F(1, 71) = .05, p = .82) and purchase intention ($M_{\text{dollar-off}}$ = 3.37, $M_{\text{percentage-off}}$ = 3.83; F(1, 71) = 1.78, p = .19). Therefore, H2d is empirically supported. In fact, consumers who shop for low-priced products do not react based on their level of math anxiety. The observations reveal that both high and low math anxiety respondents show slightly higher price satisfaction and willingness to buy a low-priced product that is offered with a percentage-off discount compared to the dollar-off (see Figure 4.6).

Figure 4.6: Interaction Effects of Math Anxiety and Discount Framings (Low-priced)

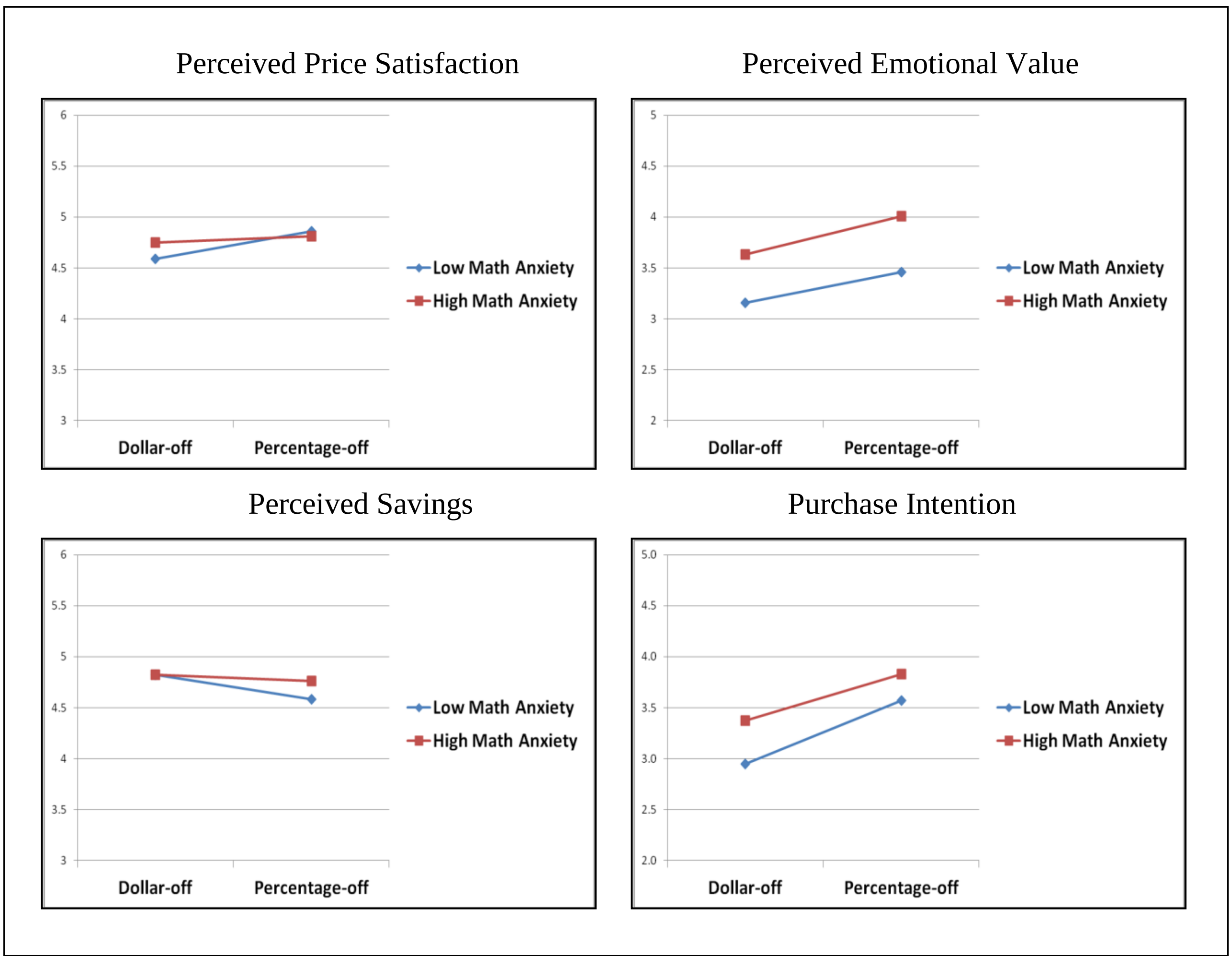


Table 4.8: Means and Standard Deviations of Interaction Effect (Study 2a-Low-priced)

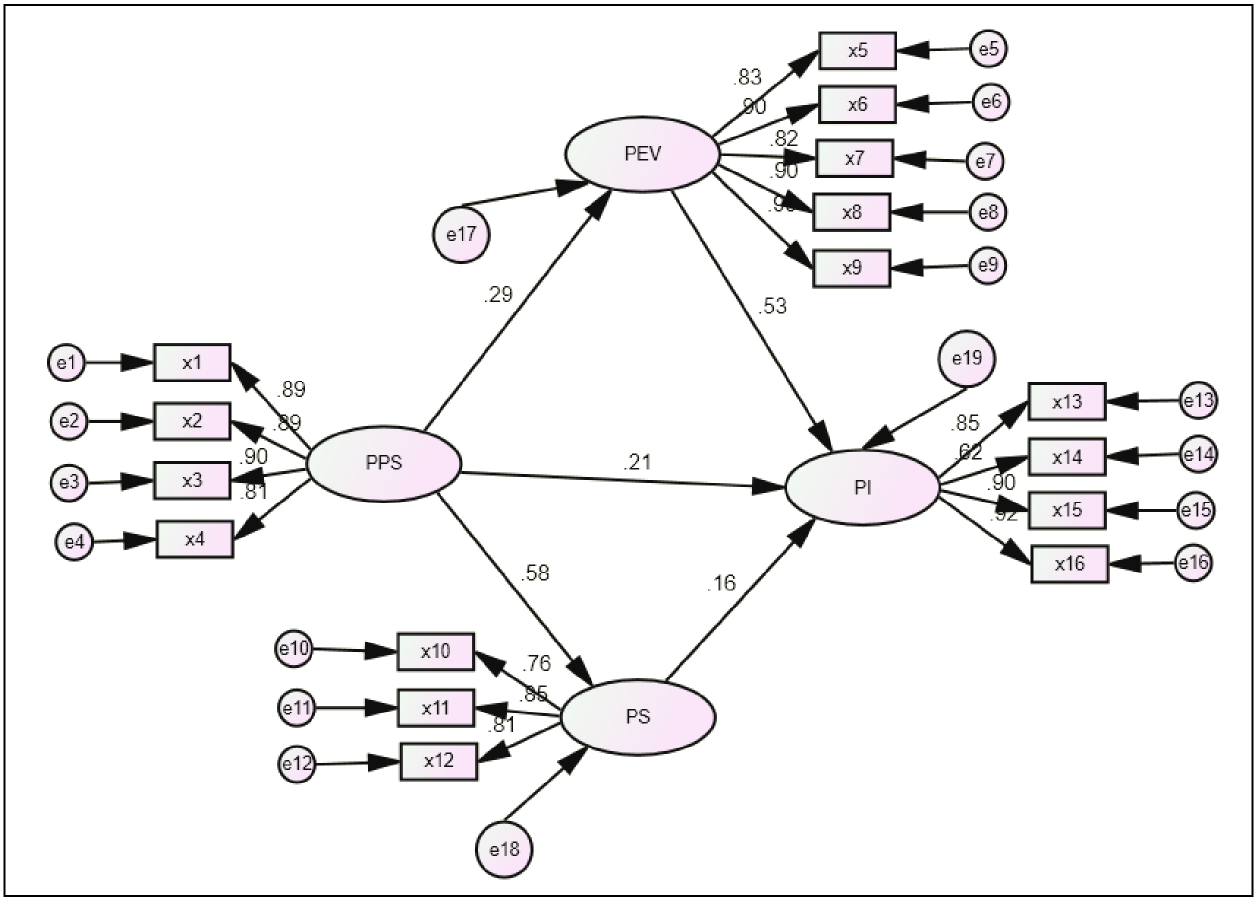
Manipulations	Promotion Framing	Dependent Variables			
		Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention
Low math anxiety	Dollar-off discount	4.59 (1.40)	3.16 (1.33)	4.82 (1.27)	2.95 (1.60)
	Percentage-off discount	4.86 (1.44)	3.46 (1.69)	4.58 (1.59)	3.57 (1.79)
High math anxiety	Dollar-off discount	4.75 (1.32)	3.63 (1.68)	4.82 (1.37)	3.37 (1.58)
	Percentage-off discount	4.81 (.99)	4.01 (1.56)	4.76 (1.07)	3.83 (1.37)

Similar to Study 1, the structural equation models were calculated for Study 2a as well to examine the main relationships between dependent variables and to test the hypothesized mediating effects. The measurement model of the study confirms the structure of the factors suggested by the EFA (Appendix J). The model shows an acceptable goodness-of-fit (GOF) because χ^2 is significant and CMIN/DF is 2.88 (less than 3), comparative fit index (CFI) is .95, non-normed fit index (NFI) is .93 (close to 1) and the root mean square error of approximation (RMSEA) is equal to .08. Therefore, the model is appropriate for analysis. Figure 4.7 shows the structural model of the study that explains the main effects between dependent variables. As shown in Table 4.9, the relationships between dependent variables in the structural model are positive and significant.

Table 4.9: Structural Model Estimates for Hypotheses Testing (Study 2a)

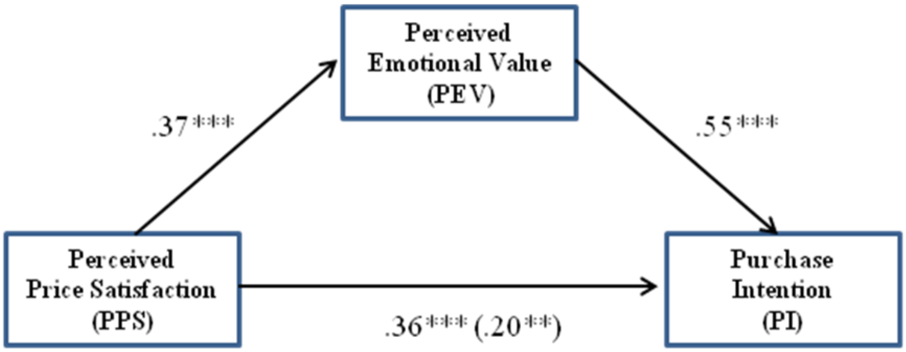
Relationships	Path Coefficient (B)	Standard Error (S.E.)	t-value	Significance (*P*)	Standardized (B)
PPS → PI	.29	.07	4.06	< .001	.21
PPS → PEV	.39	.07	5.60	< .001	.31
PPS → PS	.63	.06	10.42	< .001	.60
PEV → PI	.64	.05	13.59	< .001	.58
PS → PI	.26	.06	4.16	< .001	.19

Figure 4.7: The Structural Model of Study 2a



The mediating hypothesis (H5) was tested using a separate SEM model with 5,000 bootstrapped samples. The study supposed that perceived price satisfaction influences purchase intention through perceived emotional value. The mediation results revealed that perceived price satisfaction had a significant indirect effect on purchase intention ($\beta = .20$, $p < .01$). Moreover, there was a significant positive effect of price satisfaction on the perceived emotional value ($\beta = .37$, $t = 6.55$, $p < .001$). Perceived emotional value in turn positively influenced purchase intention ($\beta = .55$, $t = 11.05$, $p < .001$). When the mediator entered the model, perceived price satisfaction continued its significant direct effect on purchase intention ($\beta = .36$, $t = 7.01$, $p < .001$). This demonstrates a partial mediating effect, which supports H5 (see Figure 4.8).

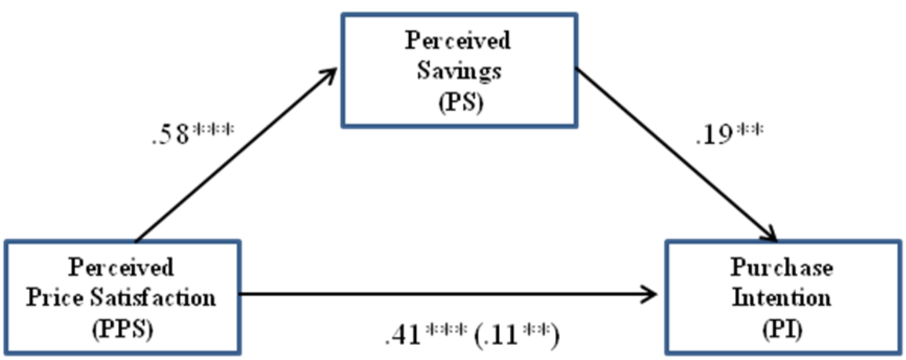
Figure 4.8: Mediating Effect of Perceived Emotional Value (Study 2a)



Note: * $p < .10$, ** $p < .05$, *** $p < .001$

To test the mediating role of perceived savings in the relationship between perceived price satisfaction and purchase intention (H6), the same process was repeated, while excluding emotional value from the model. The mediation analysis revealed that there is a significant indirect effect of price satisfaction on purchase intention ($\beta = .11$, $p < .01$). Perceived price satisfaction positively influenced perceived savings ($\beta = .58$, $t = 9.02$, $p < .001$), while perceived savings had a significant positive effect on purchase intention ($\beta = .19$, $t = 2.67$, $p < .01$). After entering the mediator to the model, the direct effect of price satisfaction on purchase intention stayed significant ($\beta = .41$, $t = 6.27$, $p < .001$). This shows that perceived savings partially mediates the effect of price satisfaction on purchase intention, supporting H6 (see Figure 4.9).

Figure 4.9: Mediating Effect of Perceived Savings (Study 2a)



Note: * $p < .10$, ** $p < .05$, *** $p < .001$

Data Analysis Study 2b

Study 2b is an extension of discount framing effects. It suggests that when retailers offer multiple discounts to sell a product or service, it may interact with math anxiety and influence consumer behavior, so that if consumers with high math anxiety are exposed to multiple discounts framed as percentage-off, they will perceive lower price satisfaction and purchase intention than when they face a single discount with the same economic value. In contrast, multiple discounts stimulate higher price satisfaction and purchase intention for consumers with low math anxiety than a single discount with the same economic value. To test this interaction effect (H3), the study conducted an experiment on 162 college students (81 participants in each scenario, 40 to 41 cases in each cell).

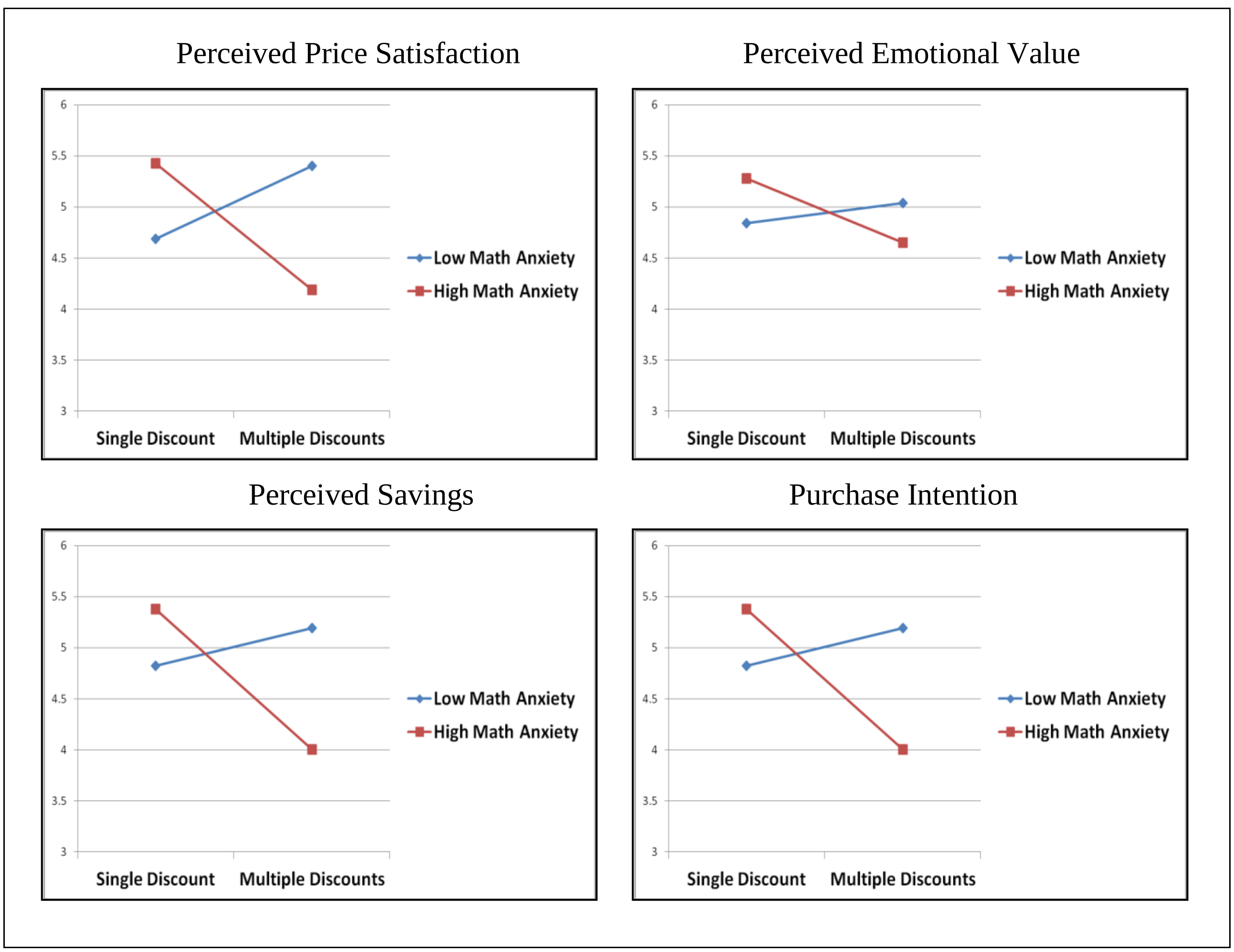
A 2 x 2 MANCOVA was applied, while using gender as a covariate. As the covariate did not show a significant effect ($F(4, 157) = 1.46$, $p = .22$), it was excluded from the analysis. The MANOVA demonstrated an insignificant main effect of math anxiety ($\lambda = .98$; $F(3, 158) = .73$, $p = .57$), but a significant interaction effect ($\lambda = .81$; $F(3, 158) = 9.39$, $p < .001$). Subsequent ANOVA showed a significant interaction effect on perceived price satisfaction ($F(3, 158) = 23.59$, $p < .001$) and purchase intention ($F(3, 158) = 34.75$, $p < .001$).

As shown in Table 4.10, when sellers provide consumers with a single discount, compared to multiple discounts, high math anxiety consumers perceived significantly higher price satisfaction ($M_{singlediscount} = 5.43$, $M_{multiplediscount} = 4.19$; $F(1, 79) = 21.18$, $p < .001$) and higher purchase intention ($M_{singlediscount} = 5.15$, $M_{multiplediscount} = 3.41$; $F(1, 79) = 35.59$, $p < .001$), supporting H3a. On the contrary, when multiple discounts are offered, compared to a single discount, consumers with low math anxiety showed higher perceived price satisfaction ($M_{multiplediscount} = 5.40$, $M_{singlediscount} = 4.69$; $F(1, 79) = 5.72$, $p < .05$), and greater intention to buy the product ($M_{multiplediscount}$ = 4.90, $M_{singlediscount}$ = 4.04; $F(1, 79) = 6.71$, $p > .05$). Therefore, H3b is supported. Figure 4.10 indicates the interaction effects and the differences in consumer responses to different discount frames considering the level of math anxiety.

Table 4.10: Means and Standard Deviations of Interaction Effect (Study 2b)

Manipulations	Promotion Framing	Dependent Variables			
		Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention
Low math anxiety	Single discount	4.69 (1.53)	4.84 (1.54)	4.82 (1.14)	4.04 (1.53)
	Multiple discounts	5.40 (1.13)	5.04 (1.25)	5.19 (1.23)	4.90 (1.43)
High math anxiety	Single discount	5.43 (1.21)	5.28 (1.23)	5.38 (1.21)	5.15 (1.19)
	Multiple discounts	4.19 (1.21)	4.65 (1.14)	4.00 (1.48)	3.41 (1.43)

Figure 4.10: Interaction Effects of Math Anxiety and Multiple Discounts



To observe the relationships between dependent variables and to examine the mediating effects, Study 2b used the structural equation models. The measurement model of the study confirmed the structure of the factors suggested by the EFA (Appendix J). The goodness-of-fit (GOF) of the model is acceptable because χ^2 is significant and CMIN/DF is 2.62 (less than 3), comparative fit index (CFI) is .94, non-normed fit index (NFI) is .90 (close to 1) and the root mean square error of approximation (RMSEA) is .10 (slightly above .08). Therefore, the model is suitable for analysis. Figure 4.11 illustrates the structural model of the study and explains the main effects between dependent variables. As shown in Table 4.11, the relationships between dependent variables in the structural model are positive and significant.

Figure 4.11: The Structural Model of Study 2b

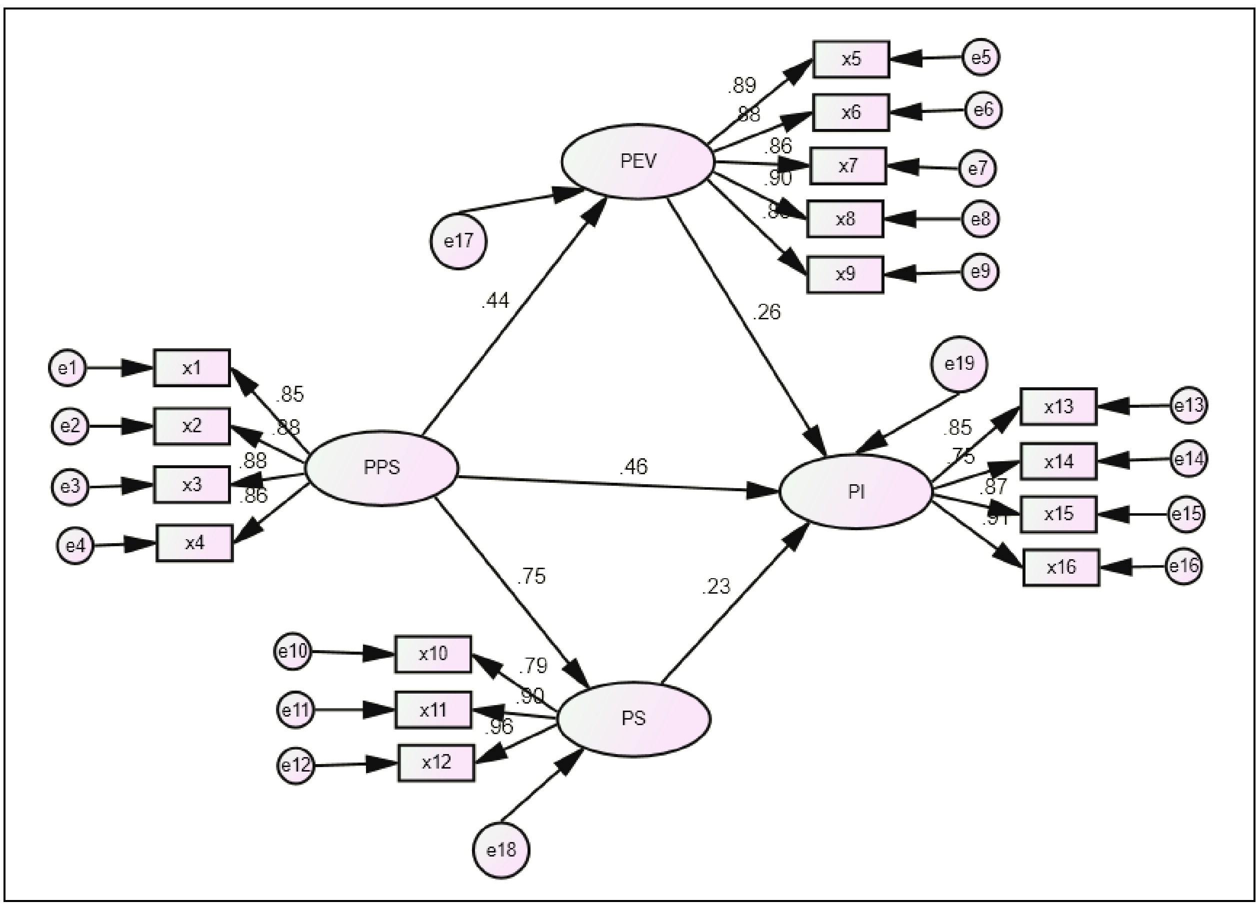
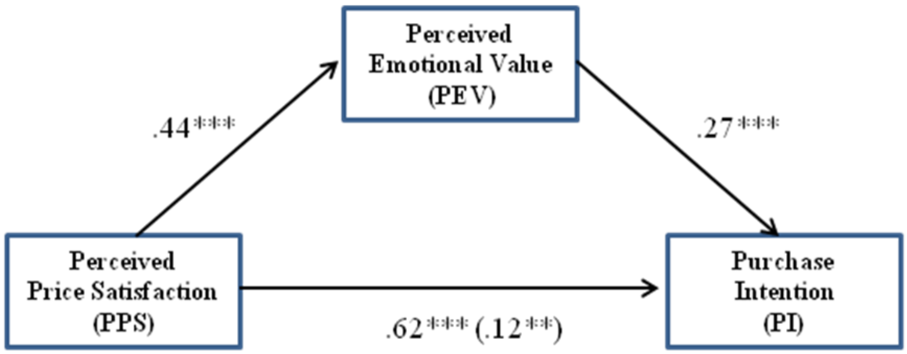


Table 4.11: Structural Model Estimates for Hypotheses Testing (Study 2b)

Relationships	Path Coefficient (B)	Standard Error (S.E.)	t-value	Significance (*P*)	Standardized (B)
PPS → PI	.51	.11	4.53	< .001	.46
PPS → PEV	.43	.08	5.48	< .001	.44
PPS → PS	.81	.08	10.67	< .001	.75
PEV → PI	.31	.08	4.03	< .001	.26
PS → PI	.24	.09	2.58	< .050	.23

To test the mediating hypotheses in study 2b, the similar SEM method used in previous studies was applied. The study investigates whether the effect of perceived price satisfaction on purchase intention is mediated by perceived emotional value or not. The results of mediation analysis showed that the indirect effect of price satisfaction on purchase intention was positive and significant (β = .12, p < .01). Perceived price satisfaction also had a significant positive effect on the perceived emotional value (β = .44, t = 5.40, p < .001). Additionally, emotional value positively affected purchase intention (β = .27, t = 4.11, p < .001). However, after entering the mediating variable in the model, the direct effect of perceived price satisfaction on purchase intention remained significant (β = .62, t = 8.17, p < .001). This explains a partial mediation effect, supporting H5 (see Figure 4.12).

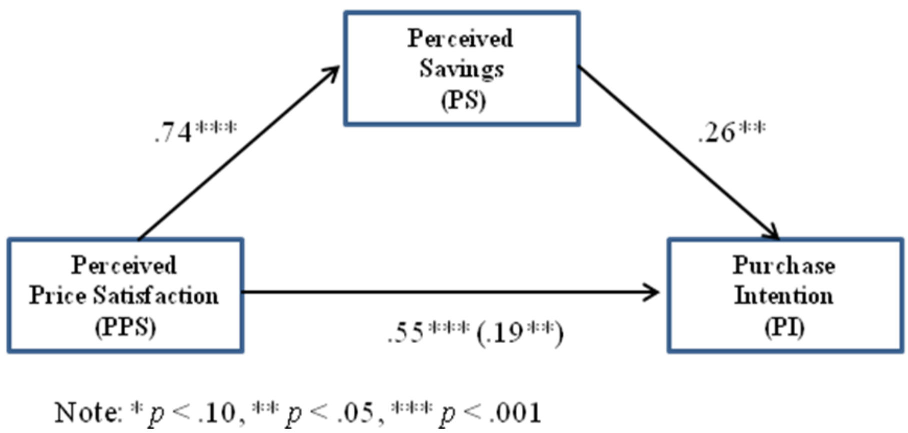
Figure 4.12: Mediating Effect of Perceived Emotional Value (Study 2b)



Note: * p < .10, ** p < .05, *** p < .001

To test H6, which suggests the mediating role of perceived savings in the relationship between price satisfaction and purchase intention, a separate SEM model was generated. The mediation analysis confirmed a significant indirect effect of perceived price satisfaction on purchase intention ($\beta = .19$, $p < .01$). Perceived price satisfaction positively affected perceived savings ($\beta = .74$, $t = 10.62$, $p < .001$), while perceived savings showed a significant positive effect on purchase intention ($\beta = .26$, $t = 2.73$, $p < .01$). When the mediator entered the model, the direct effect of perceived price satisfaction on purchase intention stayed significant ($\beta = .55$, $t = 5.34$, $p < .001$). Therefore, perceived savings partially mediates the effect of perceived price satisfaction on purchase intention, supporting H6 (see Figure 4.13).

Figure 4.13: Mediating Effect of Perceived Savings (Study 2b)



Data Analysis Study 3

Study 3 investigates the premise that when marketers provide a single price for bundle offers, consumers with high math anxiety will perceive higher price satisfaction and express greater willingness to buy the product in comparison to bundles that come with a list of the separate prices for bundle items. However, low math anxiety consumers will have higher perceptions of price satisfaction and purchase intention if they are exposed to a list of separate prices instead of a single price. To test this hypothesized interaction effect (H4), the study conducted an experiment on actual consumers using online surveys through Amazon Turk. A total of 246 respondents participated in the experiment for monetary compensation (123 participants in each scenario, 61 to 62 cases in each cell).

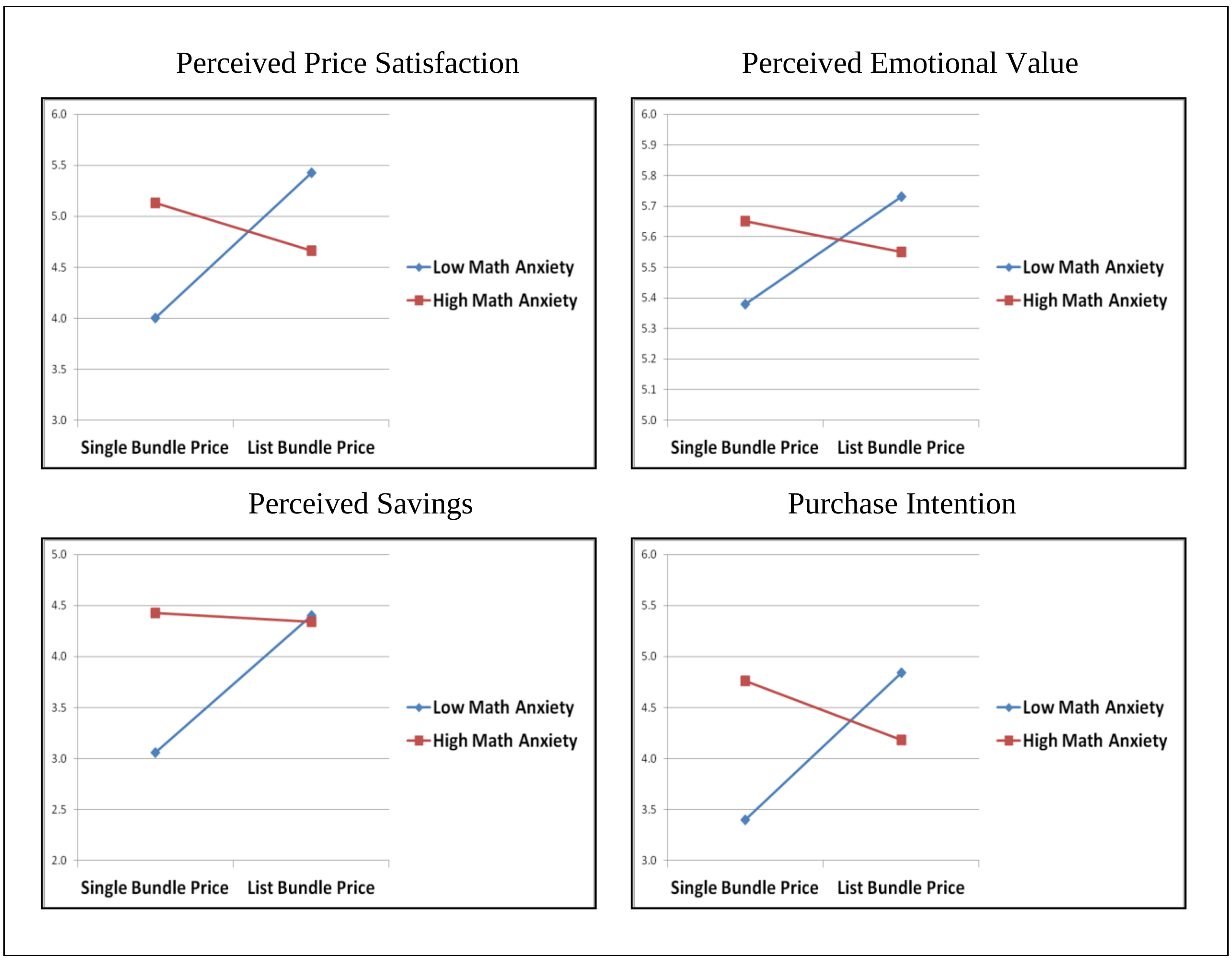
A 2 x 2 MANCOVA was performed with gender as a covariate. The results showed that the covariate did not have a significant effect ($F(5, 240) = 1.12$, $p = .35$). Therefore, it was removed from the analysis. The results of MANOVA showed a main effect of math anxiety ($\lambda = .94$; $F(3, 242) = 4.03$, $p < .01$), and an interaction effect ($\lambda = .84$; $F(3, 242) = 11.49$, $p < .001$). Subsequent ANOVA showed a significant main effect of math anxiety only on perceived savings ($F(3, 242) = 15.12$, $p < .001$) and purchase intention ($F(3, 242) = 3.71$, $p < .10$), and a significant interaction effect on perceived price satisfaction ($F(3, 242) = 43.63$, $p < .001$) as well as purchase intention ($F(3, 242) = 30.58$, $p < .001$).

Table 4.12 summarizes the interaction effect showing that when a bundle offer has a single price, compared to a price list of bundle items, high math anxiety consumers perceived a significantly higher price satisfaction ($M_{singlebundleprice} = 5.13$, $M_{listbundleprice} = 4.66$; $F(1, 122) = 5.46$, $p < .05$) and expressed higher purchase intention for the product ($M_{singlebundleprice} = 4.76$, $M_{listbundleprice} = 4.18$; $F(1, 122) = 5.19$, $p < .05$), supporting H4a. In contrast, when a bundle promotion includes a list of separate prices of bundle items, compared to a single bundle price, low math anxiety consumers perceived higher price satisfactions ($M_{listbundleprice} = 5.43$, $M_{singlebundleprice} = 4.00$; $F(1, 122) = 48.51$, $p < .001$) and showed higher purchase intentions ($M_{listbundleprice} = 4.84$, $M_{singlebundleprice} = 3.40$; $F(1, 122) = 29.81$, $p > .001$). This supports H4b (see Figure 4.14).

Table 4.12: Means and Standard Deviations of Interaction Effect (Study 3)

Manipulations	Promotion Framing	Dependent Variables			
		Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention
Low math anxiety	Single bundle price	4.00 (1.31)	5.38 (1.16)	3.06 (1.40)	3.40 (1.44)
	List bundle price	5.43 (.92)	5.73 (.91)	4.40 (1.28)	4.84 (1.48)
High math anxiety	Single bundle price	5.13 (.99)	5.65 (.93)	4.43 (1.21)	4.76 (1.18)
	List bundle price	4.66 (1.24)	5.55 (1.02)	4.34 (1.34)	4.18 (1.60)

Figure 4.14: Interaction Effects of Math Anxiety and Bundle Price Framing



Similar to previous studies, the structural equation models were calculated for Study 3 to observe the relationships between dependent variables and to assess the proposed mediating effects. As shown in Appendix J, the factor structure suggested by the EFA was confirmed by the CFA measurement model of the study. The model shows an acceptable goodness-of-fit (GOF) because χ^2 is significant and CMIN/DF equals to 3.17 (slightly above 3), comparative fit index (CFI) is .94, non-normed fit index (NFI) is .92 and the root mean square error of approximation (RMSEA) is .09 (slightly above .08). Therefore, the model is appropriate for analysis. Figure 4.15 shows the structural model of the study that explains the main effects between dependent variables. As shown in Table 4.13, the relationships between dependent variables in the structural model are positive and significant.

Figure 4.15: The Structural Model of Study 3

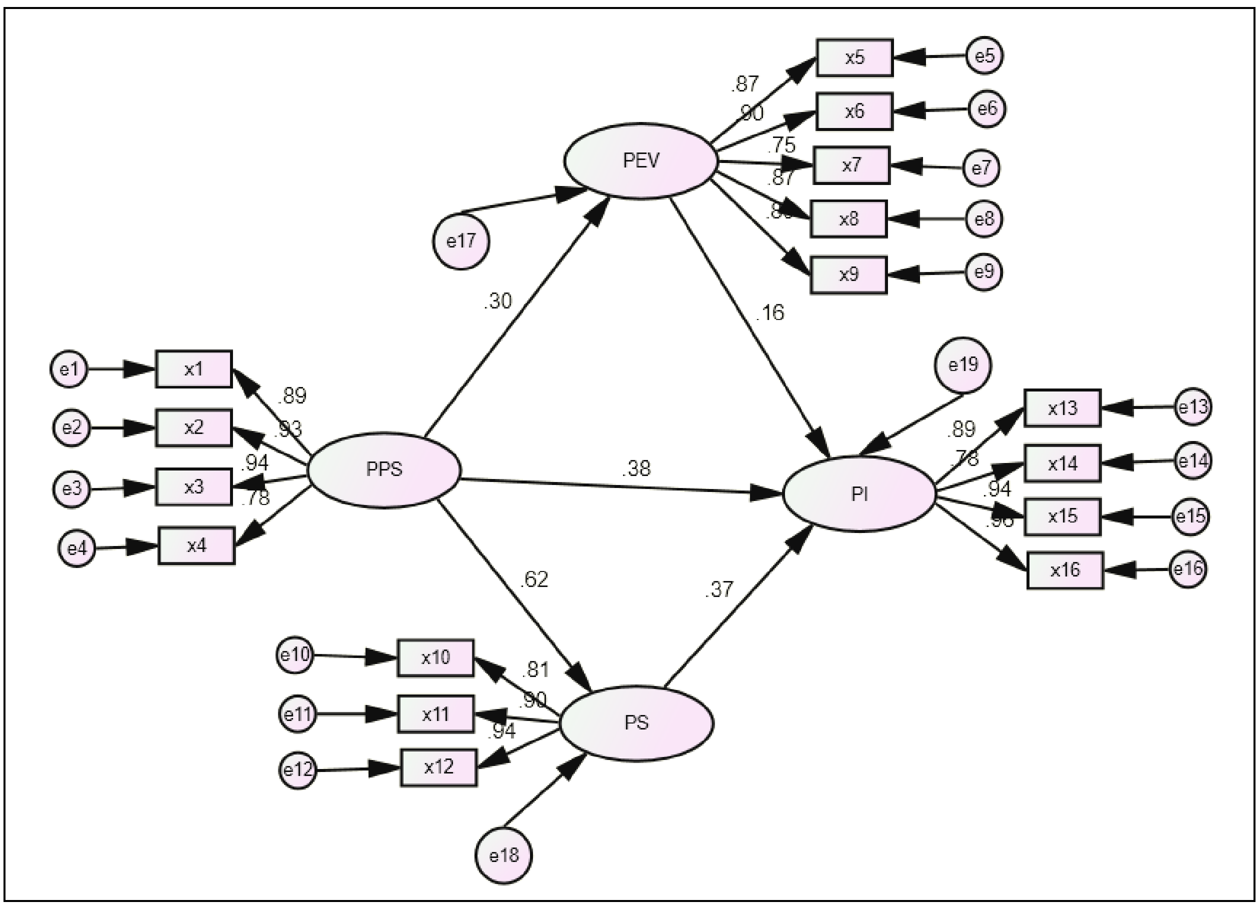
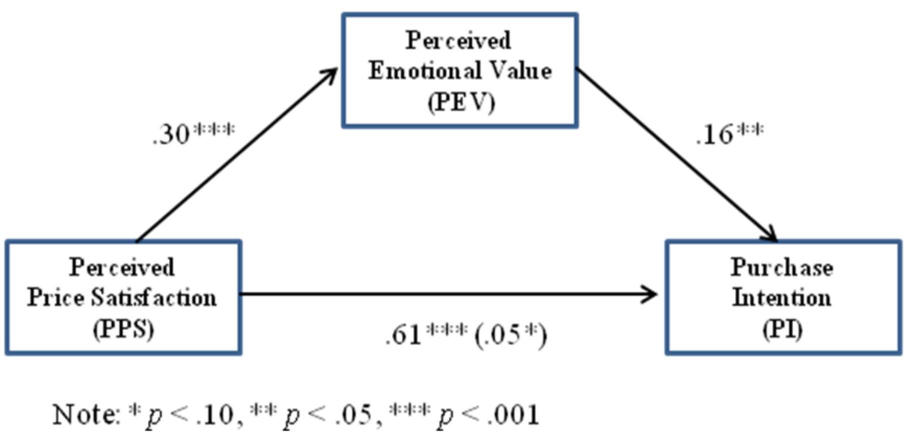


Table 4.13: Structural Model Estimates for Hypotheses Testing (Study 3)

Relationships	Path Coefficient (B)	Standard Error (S.E.)	t-value	Significance (*P*)	Standardized (B)
PPS → PI	.51	.09	5.65	< .001	.38
PPS → PEV	.28	.06	4.48	< .001	.30
PPS → PS	.79	.08	9.53	< .001	.62
PEV → PI	.23	.07	3.16	< .010	.16
PS → PI	.39	.07	5.81	< .001	.37

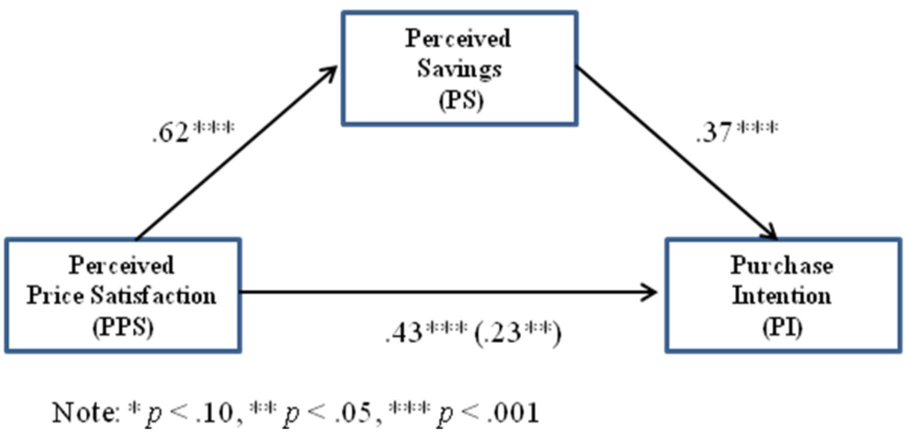
The mediating hypothesis (H5) was tested by the SEM using 5,000 bootstrapped samples. It was expected that perceived price satisfaction affects purchase intention through perceived emotional value. The mediation test demonstrated a significant indirect effect of perceived price satisfaction on purchase intention (β = .05, p < .05). There was also a significant positive effect of perceived price satisfaction on the perceived emotional value (β = .30, t = 4.46, p < .001). In addition, perceived emotional value positively influenced purchase intention (β = .16, t = 2.96, p < .01). However, when the mediating variable entered the model, the direct effect of perceived price satisfaction on purchase intention remained significant (β = .61, t = 9.35, p < .001). Therefore, there is a partial mediating effect, which supports H5 (see Figure 4.16).

Figure 4.16: Mediating Effect of Perceived Emotional Value (Study 3)



Hypothesis 6 regarding the mediating effect of perceived savings in the relationship between perceived price satisfaction and purchase intention was examined by the same process. The mediation analysis suggested a significant indirect effect of perceived price satisfaction on purchase intention ($\beta = .23$, $p < .01$). Price satisfaction had a positive significant effect on perceived savings ($\beta = .62$, $t = 9.51$, $p < .001$), whereas perceived savings positively affected purchase intention ($\beta = .37$, $t = 5.71$, $p < .001$). When the mediator was added to the model, the direct effect of perceived price satisfaction on purchase intention stayed significant ($\beta = .43$, $t = 6.31$, $p < .001$). This explains the partial mediation role of perceived savings in the relationship between perceived price satisfaction and purchase intention, supporting H6 (see Figure 4.17).

Figure 4.17: Mediating Effect of Perceived Savings (Study 3)



Summary

This chapter analyzed the data collected from 890 participants during four experimental studies, of which three studies used college students as a research sample and one study asked non-student consumers to answer an online experimental survey. The results showed a relatively equal number of male and female respondents that eliminates gender bias. A set of statistical methods was used to test the validity and reliability of the research instruments, including the math anxiety scale (MARS-Brief) and the main scenario-based surveys for measuring dependent variables. All four studies showed convergent and discriminant validity that reflect construct validity of the measurement scales. In addition, nomological validity was confirmed, demonstrating the sound theoretical basis of the scales.

The results of data analysis showed that the interaction effects in all four studies were significant and meaningful. Study 1 supported that when a promotion is framed as buy one get one free, consumers with a high level of math anxiety perceive higher price satisfaction and will most likely buy the product, compared to when they are exposed to a percentage-off discount. Conversely, low math anxiety consumers prefer percentage-off discounts. Study 2a showed that a discount framed as dollar-off will lead to higher perceived price satisfaction and intention to purchase the product in high math anxious consumers than percentage-off discounts with the same economic value. However, low math anxiety consumers did not show a significant difference in their perception of price satisfaction and purchase intention when dealing with dollar-off versus percentage-off discounts. The study found that this interaction effect is only valid for high-priced products, while respondents did not show a significant difference in perceived price satisfaction and purchase intention when shopping for low-priced products.

Study 2b revealed that consumers with high math anxiety will have higher satisfaction with the price and purchase intention when the product is offered with a single discount, while low math anxiety individuals show higher perceived price satisfaction and intention to purchase for the products offered with multiple discounts. Study 3 found that presentation of price bundles is a crucial factor in sales because when marketers use only a single price for a bundle, high math anxiety buyers will perceive higher price satisfaction and express higher purchase intention. In contrast, low math anxiety people are more satisfied with the price and willing to buy the product when the bundle comes with a detailed price list of bundle items.

Structural equation models confirmed the factor structure suggested by EFA. The structural model of each study showed significant positive relationships among dependent variables. The mediation analysis using bootstrapped samples supported the hypotheses that suggest the mediating role of perceived emotional value and perceived savings in the relationship between perceived price satisfaction and purchase intention.

The next chapter will discuss research findings and explain the logic behind each interaction effect by comparing the results with the literature and relevant theories. This helps to understand the importance of math anxiety in shaping consumer behavior concerning different price formats and promotion framings. Implications of the study for marketers and retailers are explained and directions for future research will be provided.

CHAPTER V

SUMMARY AND CONCLUSIONS

Overview

The notion of math anxiety as an obstacle for academic performance has attracted the attention of researchers in education science. However, math anxiety also reduces consumers' ability to process price information and make desired purchase decisions in a competitive market, where numerous options are offered at different prices and when calculation is involved in making the final purchase decision. Therefore, the importance of anxiety about math and numerical information processing in shaping consumer behavior requires further marketing research and collecting empirical evidence. The present study aimed to explore how and to what extent math anxiety influences consumers' perception of the price and value that results in their willingness to buy the products and services.

General Discussion of Research Findings

Recent studies found that consumers with high level of math anxiety avoid choices that require difficult arithmetic to calculate the final price (Feng, Suri and Bell, 2014; Suri, Monroe and Koc, 2013). However, there is a need for empirical studies to discover under what conditions such avoidance take place and how math anxiety affects buyers' final purchase decision-making. Combining the findings of education literature and neuroscience (Winecoff *et al.*, 2013; Young, Wu and Menon, 2012), we assumed that math anxiety will lead to lower perceptions of price satisfaction. This is because anxiety toward math creates a negative feeling about the price, but it depends on the way that sellers present the product prices or frame price promotions. The empirical studies conducted by this research enlighten us about some aspects of the effects of math anxiety on consumer behavior.

Study 1 Findings

Study 1 examined the interaction effects of math anxiety and promotion framings on consumers' perceived price satisfaction and purchase intention. The study compared a buy one get one free promotion on a video game sold online to a percentage-off discount. The results supported hypothesis 1 claiming that when the promotion is framed as gains, such as buy one get one free, high math anxiety consumers perceive higher satisfaction with the price and express greater intention to buy the product than percentage-off discounts. Conversely, low math anxiety buyers show higher perceived price satisfaction and purchase intention if the promotion is framed as a percentage-off discount and inspires reduced loss.

As explained in Chapter 2, Prospect Theory suggests that consumers usually prefer reduced loss frames to gain frames because they are more sensitive to loss than to gain and will be attracted by promotions that exhibit higher loss aversion (Kahneman and Tversky, 1979). The behavioral inhibition system also motivates consumers to avoid loss and find ways to reduce it (Yan, Dillard and Shen, 2012). In contrast, people do not easily integrate value-added promotions, such as free gifts or free extra products, with the reference price, as they are framed in units other than money. However, the results of Study 1 indicate a contradiction in such assumptions. The reason is that math anxiety impairs the ability of consumers to realize the actual value of promotions.

People who suffer from high math anxiety avoid price deals that require difficult price computations (Feng, Suri and Bell, 2014). When dealing with such price deals, working memory should be more involved in numerical processing activities, while math anxiety decreseas the capacity of working memory (Ashcraft and Kirk, 2001; Ashcraft and Krause, 2007). Therefore, they perceive greater negative emotions and show lower satisfaction with percentage-off discounts regardless of their meaning of reduced loss. Conversely, when they receive an offer in the form of matching discounts, such as buy one get one free, their focus will be on the free content of a price offer that creates a psychological condition. Therefore, they may choose an alternative that is more expensive, but comes with free components (Nicolau, 2012).

This is similar to the Attentional Control Theory, which explains that highly math-anxious people focus on the stimulus-driven system that is directed by feelings and emotions. The results also extend the research findings of Davis and Millner (2005) who studied consumers' reactions to matching discounts versus rebates showing that preferring the buy one get one free promotions is not only due to rebate aversion strategy, but also because of less difficulty in price computation compared to every discount or promotion that requires complex arithmetic.

Study 1 also found that the effect of perceived price satisfaction on purchase intention is partially mediated by consumers' perceived emotional value and perceived savings. The result of the structural model showed that in the presence of the mediating factors, perceived price satisfaction preserved its significant effect on purchase intention. However, the strength of the effect is dramatically increased. This supports the literature suggesting that first, perception of product emotional value has a vital influence on purchase decision and behavioral intentions (Lee, Lee and Choi, 2011; Sheth, Newman and Gross, 1991), and second, greater perceptions of savings will lead to stronger intent to make a purchase (Monroe, 2003; Weisstein, Asgari and Siew, 2014; Xia and Monroe, 2009).

Study 2a Findings

The findings of Study 2a on the purchase scenarios related to wedding bands has two distinct facets. First, when consumers perceive the product as a high-priced item, if the discount is framed as dollar-off, compared to the percentage-off, high math anxiety consumers perceive higher satisfaction with the price and express greater willingness to purchase. Consequently, dollar-off discounts seem to be more effective than percentage-off framing for math-anxious buyers. If the discount is framed as percentage-off, such consumers do not find the promotion attractive. The main reason is that percentage-off deals may require difficult calculations that needs using greater resources of working memory (Ashcraft, 1992; Suri, Monroe and Koc, 2013). According to Inhibition Theory, high math anxiety people pay greater attention to simpler tasks (and prefer simpler price formats) to avoid irrelevant tasks and regulate working memory performance (Hasher and Zacks, 1988; McCabe *et al.*, 2010). On the other hand, consumers with low math anxiety perceive no significant difference between discounts framed as percentage-off versus dollar-off in terms of price satisfaction and purchase intention. This is because it is fairly easy for them to calculate the final net price and find out which discount is more beneficial.

The literature suggests that for high-priced products, consumers generally prefer absolute terms, i.e., dollar-off discounts, to relative terms, i.e., percentage-off. However, the reason is that the dollar amount of price reduction is usually greater than the percentage discount presented (Chen, Monroe and Lou, 1998). In fact, buyers responded to their perceived discount magnitude. However, the effect of math anxiety refers to the extent to which the final price after discount is easily understood. Therefore, low math anxiety consumers who are able to perform math computations and have lower negative emotions toward complex prices did not find a difference between dollar-off and percentage-off discounts. In addition, as Kim and Kramer (2006) stated, if buyers have higher needs for cognition, they may prefer percentage-off discounts because they can perform complex price calculations that provides a psychological enjoyment for them. In other words, they look for epistemic value in such deals to satisfy their curiosity (Sheth, Newman and Gross, 1991).

Chen, Monroe and Lou (1998) found that for low-priced products, consumers prefer percentage-off discounts to dollar-off because the amount of percentage discount is often larger than its equivalent dollar reduction in the price. However, when we used a low-priced product, Study 2a did not find any significant difference between high math anxiety and low math anxiety consumers in responding to different discount formats. Although both groups showed a higher tendency toward percentage-off discounts that are viewed as reduced loss, the effect was not significant. This means that the assumption of Chen, Monroe and Lou (1998) may not hold true for low-priced products.

Study 2a also supported the mediating effect hypotheses claiming that perceived price satisfaction influences purchase intention through perceived emotional value and perceived savings. In fact, the results showed that although the mediation was partial and the direct effect of perceived price satisfaction remained significant, it became even stronger than when mediators were absent. Therefore, the effect of math anxiety is not limited to price satisfaction, but results in the assessment of product emotional value, which is an affective response, as well as perception of savings yielded by accepting the offer that, according to the Transaction Utility Theory of Thaler (1983), is a cognitive judgment.

Study 2b Findings

According to Prospect Theory, multiple discounts stimulate higher perceived price satisfaction and willingness to buy for consumers compared to a single discount because they explain greater loss reduction. In other words, people may perceive greater transaction value if the product price is discounted twice or more (Kahneman and Tversky, 1979; Thaler, 1985). However, offering multiple discounts creates the need for complex price computations to estimate the final price to be paid after discount. Therefore, Study 2b found that when sellers use a single discount for a product, high math anxiety consumers perceive higher price satisfaction and purchase intention compared to multiple discounts. In contrast, low anxiety consumers are satisfied with the price of products sold with multiple discounts and show higher willingness to buy them. In fact, the assumption of Prospect Theory about the preference for multiple or stackable discounts holds true only if the level of math anxiety is low.

As Cai and Suri (2009) explained, consumers will perceive higher perceived savings with stackable discounts if they pay full attention to them. However, math anxiety reduces the capacity of working memory and attention to computation. Based on the Attentional Control Theory, anxiety toward math disrupt the balance between the goal driven system and the stimulus-driven system. This will result in poor cognitive performance (Derakshan and Eysenck, 2009; Eysenck *et al.*, 2007). Therefore, consumers with high math anxiety may prefer to avoid complex deals instead of spending time and effort to calculate multiple discounts and find greater savings. Consequently, using a single discount is more effective than multiple discounts for highly math-anxious buyers. If sellers offer multiple discounts requiring compound calculation, such consumers may refuse to make a purchase. However, low math anxiety consumers follow their cognitive assessments and prefer multiple discounts that create a sense of loss reduction and greater savings (Cai and Suri, 2007, 2009).

Besides the interaction effect, Study 2b provided empirical support for the assumptions that the effect of perceived price satisfaction on purchase intention is mediated by perceived emotional value and perceived savings. In case of multiple discounts, perceived savings may create a stronger impact on the relationship between perceived price satisfaction and purchase intention, as consumers may find a greater chance to save when purchasing a product with multiple discounts compared to a single discount.

Study 3 Findings

Price bundling is a commonly used method of promotion that not only attracts consumers, but also increases firm profitability through price segmentation (Adams and Yellen, 1976; Nagle, 1984). As Stremersch and Tellis (2002) suggested, product bundles create added value for consumers by offering complementary products in a package, but the value of price bundles depends on the discounts offered by sellers. Therefore, bundles are considered price promotions. Interestingly, consumers often prefer bundles due to the price misperception, as they have limited information and underestimate the final price they have to pay (Bar-Gill, 2006). Therefore, it is important to consider how to present the bundle price.

As Prospect Theory suggests, people are more sensitive to loss, and paying product price is a painful loss for them. Hence, if they avoid paying multiple prices, they will have the higher price satisfaction (Thaler, 1985). Therefore, marketers may integrate all price information in a single bundle price to optimize bundles and stimulate purchase intention (Gilbride, Guiltinan and Urbany, 2008; Stremersch and Tellis, 2002). In contrast, presenting a list of the separate prices for bundle items helps consumers to perceive greater savings with the bundle (Stremersch and Tellis, 2002). However, math anxiety may guide us to understand which consumers will favor each type of bundle price framing.

Study 3 examined consumer responses to different price presentations in a bundle through an online consumer survey based on an experiment using a digital camera kit. The results revealed that when sellers use a single price for the bundle, high math anxiety consumers show higher perceived price satisfaction and purchase intention compared to offering the bundle with a list of separate prices of each item before promotion. This is because such price lists confuse them and they may not be able to calculate the exact amount of savings with the bundle because estimating the final price of such a bundle requires consuming working memory to do computation (Hitch, 1978). Therefore, they may use anchoring and adjustment to simplify calculations when they combine separate prices of the bundle items. As a result, they pay more attention to the price of the main item and make inadequate upward adjustment of the prices of other items. This will result in mistakes in estimating the final price or the amount of savings. Consequently, as Sheng, Bao and Pan (2007) suggested, most consumers prefer a single bundle price to partitioned prices. Nevertheless, the study showed that low math anxiety buyers reported higher satisfaction with the price when the bundle comes with the a list of separate prices. This helps them to compute how much they will save if they buy the bundle.

Similar to previous experiments, Study 3 supports the mediating role of perceived emotional value and perceived savings in the relationship between perceived price satisfaction and purchase intention. This means that higher perceived price satisfaction will lead to greater purchase intention, especially when consumers perceive higher emotional value with the product or find a greater savings in the promotion offered by marketers.

Research Contributions

This research contributes to the pricing literature by showing that math anxiety negatively influences consumers' perceived price satisfaction and subsequently reduces their purchase intentions while being exposed to promotion framings that require difficult price calculations. Four experimental studies conducted to observe differences between highly math-anxious and low math anxiety consumers in terms of their responses to different promotion framings (i.e., buy one get one free versus percentage-off discounts), discount framings (i.e., dollar-off versus percentage-off discounts, and a single discount versus multiple discounts), and bundle price framings (a single bundle price versus a list of separate item prices). Therefore, the study provides a broad understanding of the effects of math anxiety on consumer price perception and purchase decision with regard to different price promotion framings.

The theoretical contribution of the study is mainly related to correcting some assumptions of Prospect Theory regarding consumer responses to the prospect of loss versus the prospect of gain. It also provides empirical support for cognitive psychology and its related theories that explain the impact of math anxiety on the capacity working memory and the motivation of people to do math calculations. The research findings indicated that high math anxiety respondents tended to avoid promotions that forced them to do fairly complex arithmetic to arrive at the final price or the amount of savings. Therefore, marketers can use simpler prices and promotion frames to increase their price satisfaction and purchase intentions. Furthermore, the study showed that variations in perceived price satisfaction and purchase intention did not relate to math ability or the capability of respondents to do math operations or solve math problems.

We further contribute to the literature by showing that perceived emotional value and perceived savings are two important factors that mediate the relationship between perceived price satisfaction and purchase intention. This means that when high math anxiety consumers perceive lower satisfaction with complex promotion frames, they may perceive lower emotional value for the product or perceive the lower amount of savings possible with the offer and, thus, avoid making a purchase. Therefore, to improve perceptions of emotional value and savings among such consumers, marketers need to adopt simpler promotion framings.

Research Implications

Theoretical Implications

The major implication of this research from a theoretical perspective is that behavioral pricing should consider differences among consumers with regard to the degree of mathematics anxiety. The importance of this special attention is that a high level of math anxiety may cause contradictory consumer responses that have not been explained by the existing pricing theories. Pricing research needs further empirical research to explain how math anxiety affects consumer perception of prices in different purchase situations, under different contextual factors, and with various price presentations or promotion frames.

We need to identify consumer segments that are highly affected by math anxiety and find ways to reduce the negative consequences of this psychological status. Studying the role of heuristics in consumer purchase decision-making, integrating anchoring and adjustment research with mental accounting findings, integrating cognitive psychology theories with pricing theories, and conducting further experiments on consumer samples will certainly help marketing science and behavioral pricing to obtain a deeper understanding and knowledge about math anxiety and its effects, and provide more appealing theories.

Marketing Practice Implications

The main managerial implication of the current study is that we recommend retailers and pricing managers avoid using price presentations or promotion framings that are not easily calculated by consumers, especially when a majority of consumer segments suffer from a high degree of math anxiety. As study 1 showed, using matching discounts or promotions that contain free products or higher quantity of the product for the same price is a great solution for high math anxiety buyers. This will work well for products like laundry detergents or children’s clothing that are mainly purchased by women. As previous studies show, the degree of math anxiety is higher among female students compared to males (Ashcraft and Faust, 1994; Woodard, 2004). Similarly, female consumers will show higher math anxiety and stronger negative emotional responses while shopping. Therefore, they may prefer simpler promotion frames. However, women who are shopping experts may have reference prices in their mind and have less difficulty with complex prices.

Marketers can offer the product at higher prices, but give consumers attractive options, such as buy one get one free, or buy two get one free. This helps them to catch the attention of new customers. In contrast, using complex price promotions, such as buy one get the next one with 50% off or similar discounts when the price is not round or calculating is difficult can be problematic. Such a tactic is suitable if the consumer segment has higher math competence and lower math anxiety, e.g., professionals, scientists, architects, or engineers.

As Study 2a revealed, marketers should avoid offering price discounts expressed as a percentage-off for the products that are sold to market segments that are highly math-anxious. This is more crucial if the product is a luxury or high-priced. We suggest that retailers might use simpler discount formats such as dollar-off for products like cosmetics, luxury bags, or perfumes that are mainly purchased by women. For home appliances, electronics and cars that percentage-off discounts are widely used, we recommend marketers to provide the price after discount as a reference for consumers to make it easier for them to perceive the value of the deal and savings. However, for low-priced items, where math anxiety does not have a significant effect on consumer purchase decision, they can use a combination of dollar-off and percentage-off discounts without showing the final price. For example, HEB stores often use dollar-off discounts for products such as shampoo, razers, toothbrush, and groceries, while applying percentage-off discounts on kitchen utensils and other products at slightly higher prices.

Based on the findings of Study 3, we suggest marketers use a single discount for products that are often purchased by high math anxiety consumers. It may be useful to offer computers, electronics, and high-priced products to professionals or business consumers by providing multiple discounts. However, even college students showed negative responses to such deals when they had high math anxiety. For convenience goods, family products, and low-priced shopping goods, offering a single discount is easier to understand and more attractive for consumers. If marketers decide to offer multiple discounts, it is suggested to use dollar-off price reductions instead of percentage-off.

Framing of price bundles is also important for increasing product sales. As Study 3 found, high math anxiety consumers show positive responses to bundles that come with a single price rather than offering a list of separate item prices. Therefore, for products that are targeted to consumer segments with high math anxiety, such as women or children, using a single bundle price is recommended. For example, value meals and combo offers in fast food chains should contain a single price while showing different bundle items. However, for professional services and products, using a price list for the bundle may increase perceived savings of the buyers.

Finally, the present research found that the effect of perceived price satisfaction on purchase intention is partially mediated by consumers' perceived emotional value and perceived savings. This means that in order to keep customers satisfied with the price and encourage them to make a purchase, sellers should not only apply simpler price promotion framings, but also they should use tactics to increase the buyers' perception of emotional value as well as savings. Improving the hedonistic aspects of the product and showing the actual amount of savings are effective ways to increase sales. For example, Feng, Suri and Bell (2014) examined the effect of background music and found that using music with a slow tempo can reduce the degree of math anxiety at the time of purchase. However, if marketers want to encourage consumers to make impulse purchases and pay higher amounts, using fast tempo music will be appropriate. In stores like Best Buy or JCPenny, marketers sometimes emphasize the amount of savings through specific terms, such as “you save $25.00”. This can reduce the consumer need to use arithmetic and increase the chance of making a purchase.

Directions for Future Research

The present study has faced some limitations during its empirical investigation. First, the study focused only on promotion frames and their interactions with math anxiety in influencing consumers’ price perceptions and purchase decisions. However, price presentations also can create similar interaction effects. For example, presenting odd-ended prices may generate different responses in highly math-anxious buyers compared to even-ended or round prices. As Coulter and Roggeveen (2014) explained, consumers who have lower deal processing fluency will react negatively to even-ended prices. This may be extended to high math anxiety buyers who may prefer rounded prices that are easier to process.

Second, this study examined a variety of promotion framings. However, there are other framings that need further investigation. For example, the reaction of consumers suffering from math anxiety to partitioned prices and offers that come with shipping fees or surcharges can be studied. Third, this study used the MARS-Brief instrument to measure math anxiety among respondents. Although this scale showed high reliability during the studies, it is necessary for marketing to generate a more exact instrument that reflects math anxiety specifically for consumer samples and exclude math test or math course anxiety measures that may not directly affect consumer behavior. This may be practical through conducting scale development studies.

Fourth, the present research referred only to an online consumer sample through Amazon Turk to obtain more reliable data compared to studies that only use student samples. However, future research can extend these experiments to in-store investigations and actual consumers to confirm the findings or observe possible contradictions. Fifth, the study only covered student and consumer samples from the United Sates, while researchers need to extend this study to other parts of the world to check whether the same results will be obtained in less-developed markets. In addition, the results may be different in East Asian countries such as Japan and South Korea, where students do better on math tests. Finally, this study considered perceived emotional value and perceived savings as mediating variables in the conceptual framework and examined their mediating effects through experiments. Future research can add other factors, such as perceived price fairness and brand familiarity, to the model and inspect their mediating effects.

Summary

This chapter discussed the findings of each experiment conducted by the present research. The results showed some contradictions to the existing theories of consumers' price perception. The logic for such contradictory results is the fact that many consumers suffer from high math anxiety that limits the capacity of working memory and makes them unable to calculate the exact final price after the promotion or the real value of the deal. Therefore, managers should select promotion frames that offer products with simpler price formats and are easier to calculate.

The study also showed that perceived emotional value and perceived savings mediate the effect of perceived price satisfaction of purchase intention. Perceived emotional value reveals the affective aspect of math anxiety effects, while perceived savings denote cognitive judgments that consumers make regarding the value of a transaction. The study contributes to marketing knowledge and pricing research by providing new insights about the role of math anxiety in consumer purchase behavior. This chapter provided some theoretical and managerial implications for marketers with regard to research findings. Finally, guidelines for future research were provided to extend the scope of the research, to improve the existing knowledge in this field, and to resolve limitations of the study.

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APPENDIX A

APPENDIX A

PRE-TEST FOR PRODUCT SELECTION

<u>Student Name:</u> <u>Class:</u>

Please read the following questions and answer clearly based on your experience.

1. What are the major products or services you usually buy in store? (Please name 5 items).

2. What are the major products or items you usually buy online? Please name 5 items.

3. What is the price range of these items? Please provide an approximate price you paid or expected to pay for those products.

4. How often do you make an online purchase?

Thank you very much for participating

APPENDIX B

APPENDIX B

PILOT TEST OF THE MEASUREMENTS OF MATH ANXIETY

Factor Structure of the sMARS Scale

Items		F1	F2	F3
1	Studying for a math test	.71		
2	Taking the mathematics section of college entrance exam	.76		
3	Taking an exam (quiz) in a math course	.75		
4	Taking an exam (final) in a math course	.79		
5	Picking up math textbook to begin working on a homework assignment	<.50		.62
6	Being given homework assignments of many difficult problems that are due the next class meeting	.72		
7	Thinking about an upcoming math test 1 week before	.53		
8	Thinking about an upcoming math test 1 day before	.80		
9	Thinking about an upcoming math test 1 hour before	.81		
10	Realizing you have to take a certain number of math classes to fulfill requirements in your major	.59		
11	Picking up math textbook to begin a difficult reading assignment	<.50		
12	Receiving your final math grade in the mail	.62		
13	Opening a math or stat book and seeing a page full of problems	.70		
14	Getting ready to study for a math test	.53		.59
15	Being given a "pop" quiz in a math class	.67		
16	Reading a cash register receipt after your purchase		.61	
17	Being given a set of numerical problems involving addition to solve on paper		.78	
18	Being given a set of subtraction problems to solve		.86	
19	Being given a set of multiplication problems to solve		.93	
20	Being given a set of division problems to solve		.82	
21	Buying a math textbook			.57
22	Watching a teacher work on an algebraic equation on the blackboard			.77
23	Signing up for a math course			.78
24	Listening to another student explain a math formula			.78
25	Walking into a math course			.68

Factor Sturcture of the MARS-Brief Scale

Items		F1	F2
1	Taking an examination (final) in a math course	.64	
2	Thinking about an upcoming math test one week before	.74	
3	Thinking about an upcoming math test one day before	.76	
4	Thinking about an upcoming math test one hour before	.75	
5	Thinking about an upcoming math test five minutes before	.70	
6	Waiting to get a math test returned in which you expected to do well	.54	
7	Receiving your final math grade in the mail	.61	
8	Realizing that you have to take a certain number of math classes to fulfill the requirements in your major	.70	
9	Being given a "pop" quiz in a math class	.72	
10	Studying for a math test	.70	
11	Taking the math section of a college entrance exam	.71	
12	Taking an examination (quiz) in a math course	.77	
13	Picking up the math textbook to begin working on a homework assignment	< .50	
14	Being given a homework assignment of many difficult problems, which is due the next class meeting	.63	
15	Getting ready to study for a math test	.62	
16	Dividing a five digit number by a two digit number in private with pencil and paper		< .50
17	Adding up 976+777 on paper		.70
18	Reading a cash register receipt after your purchase		.72
19	Figuring the sales tax on a purchase that costs more than $1.00		.69
20	Figuring out your monthly budget		.52
21	Being given a set of numerical problems involving addition to solve on paper		.73
22	Having someone watch you as you total up a column of figures		< .50
23	Totaling up a dinner bill that you think overcharged you		.71
24	Being responsible for collecting dues for an organization and keeping track of the amount		.68
25	Studying for a driver's license test and memorizing the figures involved, such as the distances it takes to stop a car going at different speeds		.65
26	Totaling up the dues received and the expenses of a club you belong to		.69
27	Watching someone work with a calculator		.66
28	Being given a set of division problems to solve		.68
29	Being given a set of subtraction problems to solve		.83
30	Being given a set of multiplication problems to solve		.76

APPENDIX C

APPENDIX C

PILOT TEST SCENARIOS

Please read the following scenario and answer the questions based on your decision-making.

You have 25 pictures and decide to put them in flipbooks for 10 friends and family.

Scenario 1:

The cost of printing is \$0.20 per print (4”×6”) for a set of 25 prints in a flipbook that costs \$1. The printing shop gives you the option to take 30% off your order of 10 flipbooks.

Based on the information provided, please tell us how much do you think you should pay.

Considering this situation, please indicate to what extent you agree with the following statements (Measurements of dependent variables shown on Table 6 Chapter 3).

Scenario 2:

The cost of printing is \$0.20 per print (4”×6”) for a set of 25 prints in a flipbook that costs \$1. The printing shop gives you the option to take \$18 off your order of 10 flipbooks.

Based on the information provided, please tell us how much do you think you should pay.

Considering this situation, please indicate to what extent you agree with the following statements (Measurements of dependent variables shown on Table 6 Chapter 3).

APPENDIX D

APPENDIX D

QUESTIONNAIRES FOR MEASURING MATH ABILITY

Math Ability Test

This is a test to see how quickly and accurately you can solve math problems. It is not expected that you will finish all the problems in the time allowed. Please, circle the correct answer without using a calculator. You will have **10 minutes** for this test. When you finish the test, STOP. Please do not go to the next sections until you are asked to do so.

1. When Jim was 8 years old, he received an allowance of $2.00 per week. If his weekly allowance was increased by $1.80 each year, how much was he receiving each week when he was 16?

   (a) $15.60 (b) $15.75 (c) $16.00 (d) $16.10 (e) $16.40

2. How many seedlings must be planted to obtain 1,300 trees if only 65% of the seedlings can be expected to survive?

   (a) 1,775 (b) 1,800 (c) 2,000 (d) 2,145 (e) 3,750

3. After Mike spent $6.00 of his savings for a new plane kit and one-half of the remainder of school supplies, he had $2.50 left. How much money did he have originally?

   (a) $8.50 (b) $10.00 (c) $11.00 (d) $13.50 (e) $14.50

4. Brenda sold her tennis racket for $20.00 which was 80% of the original cost. For how much should she have sold it to make a 10% profit?

   (a) $24.00 (b) $27.50 (c) $30.00 (d) $31.75 (e) $35.00

5. If lemons are sold at 3 for 60 cents, how much will 1 ½ dozen lemons cost?

   (a) $3.00 (b) $3.40 (c) $3.60 (d) $4.20 (e) $4.60

6. The ratio of children's books to adult books in a certain public library is 2 to 8. With the same ratio, how many children's books should be ordered when 1,000 books for adults are ordered?

   (a) 150 (b) 200 (c) 250 (d) 300 (e) 350

7. Sue and Jane played 45 games of Tie-Tac-Toe. Twelve games ended in a tie, and Sue won a 1/3 of the rest. How many games did Jane win?

   (a) 8 (b) 11 (c) 15 (d) 18 (e) 22

8. If coal costs $150.00 per ton, and the cost of 7 ½ tons of coal is shared by 90 co-op apartment owners, what is each member's share?

(a) $12.50 (b) $13.50 (c) $14.00 (d) $14.30 (e) $15.75

9. Three tractors and their operators can do as much work as 75 farm workers with no tractors. How many farm workers would be replaced by 10 tractors and their operators?

(a) 240 (b) 250 (c) 504 (d) 525 (e) 750

10. One cake recipe calls for 1 ½ cups of sugar and a second recipe calls for 2 cups of sugar. In making 8 cakes, how many fewer cups of sugar are used in the first recipe than with the second?

(a) 2 (b) 2 ½ (c) 3 (d) 3 ½ (e) 4

11. Approximately 32,400 people live in a city that is 3 miles long and 2 miles wide. What is the average number of people living in each square mile?

(a) 5,400 (b) 6,100 (c) 6,480 (d) 8,100 (e) 10,800

12. In value, seven $5-bills equal how many quarters?

(a) 28 (b) 35 (c) 56 (d) 70 (e) 140

13. If the price of a certain canned soup is reduced from 2 cans for $1.00 to 3 cans for $1.20, how much is saved on the purchase of 9 cans?

(a) 36 cents (b) 45 cents (c) 60 cents (d) 72 cents (e) 90 cents

14. The sum of two consecutive numbers is 47. What is the largest number?

(a) 23 (b) 24 (c) 25 (d) 26 (e) 27

15. In a record snowstorm 24.3 inches of snow fell at the rate of about 0.90 inches per hour. For how many hours did the storm last?

(a) 2.7 (b) 21.67 (c) 27 (d) 33.6 (e) 39

16. If a grocery store buys a crate of 360 eggs for $18.00, how much per dozen are they paying?

(a) 36 cents (b) 45 cents (c) 54 cents (d) 60 cents (e) 72 cents

17. A store selling furniture for 80% of the list price was selling a sofa for $560. What was the list price of the sofa?

(a) $665 (b) $690 (c) $700 (d) $740 (e) $790

18. Joe attended school for a total of 1,620 days. What part of a 12-year course did he complete, if 180 days were counted as a school year?

(a) 1/3 (b) 1/2 (c) 5/8 (d) 2/3 (e) 3/4

19. Jane is 4 years old and her brother is three times as old. When Jane is 11, how old will her brother be?

(a) 17 (b) 18 (c) 19 (d) 24 (e) 33

20. Betty raised 25 heads of cabbage averaging 8 pounds each. She spent $10.00 for plants and $7.00 for fertilizer. What was her profit if she sold them at $0.50 a pound?

(a) $56.00 (b) $60.00 (c) $70.00 (d) $83.00 (e) $100.00

Math Fluency Test

This is a test to see how quickly and accurately you can do math operations. It is not expected that you will finish all the problems in the time allowed. You are to write your answers in the boxes below the problems. Your score on this test will be the number of problems that are solved correctly. Work as rapidly as you can without sacrificing accuracy. You will have **5 minutes** for this test. When you finish the test, STOP. Please do not go to the next sections until you are asked to do so.

8	2	12	43	67	23	83	63	19	48
+3	+51	+42	+71	+95	+74	+14	+99	+57	+17

48	42	95	81	40	51	42	97	93	74
-19	-31	-65	-62	-31	-27	-18	-18	-45	-23

14	38	50	80	61	52	97	72	16	49
× 3	× 8	× 2	× 9	× 7	× 7	× 4	× 7	× 5	× 6

95 ÷ 5	42 ÷ 6	120 ÷ 6	344 ÷ 4	62 ÷ 2	162 ÷ 3	679 ÷ 7	224 ÷ 8	235 ÷ 5	99 ÷ 9

19	69	6	30	50	75	39	52	17	81
+8	+40	+67	+98	+42	+17	+90	+45	+55	+83
+27	-44	+38	-59	+13	-19	+82	-91	+58	-42

89	52	60	51	85	18	49	83	42	68
-60	-48	-39	-28	-23	-11	-37	-57	-23	-47

45	32	79	37	19	52	17	47	39	78
× 9	× 6	× 2	× 8	× 9	× 6	× 5	× 2	× 3	× 7

316 ÷ 4	56 ÷ 8	126 ÷ 9	567 ÷ 7	672 ÷ 8	175 ÷ 5	81 ÷ 3	70 ÷ 2	132 ÷ 4	122 ÷ 2

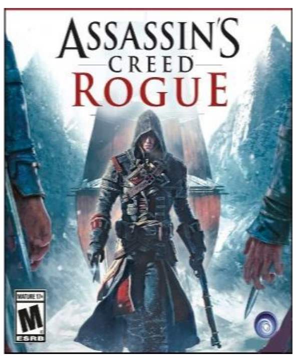
APPENDIX E

APPENDIX E

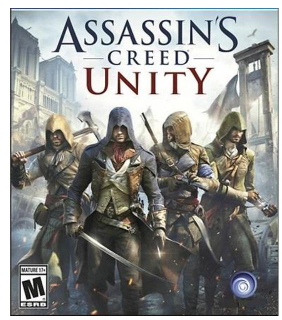
SCNARIOS OF EXPERIMENTAL STUDIES

Purchase Scenario 1 (Study 1)

Assume that you are a game player. You decide to buy two video games to play by Play Station. You search online and find a seller who offers a deal in which you will get a 50% discount on your second game when you purchase the following video game.



+



$37.79

Buy ONE Video Game
Get the Next One 50% OFF

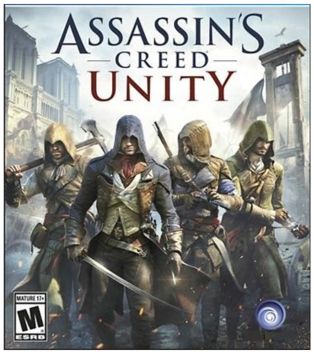
Video Game Condition: New
Battery no battery is used
Genre: Adventure
Platform: PlayStation 4

Game details:

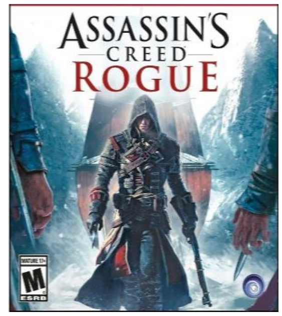
During the French and Indian War in the 18th century, Shay Patrick, a fearless member of the Assassin Brotherhood, undergoes a dark transformation. After failure in a dangerous mission, Assassins attempt to end Shay's life. Thus, Shay turns his back on them and sets out on a mission to wipe out all who turned against him and to ultimately become the most feared Assassin hunters in history. As Shay, you will experience the slow transformation from Assassin to Assassin hunter. Follow your own creed and set off on an extraordinary journey through New York City, the wild river valley, and far away in the icy cold waters of the North Atlantic in pursuit of your ultimate goal, to bring down the Assassins.

Purchase Scenario 2 (Study 1)

Assume that you are a game player. You decide to buy two video games to play by Play Station. You search online and find a seller who offers a deal in which you will get a free second game when you purchase the following video game.



+



$56.69

Buy ONE Video Game
Get the Next One FREE

Video Game Condition: New
Battery no battery is used
Genre: Adventure
Platform: PlayStation 4

Game details:

During the French Revolution in 1789, Paris is turned into a place of terror and chaos. As the nation tears itself apart, a young man named Arno will embark on an extraordinary journey to expose the true powers behind the Revolution. His pursuit will throw him into the middle of a ruthless struggle for the fate of a nation, and transform him into a true Master Assassin. As Arno, you will experience the French Revolution as never before, from the storming of the Bastille to the execution of King Louis XVI, and help the people of France carve an entirely new destiny. Become the ultimate Master Assassin and take down your prey with a range of new weapons such as the Phantom Blade, a hidden blade with crossbow capabilities.

Purchase Scenario 1 (Study 2a)

Assume that you are a new couple preparing for your wedding. You decide to buy two wedding bands from a jewelry shop. You search the market and find a store that offers a deal in which you can buy two diamond wedding bands with a price discount on each one as shown below. The seller also offers a wedding keepsake box for the bands at a discount off the original price.

$364.99
$146.00 off

Product details:

This stunning wedding band is the perfect illustration of your eternal bond. 1/4 carats total weight of sparkling round diamonds in a channel setting create a dramatic look.

Metal: 10k yellow gold
Stones: 1/4 ct. t.w. Round diamonds
Setting: Channel
Clarity Rating: I3

$320.00
$48.00 off

Product details:

This contemporary wedding band that showcases two rows of round, prong-set diamonds. You will enjoy the subtle shimmer, along with the rounded, comfort fit interior that promotes easy slide.

Metal: Tungsten carbide
Stones: 1/5 ct. t.w. Round diamonds
Setting: Prong
Width: 7mm

$53.90
$7.00 off

Product details:

This custom-engraved, beautifully finished wooden box can be engraved with a single script initial two first names and numeric date.

Material: Wood
Measures: 12x12x2½"H
Scrubbing: Wipe clean with damp cloth

Purchase Scenario 2 (Study 2a)

Assume that you are a new couple preparing for your wedding. You decide to buy two wedding bands from a jewelry shop. You search the market and find a store that offers a deal in which you can buy two diamond wedding bands with a price discount on each one as shown below. The seller also offers a wedding keepsake box for the bands at a discount off the original price.

 **$364.99** **40% off**	**Product details:** This stunning wedding band is the perfect illustration of your eternal bond. 1/4 carats total weight of sparkling round diamonds in a channel setting create a dramatic look. **Metal:** 10k yellow gold **Stones:** 1/4 ct. t.w. Round diamonds **Setting:** Channel **Clarity Rating:** I3
 **$320.00** **15% off**	**Product details:** This contemporary wedding band that showcases two rows of round, prong-set diamonds. You will enjoy the subtle shimmer, along with the rounded, comfort fit interior that promotes easy slide. **Metal:** Tungsten carbide **Stones:** 1/5 ct. t.w. Round diamonds **Setting:** Prong **Width:** 7mm
 **$53.90** **13% off**	**Product details:** This custom-engraved, beautifully finished wooden box can be engraved with a single script initial two first names and numeric date. **Material:** Wood **Measures:** 12x12x2½"H **Scrubbing:** Wipe clean with damp cloth

Purchase Scenario 3 (Study 2a)

Assume that you are a new couple preparing for your wedding. You decide to buy two wedding bands from a jewelry shop. You search the market and find a store that offers a deal in which you can buy two wedding bands with a price discount on each one as shown below. The seller also offers a wedding keepsake box for the bands at a discount off the original price.

$134.99
$54.00 off

Product details:

This terrific wedding band is a lasting symbol of your commitment. The band looks great and fits wonderfully.

Metal: 10k yellow gold
Width: 3.0mm
Comfort Fit: No
Thickness: 1.4mm

$80.00
$12.00 off

Product details:

This timeless tungsten wedding band features satin and high-gloss finishes with a groove design for texture and added interest. The band looks masculine and provides maximum comfort.

Metal: Tungsten carbide
Color: White
Width: 8mm

$38.49
$5.00 off

Product details:

This rustic shabby chick distressed wooden box can be personalized with your monogram, initial two first names and numeric date.

Material: Wood
Measures: 12x8x2½"H
Scrubbing: Wipe clean with damp cloth

Purchase Scenario 4 (Study 2a)

Assume that you are a new couple preparing for your wedding. You decide to buy two wedding bands from a jewelry shop. You search the market and find a store that offers a deal in which you can buy two wedding bands with a price discount on each one as shown below. The seller also offers a wedding keepsake box for the bands at a discount off the original price.

<table>
<tr><td>
$134.99
40% off</td><td>**Product details:**
This terrific wedding band is a lasting symbol of your commitment. The band looks great and fits wonderfully.
Metal: 10k yellow gold
Width: 3.0mm
Comfort Fit: No
Thickness: 1.4mm</td></tr>
<tr><td>
$80.00
15% off</td><td>**Product details:**
This timeless tungsten wedding band features satin and high-gloss finishes with a groove design for texture and added interest. The band looks masculine and provides maximum comfort.
Metal: Tungsten carbide
Color: White
Width: 8mm</td></tr>
<tr><td>
$38.49
13% off</td><td>**Product details:**
This rustic shabby chick distressed wooden box can be personalized with your monogram, initial two first names and numeric date.
Material: Wood
Measures: 12x8x2½"H
Scrubbing: Wipe clean with damp cloth</td></tr>
</table>

Purchase Scenario 1 (Study 2b)

Assume that you are a college student who is in need of a computer. You decide to buy a laptop for the sake of your studies. You search online and find a seller who offers a deal in which you can buy a laptop, as shown below, with a price discount of 25%.

Elitebook 8440P 14" LED
Intel i5 500 GB HDD,
Windows 8 Professional,
Black

$479.99
25% OFF

Product details:

Hard Drive Capacity: 500 GB
Processor Type: Intel i5 500
RAM Capacity: 8 GB
Screen Size: 13" to 14.9"

This Laptop combines style with functionality and allows you to complete the computational tasks with ease. Featuring the Intel i5-520M dual-core 2.4 GHz processor, this laptop efficiently delivers a rich visual experience and good speed during heavy processing tasks. Its 8 GB RAM lets you simultaneously access multiple applications and programs without worrying about a system overload. Save a library of movies and games, songs, documents and more with its 500 GB hard drive space. This Windows 8 Professional laptop provides you with a user-friendly interface to help you work effectively. Equipped with an Intel HD Graphics card, this laptop delivers rich visuals for an immersive entertainment experience. Its integrated stereo speakers deliver good-quality sound to go with your visuals.

Purchase Scenario 2 (Study 2b)

Assume that you are a college student who is in need of a computer. You decide to buy a laptop for the sake of your studies. You search online and find a seller who offers a deal in which you can buy a laptop, as shown below, with a price discount of 10%. The seller also gives you extra $32 off if you purchase in cash. You can also get another 10% off by showing your student ID.

Elitebook 8440P 14" LED
Intel i5 500 GB HDD,
Windows 8 Professional,
Black

$479.99
10% OFF
Pay in Cash and Get extra $32.00 Discount
Extra 10% OFF only for students

Product details:

Hard Drive Capacity: 500 GB
Processor Type: Intel i5 500
RAM Capacity: 8 GB
Screen Size: 13" to 14.9"

This Laptop combines style with functionality and allows you to complete the computational tasks with ease. Featuring the Intel i5-520M dual-core 2.4 GHz processor, this laptop efficiently delivers a rich visual experience and good speed during heavy processing tasks. Its 8 GB RAM lets you simultaneously access multiple applications and programs without worrying about a system overload. Save a library of movies and games, songs, documents and more with its 500 GB hard drive space. This Windows 8 Professional laptop provides you with a user-friendly interface to help you work effectively. Equipped with an Intel HD Graphics card, this laptop delivers rich visuals for an immersive entertainment experience. Its integrated stereo speakers deliver good-quality sound to go with your visuals.

Purchase Scenario 1 (Study 3)

Assume that you are an amateur photographer. You decide to buy a digital camera and its accessories, such as a camera case and memory card, and screen protector. You search online and find a seller who offers a bundle deal in which you will get a price discount on the camera kit when you purchase the bundle items together. The seller provides a list of bundle items with their individual prices and the bundle price after the promotion.

Bundle Price
$849.00

Buy Together and Pay Less

Product details:

The EOS Rebel T6s camera has a next-generation 24.2 Megapixel CMOS (APS-C) sensor that can capture images of incredible depth and beauty. With high resolution and an ISO sensitivity of ISO 100-12800 (expandable to H: 25600) the EOS Rebel T6s can capture images of immense quality in more lighting.

Camera Model: EOS Rebel T6s DSLR
Built-in Flash: Yes
Video Format: High definition, MP4
Viewfinder: Pentamirror 19.00mm
Battery: 1 x LP-E17 rechargeable battery pack
Warranty: 1 year limited warranty

Bundle Includes:

EOS Rebel T6s DSLR Camera Body	**$834.99**
Camera Case	**$28.00**
16GB Class 10 SDHC Card	**$9.95**
Andorama 1836A Cleaning Kit	**$14.95**
LCD Screen Protector	**$4.99**
Andorama Memory Card Wallet	**$9.95**

Purchase Scenario 2 (Study 3)

Assume that you are an amateur photographer. You decide to buy a digital camera and its accessories, such as a camera case and memory card, and screen protector. You search online and find a seller who offers a bundle deal in which you will get a price discount on the camera kit when you purchase the bundle items together. The seller provides a list of bundle items with their individual prices and the bundle price after the promotion.

Bundle Price

$849.00

~~**Original Price: $902.83**~~

Buy Together and Pay Less

Product details:

The EOS Rebel T6s camera has a next-generation 24.2 Megapixel CMOS (APS-C) sensor that can capture images of incredible depth and beauty. With high resolution and an ISO sensitivity of ISO 100-12800 (expandable to H: 25600) the EOS Rebel T6s can capture images of immense quality in more lighting.

Camera Model: EOS Rebel T6s DSLR
Built-in Flash: Yes
Video Format: High definition, MP4
Viewfinder: Pentamirror 19.00mm
Battery: 1 x LP-E17 rechargeable battery pack
Warranty: 1 year limited warranty

Bundle Includes:

EOS Rebel T6s DSLR Camera Body
Camera Case
16GB Class 10 SDHC Card
Andorama 1836A Cleaning Kit
LCD Screen Protector
Andorama Memory Card Wallet

APPENDIX F

APPENDIX F

FACTOR ANALYSIS AND RELIABILITY TESTS FOR MATH ANXIETY INSTRUMENT

Factor Analysis and Reliability Test for the Math Anxiety Scale (Study 1)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Math Test Anxiety (MTA)**					**.96**
MA1	Taking a final exam in a math course	.93	.75	.85	.82	
MA2	Thinking about a math test 1 week before	.94	.63	.62	.72	
MA3	Thinking about a math test 1 day before	.91	.74	.85	.82	
MA4	Thinking about a math test 1 hour before	.87	.70	.84	.76	
MA5	Thinking about a math test 5 minutes before	.88	.63	.79	.69	
MA6	Waiting to get a math test returned	.94	.54	.68	.70	
MA7	Receiving your final math grade in the mail	.92	.57	.75	.67	
MA8	Realizing to take required math classes	.96	.67	.76	.79	
MA9	Being given a pop quiz in a math class	.95	.72	.83	.81	
MA10	Studying for a math test	.92	.69	.69	.78	
MA11	Taking the math in college entrance exam	.97	.64	.73	.76	
MA12	Taking an exam (quiz) in a math course	.95	.74	.81	.83	
MA13	Picking up math textbook to do homework	.96	.57	.64	.71	
MA14	Being given difficult math assignments	.96	.65	.78	.77	
MA15	Getting ready to study for a math test	.92	.66	.70	.78	
F2	**Numerical Task Anxiety (NTA)**					**.96**
MA16	Dividing a 5 digit by a 2 digit number	.92	.57	.72	.74	
MA17	Adding up 976+777 on paper	.94	.60	.77	.73	
MA18	Reading a cash register receipt	.92	.65	.80	.76	
MA19	Figuring the sales tax on a purchase > $1.00	.96	.72	.83	.82	
MA20	Figuring out your monthly budget	.94	.57	.73	.73	
MA21	Being given addition problems to solve	.95	.75	.83	.82	
MA22	Having someone watch you total up figures	.96	.53	.62	.68	
MA23	Totaling up an overcharged dinner bill	.94	.66	.79	.78	
MA24	Being responsible for collecting dues	.96	.44	.61	.63	
MA25	Studying for a driver's license test	.96	.49	.66	.67	
MA26	Totaling up the dues and expenses of a club	.94	.71	.83	.82	
MA27	Watching someone work with a calculator	.95	.67	.81	.78	
MA28	Being given division problems to solve	.93	.72	.81	.82	
MA29	Being given subtraction problems to solve	.94	.75	.85	.82	
MA30	Being given multiplication problems to solve	.92	.77	.86	.85	

Factor Analysis and Reliability Test for the Math Anxiety Scale (Study 2a)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Math Test Anxiety (MTA)**					**.96**
MA1	Taking a final exam in a math course	.94	.71	.83	.80	
MA2	Thinking about a math test 1 week before	.95	.61	.70	.74	
MA3	Thinking about a math test 1 day before	.95	.75	.82	.84	
MA4	Thinking about a math test 1 hour before	.91	.73	.83	.82	
MA5	Thinking about a math test 5 minutes before	.92	.63	.78	.74	
MA6	Waiting to get a math test returned	.93	.46	.66	.64	
MA7	Receiving your final math grade in the mail	.92	.51	.71	.65	
MA8	Realizing to take required math classes	.96	.64	.77	.77	
MA9	Being given a pop quiz in a math class	.97	.62	.75	.75	
MA10	Studying for a math test	.92	.70	.77	.81	
MA11	Taking the math in college entrance exam	.98	.69	.81	.80	
MA12	Taking an exam (quiz) in a math course	.93	.77	.85	.85	
MA13	Picking up math textbook to do homework	.96	.58	.68	.72	
MA14	Being given difficult math assignments	.95	.52	.70	.68	
MA15	Getting ready to study for a math test	.92	.71	.79	.82	
F2	**Numerical Task Anxiety (NTA)**					**.95**
MA16	Dividing a 5 digit by a 2 digit number	.91	.43	.61	.62	
MA17	Adding up 976+777 on paper	.95	.61	.77	.74	
MA18	Reading a cash register receipt	.93	.67	.81	.75	
MA19	Figuring the sales tax on a purchase > $1.00	.95	.67	.80	.78	
MA20	Figuring out your monthly budget	.95	.56	.72	.70	
MA21	Being given addition problems to solve	.94	.67	.77	.77	
MA22	Having someone watch you total up figures	.94	.40	.51	.57	
MA23	Totaling up an overcharged dinner bill	.96	.62	.77	.74	
MA24	Being responsible for collecting dues	.94	.48	.66	.66	
MA25	Studying for a driver’s license test	.95	.49	.66	.66	
MA26	Totaling up the dues and expenses of a club	.93	.58	.75	.71	
MA27	Watching someone work with a calculator	.95	.55	.72	.69	
MA28	Being given division problems to solve	.91	.58	.71	.72	
MA29	Being given subtraction problems to solve	.93	.70	.81	.79	
MA30	Being given multiplication problems to solve	.93	.70	.80	.80	

Factor Analysis and Reliability Test for the Math Anxiety Scale (Study 2b)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Math Test Anxiety (MTA)**					**.96**
MA1	Taking a final exam in a math course	.90	.77	.87	.83	
MA2	Thinking about a math test 1 week before	.93	.65	.73	.77	
MA3	Thinking about a math test 1 day before	.92	.74	.85	.83	
MA4	Thinking about a math test 1 hour before	.88	.71	.84	.79	
MA5	Thinking about a math test 5 minutes before	.88	.66	.81	.75	
MA6	Waiting to get a math test returned	.90	.48	.68	.66	
MA7	Receiving your final math grade in the mail	.89	.44	.66	.62	
MA8	Realizing to take required math classes	.96	.66	.78	.78	
MA9	Being given a pop quiz in a math class	.95	.70	.81	.80	
MA10	Studying for a math test	.93	.68	.78	.80	
MA11	Taking the math in college entrance exam	.95	.68	.78	.79	
MA12	Taking an exam (quiz) in a math course	.92	.81	.87	.88	
MA13	Picking up math textbook to do homework	.95	.62	.67	.72	
MA14	Being given difficult math assignments	.94	.62	.78	.75	
MA15	Getting ready to study for a math test	.91	.70	.75	.80	
F2	**Numerical Task Anxiety (NTA)**					**.96**
MA16	Dividing a 5 digit by a 2 digit number	.94	.63	.77	.77	
MA17	Adding up 976+777 on paper	.94	.76	.87	.83	
MA18	Reading a cash register receipt	.92	.68	.82	.78	
MA19	Figuring the sales tax on a purchase > $1.00	.92	.66	.81	.76	
MA20	Figuring out your monthly budget	.95	.56	.70	.72	
MA21	Being given addition problems to solve	.93	.67	.78	.77	
MA22	Having someone watch you total up figures	.94	.53	.54	.61	
MA23	Totaling up an overcharged dinner bill	.91	.57	.73	.73	
MA24	Being responsible for collecting dues	.93	.49	.66	.67	
MA25	Studying for a driver's license test	.95	.38	.58	.58	
MA26	Totaling up the dues and expenses of a club	.94	.68	.82	.79	
MA27	Watching someone work with a calculator	.91	.69	.82	.78	
MA28	Being given division problems to solve	.91	.76	.84	.84	
MA29	Being given subtraction problems to solve	.91	.78	.87	.85	
MA30	Being given multiplication problems to solve	.92	.80	.87	.86	

Factor Analysis and Reliability Test for the Math Anxiety Scale (Study 3)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Math Test Anxiety (MTA)**					**.97**
MA1	Taking a final exam in a math course	.95	.80	.88	.86	
MA2	Thinking about a math test 1 week before	.98	.71	.72	.81	
MA3	Thinking about a math test 1 day before	.97	.84	.87	.90	
MA4	Thinking about a math test 1 hour before	.94	.83	.90	.87	
MA5	Thinking about a math test 5 minutes before	.95	.79	.88	.83	
MA6	Waiting to get a math test returned	.95	.59	.73	.74	
MA7	Receiving your final math grade in the mail	.95	.55	.72	.69	
MA8	Realizing to take required math classes	.98	.78	.82	.86	
MA9	Being given a pop quiz in a math class	.96	.78	.85	.85	
MA10	Studying for a math test	.94	.79	.79	.87	
MA11	Taking the math in college entrance exam	.98	.73	.81	.83	
MA12	Taking an exam (quiz) in a math course	.95	.85	.89	.90	
MA13	Picking up math textbook to do homework	.97	.71	.72	.81	
MA14	Being given difficult math assignments	.96	.73	.80	.83	
MA15	Getting ready to study for a math test	.95	.76	.76	.85	
F2	**Numerical Task Anxiety (NTA)**					**.96**
MA16	Dividing a 5 digit by a 2 digit number	.95	.62	.74	.75	
MA17	Adding up 976+777 on paper	.94	.69	.82	.79	
MA18	Reading a cash register receipt	.94	.65	.79	.74	
MA19	Figuring the sales tax on a purchase > $1.00	.98	.77	.85	.85	
MA20	Figuring out your monthly budget	.97	.58	.75	.72	
MA21	Being given addition problems to solve	.94	.67	.77	.77	
MA22	Having someone watch you total up figures	.96	.49	.53	.63	
MA23	Totaling up an overcharged dinner bill	.96	.65	.74	.77	
MA24	Being responsible for collecting dues	.96	.48	.58	.65	
MA25	Studying for a driver's license test	.94	.46	.60	.64	
MA26	Totaling up the dues and expenses of a club	.95	.66	.78	.78	
MA27	Watching someone work with a calculator	.95	.57	.74	.68	
MA28	Being given division problems to solve	.95	.69	.74	.79	
MA29	Being given subtraction problems to solve	.92	.75	.83	.82	
MA30	Being given multiplication problems to solve	.93	.76	.82	.85	

APPENDIX G

APPENDIX G

CONSTRUCT VALIDITY TEST FOR MATH ANXIETY INSTRUMENT

Latent Variables' Measurement Model of the Math Anxiety Scale (Study 1)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Math Test Anxiety (MTA)**	**11.32**	**8.62**	**6.38**	**.57**	**.95**
MA1	Taking a final exam in a math course	.85	.72	.28		
MA2	Thinking about a math test 1 week before	.62	.38	.62		
MA3	Thinking about a math test 1 day before	.85	.72	.28		
MA4	Thinking about a math test 1 hour before	.84	.71	.29		
MA5	Thinking about a math test 5 minutes before	.79	.62	.38		
MA6	Waiting to get a math test returned	.68	.46	.54		
MA7	Receiving your final math grade in the mail	.75	.56	.44		
MA8	Realizing to take required math classes	.76	.58	.42		
MA9	Being given a pop quiz in a math class	.83	.69	.31		
MA10	Studying for a math test	.69	.48	.52		
MA11	Taking the math in college entrance exam	.73	.53	.47		
MA12	Taking an exam (quiz) in a math course	.81	.66	.34		
MA13	Picking up math textbook to do homework	.64	.41	.59		
MA14	Being given difficult math assignments	.78	.61	.39		
MA15	Getting ready to study for a math test	.70	.49	.51		
F2	**Numerical Task Anxiety (NTA)**	**11.52**	**8.94**	**6.06**	**.60**	**.96**
MA16	Dividing a 5 digit by a 2 digit number	.72	.52	.48		
MA17	Adding up 976+777 on paper	.77	.59	.41		
MA18	Reading a cash register receipt	.80	.64	.36		
MA19	Figuring the sales tax on a purchase > $1.00	.83	.69	.31		
MA20	Figuring out your monthly budget	.73	.53	.47		
MA21	Being given addition problems to solve	.83	.69	.31		
MA22	Having someone watch you total up figures	.62	.38	.62		
MA23	Totaling up an overcharged dinner bill	.79	.62	.38		
MA24	Being responsible for collecting dues	.61	.37	.63		
MA25	Studying for a driver's license test	.66	.44	.56		
MA26	Totaling up the dues and expenses of a club	.83	.69	.31		
MA27	Watching someone work with a calculator	.81	.66	.34		
MA28	Being given division problems to solve	.81	.66	.34		
MA29	Being given subtraction problems to solve	.85	.72	.28		
MA30	Being given multiplication problems to solve	.86	.74	.26		

Inter-construct Correlation: .52*** (.27) < .57 or .60

Latent Variables' Measurement Model of the Math Anxiety Scale (Study 2a)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Math Test Anxiety (MTA)**	**11.45**	**8.78**	**6.22**	**.59**	**.95**
MA1	Taking a final exam in a math course	.83	.69	.31		
MA2	Thinking about a math test 1 week before	.70	.49	.51		
MA3	Thinking about a math test 1 day before	.82	.67	.33		
MA4	Thinking about a math test 1 hour before	.83	.69	.31		
MA5	Thinking about a math test 5 minutes before	.78	.61	.39		
MA6	Waiting to get a math test returned	.66	.44	.56		
MA7	Receiving your final math grade in the mail	.71	.50	.50		
MA8	Realizing to take required math classes	.77	.59	.41		
MA9	Being given a pop quiz in a math class	.75	.56	.44		
MA10	Studying for a math test	.77	.59	.41		
MA11	Taking the math in college entrance exam	.81	.66	.34		
MA12	Taking an exam (quiz) in a math course	.85	.72	.28		
MA13	Picking up math textbook to do homework	.68	.46	.54		
MA14	Being given difficult math assignments	.70	.49	.51		
MA15	Getting ready to study for a math test	.79	.62	.38		
F2	**Numerical Task Anxiety (NTA)**	**10.87**	**7.98**	**7.02**	**.53**	**.94**
MA16	Dividing a 5 digit by a 2 digit number	.61	.37	.63		
MA17	Adding up 976+777 on paper	.77	.59	.41		
MA18	Reading a cash register receipt	.81	.66	.34		
MA19	Figuring the sales tax on a purchase > $1.00	.80	.64	.36		
MA20	Figuring out your monthly budget	.72	.52	.48		
MA21	Being given addition problems to solve	.77	.59	.41		
MA22	Having someone watch you total up figures	.51	.26	.74		
MA23	Totaling up an overcharged dinner bill	.77	.59	.41		
MA24	Being responsible for collecting dues	.66	.44	.56		
MA25	Studying for a driver's license test	.66	.44	.56		
MA26	Totaling up the dues and expenses of a club	.75	.56	.44		
MA27	Watching someone work with a calculator	.72	.52	.48		
MA28	Being given division problems to solve	.71	.50	.50		
MA29	Being given subtraction problems to solve	.81	.66	.34		
MA30	Being given multiplication problems to solve	.80	.64	.36		

Inter-construct Correlation: .53*** (.28) < .59 or .53

Latent Variables' Measurement Model of the Math Anxiety Scale (Study 2b)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Math Test Anxiety (MTA)**	**11.66**	**9.15**	**5.85**	**.61**	**.96**
MA1	Taking a final exam in a math course	.87	.76	.24		
MA2	Thinking about a math test 1 week before	.73	.53	.47		
MA3	Thinking about a math test 1 day before	.85	.72	.28		
MA4	Thinking about a math test 1 hour before	.84	.71	.29		
MA5	Thinking about a math test 5 minutes before	.81	.66	.34		
MA6	Waiting to get a math test returned	.68	.46	.54		
MA7	Receiving your final math grade in the mail	.66	.44	.56		
MA8	Realizing to take required math classes	.78	.61	.39		
MA9	Being given a pop quiz in a math class	.81	.66	.34		
MA10	Studying for a math test	.78	.61	.39		
MA11	Taking the math in college entrance exam	.78	.61	.39		
MA12	Taking an exam (quiz) in a math course	.87	.76	.24		
MA13	Picking up math textbook to do homework	.67	.45	.55		
MA14	Being given difficult math assignments	.78	.61	.39		
MA15	Getting ready to study for a math test	.75	.56	.44		
F2	**Numerical Task Anxiety (NTA)**	**11.48**	**8.95**	**6.05**	**.60**	**.96**
MA16	Dividing a 5 digit by a 2 digit number	.77	.59	.41		
MA17	Adding up 976+777 on paper	.87	.76	.24		
MA18	Reading a cash register receipt	.82	.67	.33		
MA19	Figuring the sales tax on a purchase > $1.00	.81	.66	.34		
MA20	Figuring out your monthly budget	.70	.49	.51		
MA21	Being given addition problems to solve	.78	.61	.39		
MA22	Having someone watch you total up figures	.54	.29	.71		
MA23	Totaling up an overcharged dinner bill	.73	.53	.47		
MA24	Being responsible for collecting dues	.66	.44	.56		
MA25	Studying for a driver's license test	.58	.34	.66		
MA26	Totaling up the dues and expenses of a club	.82	.67	.33		
MA27	Watching someone work with a calculator	.82	.67	.33		
MA28	Being given division problems to solve	.84	.71	.29		
MA29	Being given subtraction problems to solve	.87	.76	.24		
MA30	Being given multiplication problems to solve	.87	.76	.24		

Inter-construct Correlation: .46*** (.21) < .61 or .60

Latent Variables' Measurement Model of the Math Anxiety Scale (Study 3)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Math Test Anxiety (MTA)**	**12.14**	**9.88**	**5.12**	**.66**	**.97**
MA1	Taking a final exam in a math course	.88	.77	.23		
MA2	Thinking about a math test 1 week before	.72	.52	.48		
MA3	Thinking about a math test 1 day before	.87	.76	.24		
MA4	Thinking about a math test 1 hour before	.90	.81	.19		
MA5	Thinking about a math test 5 minutes before	.88	.77	.23		
MA6	Waiting to get a math test returned	.73	.53	.47		
MA7	Receiving your final math grade in the mail	.72	.52	.48		
MA8	Realizing to take required math classes	.82	.67	.33		
MA9	Being given a pop quiz in a math class	.85	.72	.28		
MA10	Studying for a math test	.79	.62	.38		
MA11	Taking the math in college entrance exam	.81	.66	.34		
MA12	Taking an exam (quiz) in a math course	.89	.79	.21		
MA13	Picking up math textbook to do homework	.72	.52	.48		
MA14	Being given difficult math assignments	.80	.64	.36		
MA15	Getting ready to study for a math test	.76	.58	.42		
F2	**Numerical Task Anxiety (NTA)**	**11.08**	**8.31**	**6.69**	**.55**	**.95**
MA16	Dividing a 5 digit by a 2 digit number	.74	.55	.45		
MA17	Adding up 976+777 on paper	.82	.67	.33		
MA18	Reading a cash register receipt	.79	.62	.38		
MA19	Figuring the sales tax on a purchase > $1.00	.85	.72	.28		
MA20	Figuring out your monthly budget	.75	.56	.44		
MA21	Being given addition problems to solve	.77	.59	.41		
MA22	Having someone watch you total up figures	.53	.28	.72		
MA23	Totaling up an overcharged dinner bill	.74	.55	.45		
MA24	Being responsible for collecting dues	.58	.34	.66		
MA25	Studying for a driver's license test	.60	.36	.64		
MA26	Totaling up the dues and expenses of a club	.78	.61	.39		
MA27	Watching someone work with a calculator	.74	.55	.45		
MA28	Being given division problems to solve	.74	.55	.45		
MA29	Being given subtraction problems to solve	.83	.69	.31		
MA30	Being given multiplication problems to solve	.82	.67	.33		

Inter-construct Correlation: .62*** (.38) < .66 or .55

APPENDIX H

APPENDIX H

FACTOR ANALYSIS AND RELIABILITY TESTS FOR MAIN SURVEY INSTRUMENT

Factor Analysis and Reliability Test for the Main Survey (Study 1)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Perceived Price Satisfaction (PPS)**					**.94**
SP1	Acceptable amount to pay for the item	.94	.86	.85	.86	
SP2	Fair amount to pay for the item	.89	.90	.88	.89	
SP3	Reasonable amount to pay for the item	.90	.91	.86	.91	
SP4	Being satisfied with the amount to pay	.96	.82	.75	.81	
F2	**Perceived Emotional Value (PEV)**					**.95**
EV1	Giving me pleasure	.90	.84	.87	.86	
EV2	Making me feel good	.89	.87	.88	.89	
EV3	Feeling relaxed about using the item	.92	.77	.85	.79	
EV4	Being the one that I would enjoy	.90	.86	.87	.89	
EV5	Making me want to use it	.91	.88	.83	.89	
F3	**Perceived Savings (PS)**					**.91**
PS1	A lot of money being saved	.88	.85	.84	.80	
PS2	Implying considerable discount	.92	.83	.80	.80	
PS3	Representing a great savings	.90	.87	.85	.85	
F4	**Purchase Intention (PI)**					**.93**
PI1	High likelihood of purchase	.96	.84	.77	.84	
PI2	Considering buying the item at this price	.95	.77	.63	.75	
PI3	High probability to consider buying	.90	.91	.82	.91	
PI4	High willingness to buy	.91	.88	.82	.85	

Factor Analysis and Reliability Test for the Main Survey (Study 2a)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Perceived Price Satisfaction (PPS)**					**.92**
SP1	Acceptable amount to pay for the item	.90	.85	.87	.85	
SP2	Fair amount to pay for the item	.86	.84	.89	.83	
SP3	Reasonable amount to pay for the item	.90	.85	.88	.85	
SP4	Being satisfied with the amount to pay	.94	.75	.78	.77	
F2	**Perceived Emotional Value (PEV)**					**.94**
EV1	Giving me pleasure	.87	.76	.84	.79	
EV2	Making me feel good	.89	.86	.89	.88	
EV3	Feeling relaxed about using the item	.94	.77	.86	.80	
EV4	Being the one that I would enjoy	.91	.83	.85	.86	
EV5	Making me want to use it	.90	.83	.88	.86	
F3	**Perceived Savings (PS)**					**.85**
PS1	A lot of money being saved	.86	.78	.87	.70	
PS2	Implying considerable discount	.85	.79	.80	.74	
PS3	Representing a great savings	.85	.78	.82	.72	
F4	**Purchase Intention (PI)**					**.89**
PI1	High likelihood of purchase	.94	.79	.77	.79	
PI2	Considering buying the item at this price	.95	.59	.68	.60	
PI3	High probability to consider buying	.86	.86	.86	.84	
PI4	High willingness to buy	.89	.84	.82	.83	

Factor Analysis and Reliability Test for the Main Survey (Study 2b)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Perceived Price Satisfaction (PPS)**					**.93**
SP1	Acceptable amount to pay for the item	.92	.81	.82	.82	
SP2	Fair amount to pay for the item	.91	.86	.83	.84	
SP3	Reasonable amount to pay for the item	.93	.84	.82	.84	
SP4	Being satisfied with the amount to pay	.93	.82	.70	.80	
F2	**Perceived Emotional Value (PEV)**					**.94**
EV1	Giving me pleasure	.86	.84	.88	.86	
EV2	Making me feel good	.83	.82	.88	.84	
EV3	Feeling relaxed about using the item	.92	.80	.86	.83	
EV4	Being the one that I would enjoy	.89	.85	.86	.87	
EV5	Making me want to use it	.90	.78	.86	.82	
F3	**Perceived Savings (PS)**					**.91**
PS1	A lot of money being saved	.88	.83	.84	.76	
PS2	Implying considerable discount	.91	.86	.79	.83	
PS3	Representing a great savings	.87	.90	.81	.88	
F4	**Purchase Intention (PI)**					**.91**
PI1	High likelihood of purchase	.93	.80	.75	.79	
PI2	Considering buying the item at this price	.93	.71	.66	.71	
PI3	High probability to consider buying	.91	.82	.79	.82	
PI4	High willingness to buy	.93	.87	.81	.86	

Factor Analysis and Reliability Test for the Main Survey (Study 3)

ID	Factors/Items	Exploratory Factor Analysis			Cronbach Test	
		Anti-image	Communality	Loading	Item-total Correlation	Alpha
F1	**Perceived Price Satisfaction (PPS)**					**.93**
SP1	Acceptable amount to pay for the item	.94	.86	.83	.87	
SP2	Fair amount to pay for the item	.86	.89	.88	.86	
SP3	Reasonable amount to pay for the item	.89	.90	.87	.88	
SP4	Being satisfied with the amount to pay	.95	.74	.62	.75	
F2	**Perceived Emotional Value (PEV)**					**.92**
EV1	Giving me pleasure	.86	.79	.88	.81	
EV2	Making me feel good	.85	.83	.89	.85	
EV3	Feeling relaxed about using the item	.93	.68	.80	.72	
EV4	Being the one that I would enjoy	.86	.82	.89	.84	
EV5	Making me want to use it	.85	.73	.83	.76	
F3	**Perceived Savings (PS)**					**.91**
PS1	A lot of money being saved	.93	.81	.83	.78	
PS2	Implying considerable discount	.88	.86	.85	.84	
PS3	Representing a great savings	.88	.88	.84	.86	
F4	**Purchase Intention (PI)**					**.94**
PI1	High likelihood of purchase	.91	.86	.81	.85	
PI2	Considering buying the item at this price	.96	.74	.66	.75	
PI3	High probability to consider buying	.91	.90	.86	.90	
PI4	High willingness to buy	.86	.93	.89	.92	

APPENDIX I

APPENDIX I

CONSTRUCT VALIDITY TEST FOR MAIN SURVEY INSTRUMENT

Latent Variables' Measurement Model of the Main Survey (Study 1)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Perceived Price Satisfaction (PPS)**	**3.34**	**2.79**	**1.21**	**.70**	**.90**
SP1	Acceptable amount to pay for the item	.85	.72	.28		
SP2	Fair amount to pay for the item	.88	.77	.23		
SP3	Reasonable amount to pay for the item	.86	.74	.26		
SP4	Being satisfied with the amount to pay	.75	.56	.44		
F2	**Perceived Emotional Value (PEV)**	**4.30**	**3.70**	**1.30**	**.74**	**.93**
EV1	Giving me pleasure	.87	.76	.24		
EV2	Making me feel good	.88	.77	.23		
EV3	Feeling relaxed about using the item	.85	.72	.28		
EV4	Being the one that I would enjoy	.87	.76	.24		
EV5	Making me want to use it	.83	.69	.31		
F3	**Perceived Savings (PS)**	**2.49**	**2.07**	**.93**	**.69**	**.87**
PS1	A lot of money being saved	.84	.71	.29		
PS2	Implying considerable discount	.80	.64	.36		
PS3	Representing a great savings	.85	.72	.28		
F4	**Purchase Intention (PI)**	**3.04**	**2.33**	**1.67**	**.58**	**.85**
PI1	High likelihood of purchase	.77	.59	.41		
PI2	Considering buying the item at this price	.63	.40	.60		
PI3	High probability to consider buying	.82	.67	.33		
PI4	High willingness to buy	.82	.67	.33		

Inter-construct Correlation of the Main Survey (Study 1)

Latent Variables	PPS	PEV	PS	PI
PPS *AVE = .70*	1.00	.44** (.19)	.64** (.41)	.63** (.40)
PEV *AVE = .74*	.44** (.19)	1.00	.36** (.13)	.64** (.41)
PS *AVE = .69*	.64** (.41)	.36** (.13)	1.00	.61** (.37)
PI *AVE = .58*	.63** (.40)	.64** (.41)	.61** (.37)	1.00

* Numbers in parentheses are the squared of inter-factor correlations

Latent Variables' Measurement Model of the Main Survey (Study 2a)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Perceived Price Satisfaction (PPS)**	**3.42**	**2.93**	**1.07**	**.73**	**.92**
SP1	Acceptable amount to pay for the item	.87	.76	.24		
SP2	Fair amount to pay for the item	.89	.79	.21		
SP3	Reasonable amount to pay for the item	.88	.77	.23		
SP4	Being satisfied with the amount to pay	.78	.61	.39		
F2	**Perceived Emotional Value (PEV)**	**4.32**	**3.73**	**1.27**	**.75**	**.94**
EV1	Giving me pleasure	.84	.71	.29		
EV2	Making me feel good	.89	.79	.21		
EV3	Feeling relaxed about using the item	.86	.74	.26		
EV4	Being the one that I would enjoy	.85	.72	.28		
EV5	Making me want to use it	.88	.77	.23		
F3	**Perceived Savings (PS)**	**2.49**	**2.07**	**.93**	**.69**	**.87**
PS1	A lot of money being saved	.87	.76	.24		
PS2	Implying considerable discount	.80	.64	.36		
PS3	Representing a great savings	.82	.67	.33		
F4	**Purchase Intention (PI)**	**3.13**	**2.46**	**1.54**	**.62**	**.86**
PI1	High likelihood of purchase	.77	.59	.41		
PI2	Considering buying the item at this price	.68	.46	.54		
PI3	High probability to consider buying	.86	.74	.26		
PI4	High willingness to buy	.82	.67	.33		

Inter-construct Correlation of the Main Survey (Study 2a)

Latent Variables	PPS	PEV	PS	PI
PPS *AVE = .73*	1.00	.28** (.08)	.51** (.26)	.47** (.22)
PEV *AVE = .75*	.28** (.08)	1.00	.18** (.03)	.56** (.31)
PS *AVE = .69*	.51** (.26)	.18** (.03)	1.00	.38** (.14)
PI *AVE = .62*	.47** (.22)	.56** (.31)	.38** (.14)	1.00

* Numbers in parentheses are the squared of inter-factor correlations

Latent Variables' Measurement Model of the Main Survey (Study 2b)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Perceived Price Satisfaction (PPS)**	**3.17**	**2.52**	**1.48**	**.63**	**.87**
SP1	Acceptable amount to pay for the item	.82	.67	.33		
SP2	Fair amount to pay for the item	.83	.69	.31		
SP3	Reasonable amount to pay for the item	.82	.67	.33		
SP4	Being satisfied with the amount to pay	.70	.49	.51		
F2	**Perceived Emotional Value (PEV)**	**4.34**	**3.76**	**1.24**	**.75**	**.94**
EV1	Giving me pleasure	.88	.77	.23		
EV2	Making me feel good	.88	.77	.23		
EV3	Feeling relaxed about using the item	.86	.74	.26		
EV4	Being the one that I would enjoy	.86	.74	.26		
EV5	Making me want to use it	.86	.74	.26		
F3	**Perceived Savings (PS)**	**2.44**	**1.99**	**1.01**	**.66**	**.85**
PS1	A lot of money being saved	.84	.71	.29		
PS2	Implying considerable discount	.79	.62	.38		
PS3	Representing a great savings	.81	.66	.34		
F4	**Purchase Intention (PI)**	**3.01**	**2.28**	**1.72**	**.57**	**.84**
PI1	High likelihood of purchase	.75	.56	.44		
PI2	Considering buying the item at this price	.66	.44	.56		
PI3	High probability to consider buying	.79	.62	.38		
PI4	High willingness to buy	.81	.66	.34		

Inter-construct Correlation of the Main Survey (Study 2b)

Latent Variables	PPS	PEV	PS	PI
PPS *AVE = .63*	1.00	.40** (.16)	.68** (.46)	.71** (.50)
PEV *AVE = .75*	.40** (.16)	1.00	.33** (.11)	.51** (.26)
PS *AVE = .66*	.68** (.46)	.33** (.11)	1.00	.63** (.40)
PI *AVE = .57*	.71** (.50)	.51** (.26)	.63** (.40)	1.00

* Numbers in parentheses are the squared of inter-factor correlations

Latent Variables' Measurement Model of the Main Survey (Study 3)

Xi	Latent Variables/Items	Factor Loading λ	Item Reliability λ^2	Delta $(1-\lambda^2)$	AVE $\sum(\lambda^2)/n$	Construct Reliability CR
F1	**Perceived Price Satisfaction (PPS)**	**2.92**	**2.60**	**1.40**	**.65**	**.86**
SP1	Acceptable amount to pay for the item	.83	.69	.31		
SP2	Fair amount to pay for the item	.88	.77	.23		
SP3	Reasonable amount to pay for the item	.87	.76	.24		
SP4	Being satisfied with the amount to pay	.62	.38	.62		
F2	**Perceived Emotional Value (PEV)**	**4.29**	**3.68**	**1.32**	**.74**	**.93**
EV1	Giving me pleasure	.88	.77	.23		
EV2	Making me feel good	.89	.79	.21		
EV3	Feeling relaxed about using the item	.80	.64	.36		
EV4	Being the one that I would enjoy	.89	.79	.21		
EV5	Making me want to use it	.83	.69	.31		
F3	**Perceived Savings (PS)**	**2.52**	**2.12**	**.88**	**.71**	**.88**
PS1	A lot of money being saved	.83	.69	.31		
PS2	Implying considerable discount	.85	.72	.28		
PS3	Representing a great savings	.84	.71	.29		
F4	**Purchase Intention (PI)**	**3.22**	**2.63**	**1.37**	**.66**	**.88**
PI1	High likelihood of purchase	.81	.66	.34		
PI2	Considering buying the item at this price	.66	.44	.56		
PI3	High probability to consider buying	.86	.74	.26		
PI4	High willingness to buy	.89	.79	.21		

Inter-construct Correlation of the Main Survey (Study 3)

Latent Variables	PPS	PEV	PS	PI
PPS *AVE = .65*	1.00	.32** (.10)	.61** (.37)	.70** (.49)
PEV *AVE = .74*	.32** (.10)	1.00	.18** (.03)	.33** (.11)
PS *AVE = .71*	.61** (.37)	.18** (.03)	1.00	.62** (.38)
PI *AVE = .66*	.70** (.49)	.33** (.11)	.62** (.38)	1.00

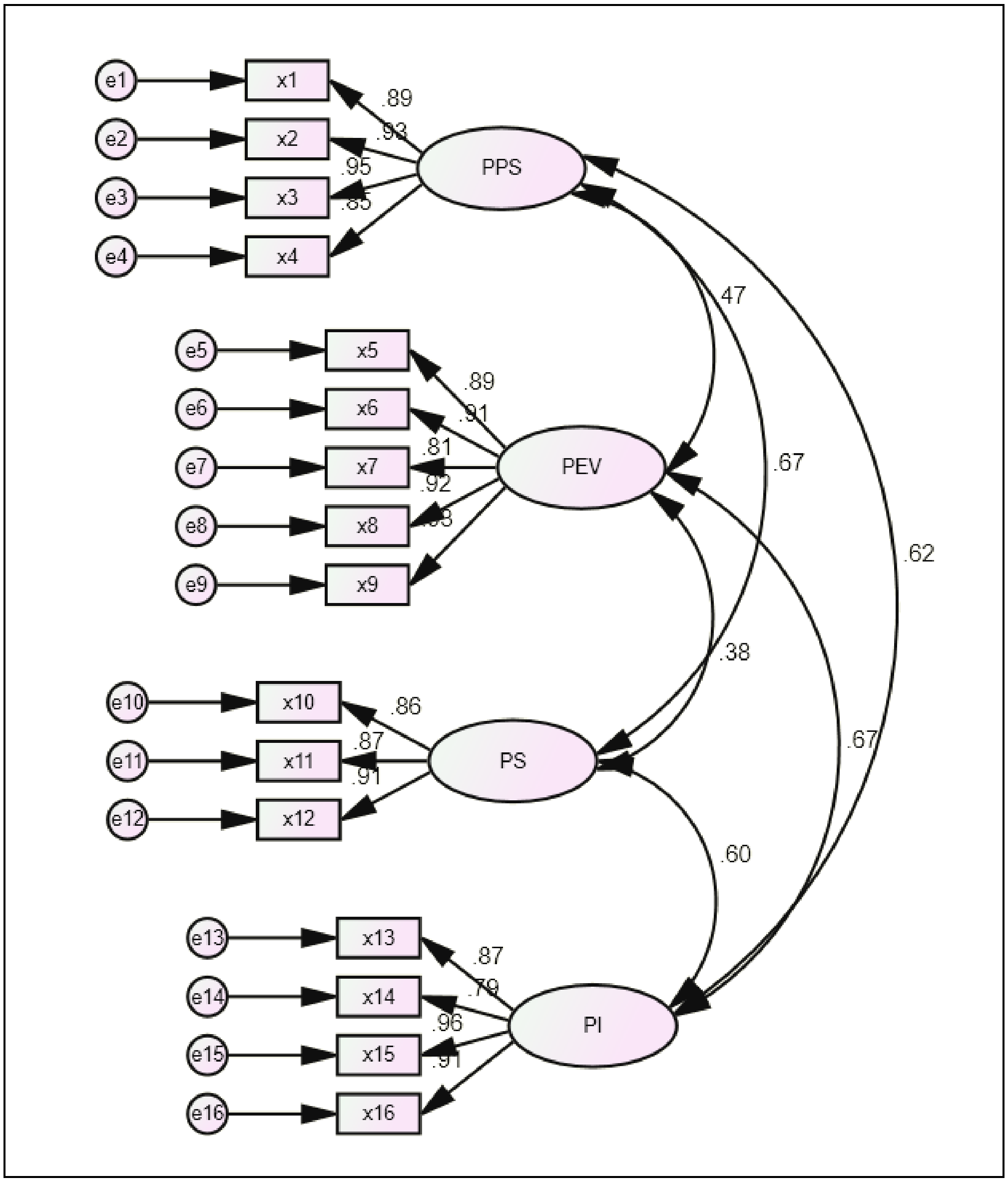
* Numbers in parentheses are the squared of inter-factor correlations

APPENDIX J

APPENDIX J

MEASUREMENT MODELS OF THE STUDY (CFA)

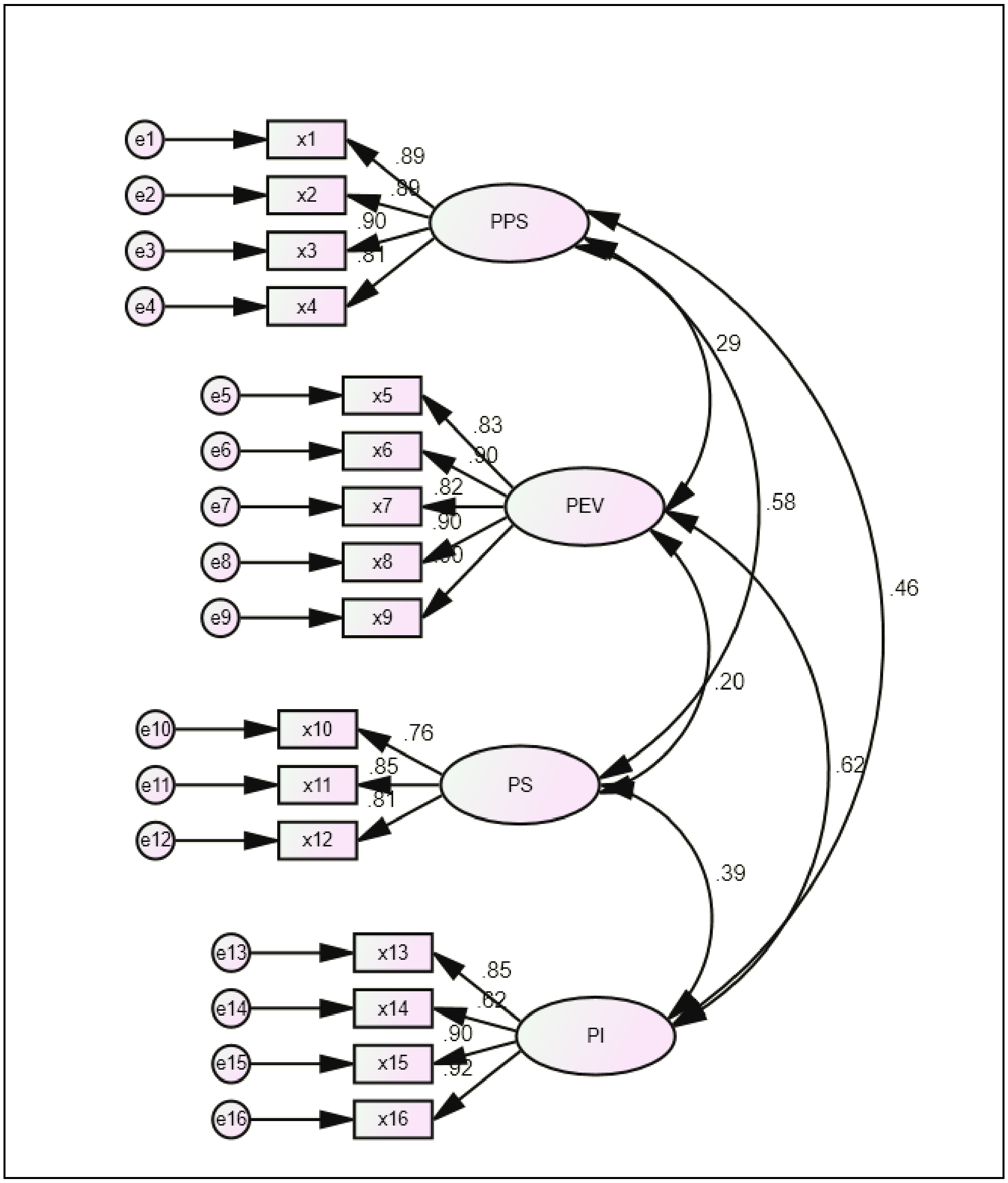
Measurement Model of Study 1



Confirmatory Latent Variables' Measurement Model of Study 1

Standard Loadings	Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention	CR
x1	.89 (.06)				7.24***
x2	.93 (.04)				
x3	.95 (.04)				
x4	.85 (.08)				
x5		.89 (.08)			8.56***
x6		.91 (.07)			
x7		.81 (.13)			
x8		.92 (.08)			
x9		.93 (.07)			
x10			.86 (.10)		7.96***
x11			.87 (.07)		
x12			.91 (.07)		
x13				.87 (.10)	8.17***
x14				.79 (.14)	
x15				.96 (.06)	
x16				.91 (.09)	

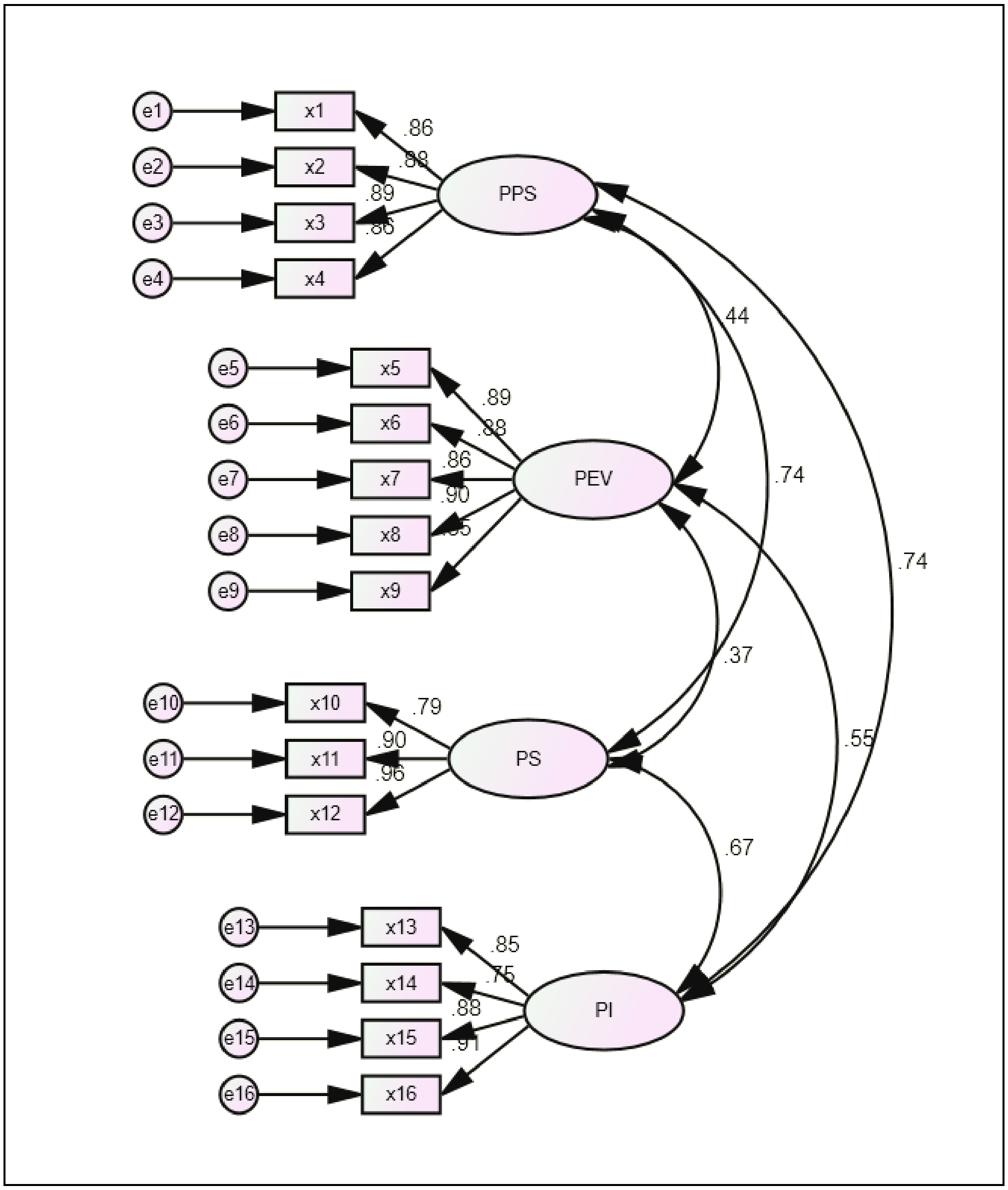
Measurement Model of Study 2a



Confirmatory Latent Variables' Measurement Model of Study 2a

Standard Loadings	Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention	CR
x1	.89 (.05)				8.13***
x2	.89 (.04)				
x3	.90 (.05)				
x4	.81 (.08)				
x5		.83 (.08)			9.65***
x6		.90 (.06)			
x7		.82 (.09)			
x8		.90 (.06)			
x9		.90 (.07)			
x10			.76 (.12)		7.82***
x11			.85 (.08)		
x12			.81 (.09)		
x13				.85 (.09)	10.01***
x14				.62 (.16)	
x15				.90 (.08)	
x16				.92 (.07)	

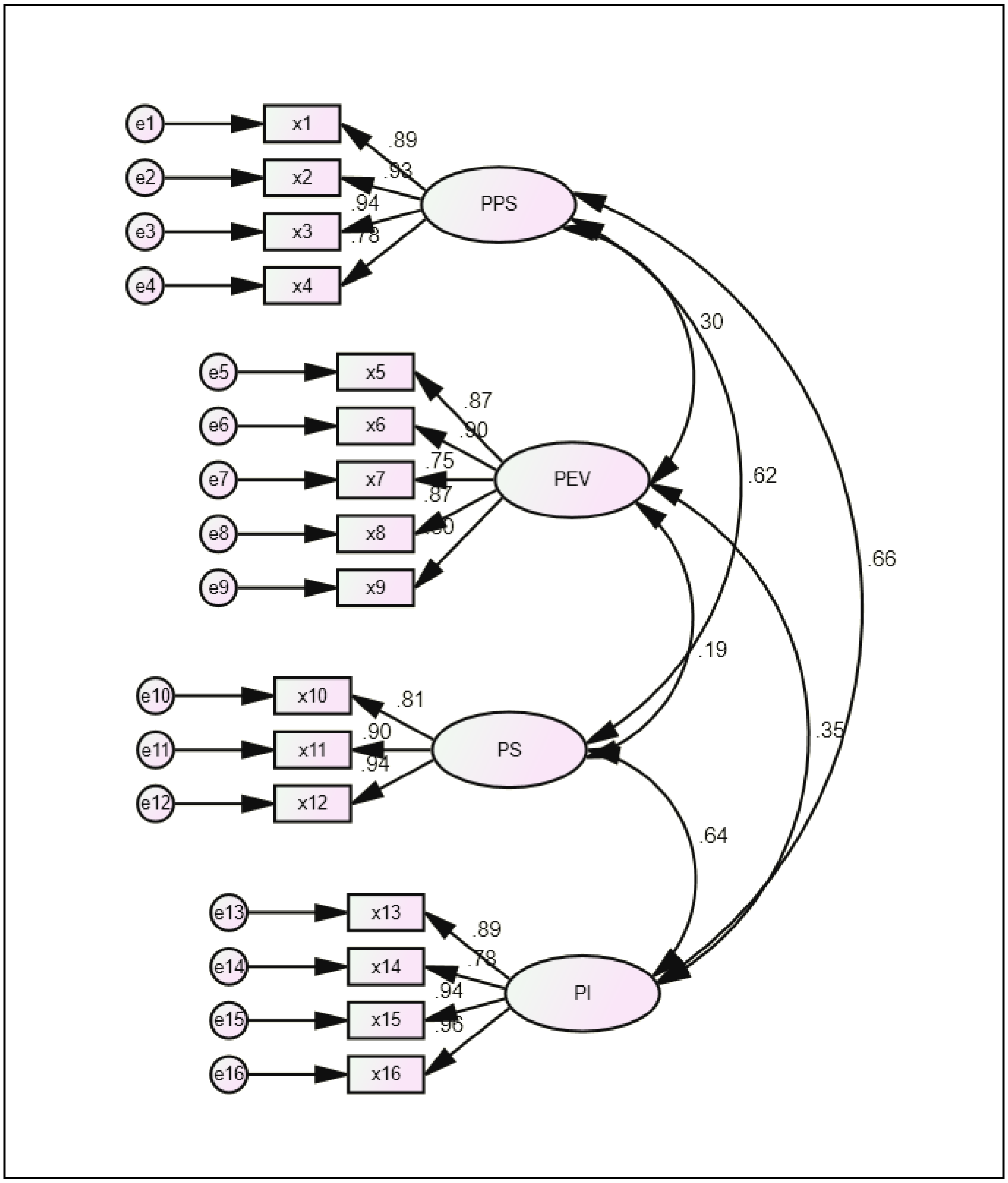
Measurement Model of Study 2b



Confirmatory Latent Variables' Measurement Model of Study 2b

Standard Loadings	Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention	CR
x1	.86 (.09)				6.75***
x2	.88 (.07)				
x3	.89 (.07)				
x4	.86 (.09)				
x5		.89 (.06)			6.59***
x6		.88 (.07)			
x7		.86 (.07)			
x8		.90 (.06)			
x9		.85 (.08)			
x10			.79 (.11)		8.03***
x11			.90 (.06)		
x12			.96 (.06)		
x13				.85 (.12)	7.43***
x14				.75 (.15)	
x15				.88 (.11)	
x16				.91 (.09)	

Measurement Model of Study 3



Confirmatory Latent Variables' Measurement Model of Study 3

Standard Loadings	Perceived Price Satisfaction	Perceived Emotional Value	Perceived Savings	Purchase Intention	CR
x1	.89 (.04)				7.16***
x2	.93 (.03)				
x3	.94 (.03)				
x4	.78 (.08)				
x5		.87 (.04)			7.37***
x6		.90 (.03)			
x7		.75 (.06)			
x8		.87 (.03)			
x9		.80 (.05)			
x10			.81 (.09)		9.56***
x11			.90 (.06)		
x12			.94 (.06)		
x13				.89 (.06)	10.16***
x14				.78 (.10)	
x15				.94 (.05)	
x16				.96 (.04)	

BIOGRAPHICAL SKETCH

Peter Andersen began his doctoral studies at the University of Texas – Pan American (UTPA) in August 2011 and earned a Ph.D. in Business Administration with an emphasis in Marketing in July 2015. Peter graduated from the University of Tehran in Iran with a Bachelor's Degree in Human Geography in 1992 and a Master's Degree in Business Administration (MBA) in 1998. He experienced working as an executive and manager at Iran Insurance Company in 1999-2006 and Nokia in 2006-2007. Peter also earned a Ph.D. in International Marketing from the University of Malaya (UM) in Malaysia in August 2012.

While working to complete his doctoral studies, Peter published a few journal papers, and presented his research at national and international conferences. With great advices of his dissertation chair, Dr. Fei L. Weisstein, Peter was awarded two Best Paper Awards in Ph.D. track from the College of Business Administration (COBA) in 2013 and 2014. He also earned the Second Best Paper Award from the COBA in 2015. Moreover, effective in August 2015, he secured a position as an Assistant Professor of Marketing at the University of Scranton in Pennsylvania.