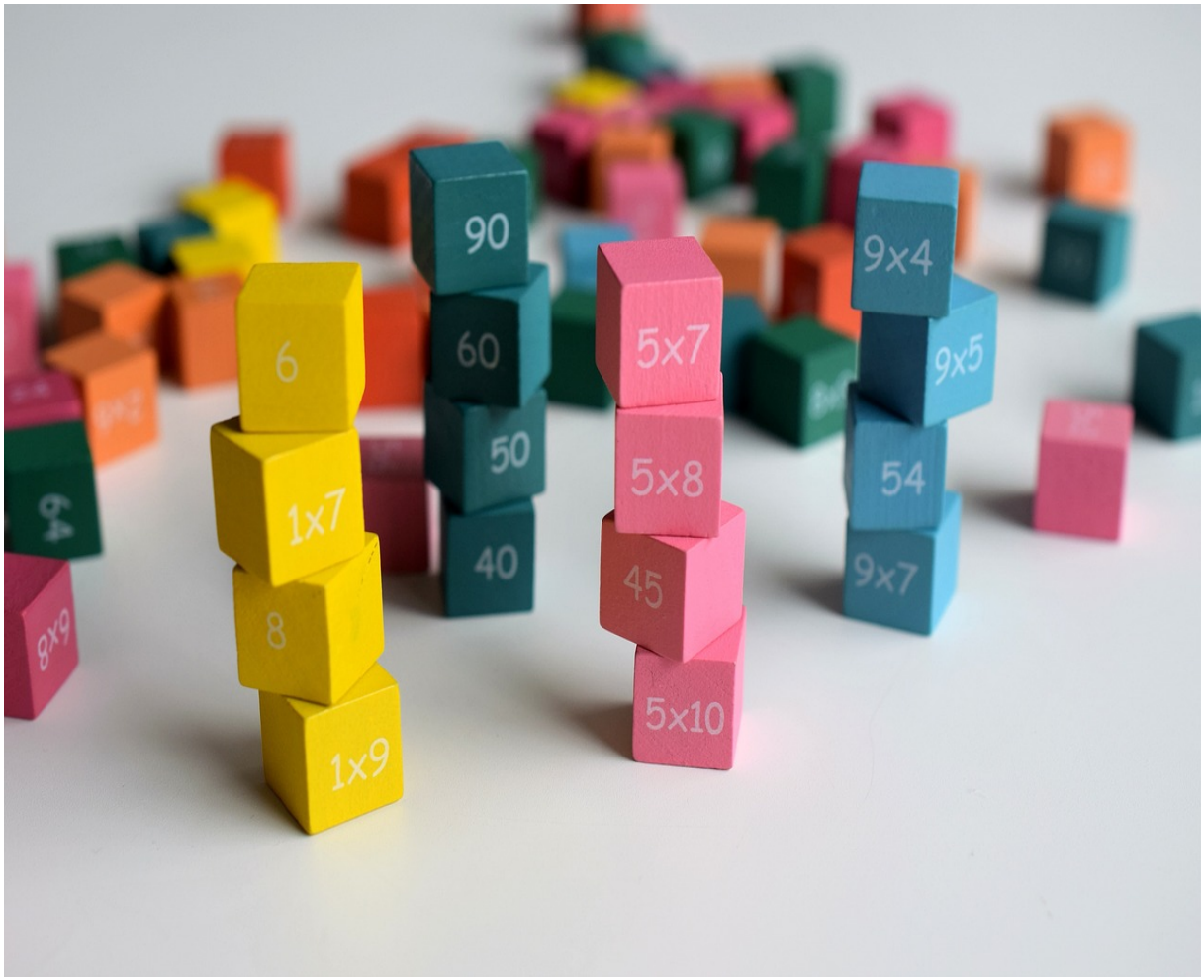
TU Delft

Master Thesis

Exploring the Relationships of Language Pattern, Math Anxiety, Self-esteem, and Curiosity



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Master Thesis

Exploring the Relationships of Language Pattern Math Anxiety, Self-esteem, and Curiosity

Master of Science

in Management of Technology at Delft University of Technology

By

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To be defended in public on 28th August 2023

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Executive Summary

Anxiety disorders are globally prevalent mental health issues. People may suffer from specific forms of anxiety that are related to their academic performance (Pizzie & Kraemer, 2017). Among them, Math Anxiety (MA), is some of the most notable one. It is a widespread problem for all ages across the globe with about 20% of the population suffering from high MA (Eden et al., 2013). People with MA tend to avoid math (Pizzie & Kraemer, 2017) and tend to perform poorly on math exams (Foley et al., 2017). Thus, people with MA are at a disadvantage in achieving good academic performance and competing in the workplace.

The causes of MA are complex and inconclusive (Hartwright et al., 2018). Personality has already been related to anxiety (Costa Jr & McCrae, 1992) and low self-esteem has been related to increased MA and reduced math performance.(Balmeo & Fabella, 2018). There are almost no interventions approved for MA (Moustafa et al., 2021). Previous studies showed that Cognitive Behavioral Therapy (CBT) is an effective way to reduce anxiety in general, such as test anxiety (Orbach et al., 2007). Recent studies showed that it could also reduce students' MA levels (Bicer et al., 2020). Based on these, individualized Cognitive Behavioral Therapy (i-CBT) intervention has the potential to be an effective way to ameliorate the individual factors that have led to MA (Sønmez et al., 2020). However, previous studies paid less attention to individual differences between participants. The inclusion of personality in research will help to explore the different reasons why people display MA and develop personalised interventions to reduce MA (Moustafa et al., 2021).

This study included two personality differences (self-esteem and curiosity) to better explore the inner world of people with high and low MA through their language patterns. Besides, much of the research on MA focused on students. This study extended the scope to the entire population. In this study, the number of students and the number of non-students were comparable. To reach the objective of this study, an online experiment was employed, which consisted of Abbreviated Math Anxiety Scale (AMAS), Rosenberg Self-esteem Scale (RSES), Five-dimension Curiosity SCALE (5D-CS), two math tests, and one expressive writing task to describe their previous math-related experiences. Finally, demographic factors were collected. In total, this study got 214 valid responses. The software JASP and LIWC2022 were used to analyze the data.

The research questions of this study were answered. The language patterns differentiated between people with high and low MA. Self-esteem and curiosity moderated the relationship between MA and people's language patterns. In the control group and for people with low MA in the expressive writing group, expressive writing helped improve people's math performance. For people with high MA in the expressive writing group, the benefits of expressive writing did not show up.

By reflecting on the whole study, some limitations were identified and could be improved for further studies. In this study, an online experiment was conducted. As a result, first, it was

not possible to monitor participants' situation and status. For example, whether all participants were in the same environmental state (e.g. quiet or noisy) could not be determined. Second, whether participants answered the questions seriously, especially the complex math questions that require effort in this experiment, can not be monitored also due to the format of the online experiment. Finally, the writing topic could be more specific to negative math-related experiences. In the current study, some people wrote down positive math-related challenges such as being selected for a math competition and being excited about it. This may lead to blurring out some of the word categories that people use, such as positive emotional words. In the future, this study could be extended in many ways. For example, Electroencephalogram (EEG) could be used to monitor people's brain activities or extra scales could be added to the research to separate MA from other relevant anxieties.

In conclusion, this study highlighted that language patterns differ between people with high and low MA. Especially, the word categories positive emotion, insight, articles and linguistic dimensions. Besides, self-esteem and curiosity moderate the relationship between MA and people's language patterns.

Acknowledgements

Two years of Master's study at TU Delft have been very rewarding and I have never regretted my decision to change my major from Materials Science and Engineering to Management of Technology. I would like to thank TU Delft for giving me such a great and supportive platform to learn and grow as a Master's student. What I have experienced here will last a lifetime.

The first person to whom I would like to express my sincerest gratitude is my first supervisor Dr., L. Rook. Thank you for your warm encouragement and patient guidance. It has been an honour to complete my Master's thesis under your supervision. This thesis was accomplished through our joint efforts. I would also like to express my gratitude to Prof. Dr., F.M. Brazier and Dr.,ir. I. Lefter. Thank you for your willingness to be a member of my graduation committee and for giving me valuable suggestions for improvement as I proceed with my thesis.

The people I have to thank most are my parents. Thank you for all the love, encouragement and support you have given me. I love you.

I also would like to thank all my friends who have made my life better. You have made my life less lonely.

Finally, I want to thank myself for always trying. Looking back, I have done so many things that I am proud of myself for. In the future, I hope I can eventually become the person I want to be.

Xiaohan Dong
13 August 2023

1

Introduction

1.1. Background

Math Anxiety (MA) refers to the emotional responses of fear, stress and apprehension that many people experience when dealing with numbers or math-related situations (Ashcraft, 2002). These emotional responses can affect the math performance of these people. People with MA tend to avoid math (Pizzie & Kraemer, 2017), which unsurprisingly impairs their ability to process math and ultimately has a negative impact on their careers. People with high MA have significantly higher physiological reactivity to mathematical problems compared to those with low MA (Faust, 1992). When people with high MA face an upcoming math task, the activity in areas related to physical threat detection and visceral pain experience itself (INSp) increases (I. M. Lyons & Beilock, 2012b). Students with MA tend to perform poorly on math exams (Foley et al., 2017), despite performing normally or even well in other subjects, such as language. It is worth noting that although MA is mainly investigated in educational settings or among students, it does not only occur in examination situations or in schools. Scenarios involving math in daily life, such as opening bank accounts or calculating tips, can also raise MA (Baumrind, 1978).

Research showed that an average of 33% of 15-year-olds in 65 countries and economies reported feeling helpless when solving mathematical problems (OECD, 2013). One study estimated that about 20% of the whole population suffered from high MA (Eden et al., 2013). Approximately 93% of American adults reported that they suffered from varying levels of MA (Blazer, 2011). Estimates of MA prevalence vary considerably between studies. This is possibly due to differences in the populations sampled and the measurement methods used. However, it is undeniable that MA is a worldwide problem prevalent across all age ranges (Luttenberger et al., 2018). MA has a variety of negative effects on people. For students, a negative correlation between MA and math performance has been found (Barroso et al., 2021). In terms of careers, people suffering from MA tend to be at a financial disadvantage in the labour market as math is often essential for higher paying jobs or more prestigious positions (Hembree, 1990).

In general, language pattern reflects the inner world of people, such as thought, feeling, and emotion. Personal choice of words reveals their cognitive and emotional processes as well as suggests their social status, age, gender and motivation (J. W. Pennebaker et al., 2003). Peo-

ple with mental disorders, such as depression (Safa et al., 2022) and general anxiety disorder (Rook et al., 2022), could be distinguished among the population through their language pattern (M. Lyons et al., 2018). Likewise, the interpretation account theory proposed by Ramirez and colleagues (Ramirez, Shaw, & Maloney, 2018) suggests that *people's interpretations of their math-related experiences largely influence the development of their MA*. Based on this, this study wants to explore whether MA is predictable through people's language patterns.

Environmental exposure to math-related failure is generally accepted as one of the main causes of MA (Suárez-Pellicioni et al., 2016). Put differently, negative math-related experiences may be directly related to MA development. When people recall or represent their past math-related experiences, it is a reappraisal of it. Reappraisal has emotional outcomes which are on the basis of an individual's subjective evaluation of events, situations, or internal states. However, since people do not understand or are familiar with how appropriate appraisal should be done, the emotional outcomes of people's reappraisals can vary widely (Scherer, 1999). For people with high MA, they are hard to put a more adaptive interpretation on their disfluent math-related experiences (Ramirez, Shaw, & Maloney, 2018). For example, people with high MA may tend to attribute underachievement in math to ability or intelligence quotient rather than think errors are necessary for learning.

Many studies have found links between anxiety and interpretation (Mathews & Mackintosh, 2000). High and low worriers have different interpretation tendencies and high worriers tend to show a lack of benign interpretation bias (Feng et al., 2019), which means high worriers tend to interpret ambiguous stimuli from a negative perspective. Negative interpretations could trigger further negative thoughts and generate more negative interpretations while positive interpretations could lighten up worry (Krahé et al., 2019). High self-esteem helps to reduce self-blame and catastrophizing as well as enhance acceptance and positive reappraisal (Doron et al., 2013). People with high self-esteem do not tend to feel bad about themselves when they experience failures (Brown, 2010). They may relieve their anxiety by positively interpreting their negative math-related experiences compared with people with low self-esteem. Thus, self-esteem might alter people's interpretation of previous negative math-related experiences, which then affects their MA development.

Curiosity serves as a counterweight to anxiety (Silvia, 2017). It motivates people to explore new knowledge, ambiguous information or novel events (Kashdan et al., 2018). Cognitive curiosity, which is defined as curiosity motivated by a lack of knowledge (Berlyne et al., 1954), is considered to be highly relevant to learning. According to different knowledge-seeking behaviours, it can be distinguished into I-type curiosity (Spielberger & Starr, 1994) and D-type of curiosity (Loewenstein, 1994). I-type curiosity relates to mastery-oriented learning, while D-type curiosity links to failure-avoidance and success-orientation learning (Litman, 2010). Different types of curiosities may influence the development of MA.

People with MA often tend to avoid math and math-related situations, which leads to poor performance in math and also affects their careers and futures. Intervention is one of the main goals of studying the mechanism of MA, which helps to reduce the anxiety level of people with MA or even prevents people from developing MA. Language pattern reflects a person's inner world, and, according to the interpretation account theory, people's interpretations of their

math-related experiences largely influence the development of MA. Thus, detailed analyses of people's language patterns may help to infer whether they are suffering from MA. Self-esteem helps to provide a shield against MA (Trzesniewski et al., 2006) and curiosity serves as a counterweight to anxiety (Silvia, 2017). Self-esteem and curiosity may alter people's language patterns. Exploring the relationships between language pattern, MA, self-esteem, and curiosity helps to reveal the cause and development of MA.

1.2. Research Objective

The first research objective of this study was to determine whether MA could be inferred from the language patterns people used when expressing their previous math-related experiences. The second research objective of this study was to explain whether self-esteem and curiosity alter the relationship between MA and people's language patterns. People with high self-esteem were expected to use more positive statements when describing math-related experiences compared with people with low self-esteem. Curiosity motivated people to explore unfamiliar things and people with high curiosity were more capable of dispelling uncertainties which may affect the development of MA. Besides, this study also would examine whether people's math performance would change before and after an expressive writing task. This study would contribute to the field of e-health, such as developing e-health applications for remote identification and intervention of MA.

1.3. Research Question

The main research question was **"Do MA, self-esteem and curiosity influence the language patterns of people when describing their experiences with math problems and challenges?"**
The main research question highlighted four variables of this study: 1) MA; 2) Language pattern; 3) Self-esteem; and 4) Curiosity based on the research objectives. Exploring the relationships between these four variables was crucial for understanding the mechanism behind the cause and development of MA.

To answer this main research question, the following sub-questions were raised:
The first sub-question was **"Will people with MA use distinctive language patterns when describing their experiences with math problems and challenges?"**
The first sub-question explored the relationship between MA and people's language patterns.

The second sub-question was **"Does self-esteem influence the language patterns of people with high or low MA levels when describing their experiences with math problems and challenges?"**
The second sub-question explored whether self-esteem altered the relationship between MA and people's language patterns.

The third sub-question was **"Does curiosity influence the language patterns of people with high or low MA levels when describing their experiences with math problems and challenges?"**
The third sub-question explored whether curiosity altered the relationship between MA and people's language patterns.

The fourth sub-question was **"Will expressive writing influence people's math performance?"**
The fourth sub-question explored whether people's math performance would change before and after an expressive writing task.

Based on the fourth sub-questions, the follow-up sub-question was **"To what extent are the differences in people's math performance changed before and after an expressive writing task?"**
This follow-up question explored whether the effect of an expressive writing task on people's math performance was significant.

1.4. Potential Application

Many people suffer from MA, which prohibits them from achieving their full academic potential and pursuing career success. A more comprehensive understanding of people with MA facilitates effective counselling and treatment. In the long term, exploring linguistics-based MA recognition could build a foundation for the development and application of remote diagnosis and treatment of MA.

2

Literature Review

2.1. Math Anxiety (MA)

2.1.1. Introduction to Math Anxiety

The concept of number anxiety was first introduced by Dreger and Aiken in 1957 (Dreger & Aiken Jr, 1957). Since then, it has been extensively researched, and now is widely accepted as the concept of math anxiety (MA). Various definitions of MA have been proposed by different researchers. In general, MA refers to the emotional responses of fear, stress and apprehension that many people experience when dealing with numbers or math-related situations (Ashcraft, 2002). It has been widely recognised as a potential barrier to the Science, Technology, Engineering and Mathematics (STEM) success (Daker et al., 2021).

MA is a widespread problem. It is estimated that about 93% of American adults suffered from varying levels of MA (Blazer, 2011), and approximately 17% of Americans suffered from severe MA. About 25% of US 4-year college students and about 80% of US community college students reported moderate to high levels of MA (Chang & Beilock, 2016). Results showed that among 15-year-olds in 65 countries and economies, 33% reported feeling helpless when solving mathematical problems, 31% reported getting very nervous doing mathematics problems, and 30% reported feeling helpless when doing a mathematics problem (OECD, 2013). In the United Kingdom, approximately 48% of adolescent apprentices were affected by MA (Johnston-Wilder et al., 2014). For secondary school students in the UK, this number was about 2% to 6% (Chinn, 2009). One study estimated that about 20% of the entire population suffered from high levels of MA (Eden et al., 2013). While another global study found that about 17% of the population would be expected to be low in MA and 17% would be high in MA (Ashcraft & Moore, 2009). The different prevalence rates under the different studies may be due to the fact that most MA measures assess scores on a continuous measure and there are no clear criteria for how severe the anxiety must be in order for a person to be labelled as having high MA.

Many studies have shown that women have higher levels of MA than men (Ferguson et al., 2015), but this difference is not present in all studies (Kyttälä & Björn, 2014). Besides, this difference is also country-related (OECD, 2013). Despite this, it is still generally accepted that women are more likely to feel anxious about math than men. In the study of MA across age, much of the early data has become less informative. Because the content and approach to math education have changed as society has evolved, so have students' levels of MA, which results

in data being less comparable across years. In general, MA seems to increase with age during childhood according to various cross-sectional studies (Dowker et al., 2016). Globally, the percentage of students who reported being very tense when having to do mathematics homework increased from 29% to 31% compared with 2003 (OECD, 2013). At the national level, countries with advanced economies and gender equality have a lower overall level of MA (Stoet et al., 2016).

2.1.2. Math Anxiety Diagnosis

Although MA is not classified as an independent mental disorder type in the 4th Diagnostic and Statistical Manual of Mental Disorders (Association et al., 1994), it can be attributed neither to test anxiety nor to general anxiety (Ashcraft & Ridley, 2005). A recent study on MA found elevated physiological arousal during exam anticipation, but not during the exam (Qu et al., 2020). It has been argued that math usually tends to trigger stronger emotional responses, particularly anxiety and even fear than most other subjects (Ashcraft & Ridley, 2005). These findings help to determine the specificity of MA.

Asking students to indicate how they feel about situations involving mathematics through self-report questionnaires is the most common method of identifying MA. The first formal instrument for measuring the construct was published by Richardson and Suinn in 1972 which was named Mathematics Anxiety Rating Scale (MARS) (Richardson & Suinn, 1972). It is a 98-item rating scale with a 5-point Likert scale. Through this scale, respondents report how anxious they are in both formal math settings and informal everyday situations. After that, many shorter, English-version scales were designed and published. The 12-item Fennema–Sherman Mathematics Anxiety Scale (MAS) was published by Fennema and Sherman in 1976 (Fennema & Sherman, 1976). The six-item Sandman Anxiety Towards Mathematics Scale (ATMS) was published by Sandman in 1980 (Sandman, 1980). The 24-item Math Anxiety Rating Scale-Revised (MARS-R) was published by Plake and Parker in 1982 (Plake & Parker, 1982). The 25-item abbreviated version of the MARS (sMARS) was published by Alexander and Martray in 1989 (Alexander & Martray, 1989). The 9-item Abbreviated Math Anxiety Scale (AMAS) was published by Hopko and colleagues in 2003 (Hopko et al., 2003). In this study, the AMAS was chosen to measure students' MA levels which is one of the most commonly used methods to assess MA. This scale only consists of nine items but has been confirmed the same effect as the longer MARS. Its validity has been examined.

2.1.3. Causes of Math Anxiety

Despite a number of studies that have been conducted and various theories have been proposed, it is still unclear which theory is most applicable to explain the cause of MA. Currently, reasons that cause MA could be categorized into three (Ramirez, Shaw, & Maloney, 2018), which are 1) Poor math skills; 2) Genetic predispositions; and 3) Socio-environmental factors. For the first category, MA is caused by poor performance or achievement in math, which is called the deficit theory. Some studies support this argument. A study of middle and high school students showed that low prior math achievement predicts high MA later in life (Ma & Xu, 2004) and another study showed that primary school students with math learning disabilities reported higher levels of anxiety (Wu et al., 2014). But such relationships were only found in the lower grades. In fact, evidence on the relationship between MA and math achievement is mixed (Carey et al., 2016). Three different theories are proposed to explain the relationship be-

tween MA and math achievement, which are the deficit theory, the debilitating anxiety model, and the reciprocal theory, and all these three theories have evidence (Sorvo et al., 2019). The debilitating anxiety model believes that people with MA may avoid math-related situations, which reduced their learning and practising opportunities and led to poor math achievements as a result (Hembree, 1990). The reciprocal theory can be seen as a combination of the deficit theory and the debilitating anxiety model which believes that poor math skills may trigger MA and further reduce math performance in a vicious cycle (Jansen et al., 2013).

In 2014, an empirical study published by Wang and colleagues (Z. Wang et al., 2014) found that genetic factors accounted for approximately 40% of the variance in MA. This finding highlighted the role of genes in students' susceptibility to MA, but it is impossible to ignore the role of various socio-environmental factors (including the role of socio-environmental factors on gene expression). Both home experiences and classroom experiences related to math are socio-environmental factors that influence students' susceptibility to MA. No clear conclusions have been drawn about the role of parents in their children's MA level. Some studies have shown that parental involvement and support can reduce children's MA level (Vukovic et al., 2013). But the opposite can be true when parents have MA because parents may pass on their own anxieties and fears about math to their children in their interactions with them (Maloney et al., 2015). Teachers' high level of MA also increases students' susceptibility to MA (Ramirez, Hooper, et al., 2018).

Ramirez and colleagues proposed the interpretation account theory in order to explain the conflict findings about the relationships between students' MA level, students' math achievement, and teachers' MA level (Ramirez, Shaw, & Maloney, 2018). In fact, many students who have poor math achievement or study with the same teacher do not end up developing MA. While many students who excelled in math are struggling with MA at the same time (Lee, 2009). The interpretation account theory believes that *"students' development of math anxiety is largely determined by how they interpret (i.e., appraise) previous math experiences and outcomes (rather than the outcomes themselves). That is, math anxiety derives not just from a student's avoidance tendencies, reduced competency, or performance worries that shape the development of math anxiety but rather how individuals interpret their math-related experiences."* (Ramirez, Shaw, & Maloney, 2018). This theory has been supported by some studies. Meece and colleagues found that students' perceptions of their math ability rather than their actual math achievement affect their MA level (Meece et al., 1990). Lyons and colleagues found students with both high MA levels and high math achievement tended to reinterpret their arousal while in math-related situations (I. M. Lyons & Beilock, 2012a), which helps to improve their performance in stressful situations (Jamieson et al., 2010). The finding that re-evaluating stress through expressive writing could reduce MA level also helps to support this theory (A. Park et al., 2011). The interpretation account theory was the basis to hypothesise that people with MA tend to have distinctive language patterns when expressing math-related experiences.

2.2. Linguistic Foundations

2.2.1. Language Pattern and Mental Disorders

Words that people use in their daily lives could reflect important aspects of their social and psychological worlds, such as inner thought, feeling, belief, personality and emotion (J. W. Pen-

nebaker et al., 2003). This is not a new concept. In 1901, Freud pointed out that people's deep fears and motives were exposed by their verbal errors (Freud, 1989). In narrative and discourse analyses, the meaning of events to people is hidden in their descriptions of events (Spera et al., 1994). Some believe that language is contextual and must be analysed in context, and therefore can only be decoded by humans. An alternative view is that language can be counted and statistically analyzed. There are mainly three types of analysis: 1) The theme of the text which could be done by empirically developed coding systems (Smith et al., 1992); 2) The word pattern of the text which could be done by mathematically detecting the word covariation (Popping, 1999); and 3) The content and style of the text which could be done by word count strategies (Boyd & Schwartz, 2021).

Studies found that language patterns, such as the use of personal pronouns (M. Lyons et al., 2018), can be used to infer a person's inner world or motivational tendencies. A finding suggested that it was possible to predict poets' suicidal tendencies through textual analysis. Suicidal poets tended to use more first-person singular self-references throughout their careers, which means their high level of preoccupation with self did not stem from their growing fame over time (Stirman & Pennebaker, 2001). This is due to the fact that the first-person singular pronouns tend to show an inward focus and negative emotions are characteristic of a range of different kinds of pain or suffering. In the last century, researchers have been exploring the relationship between language patterns and mental disorders or mental illnesses. Bucci and colleagues in 1981 found that elderly people with depression tended to use more first-person singular pronouns (Bucci & Freedman, 1981). Authors suggested that this language pattern reflected the weaknesses of depressed people in terms of relating to others. One study conducted in 2004 also found that people with depression or personality disorders tended to use first-person singular pronouns as well as negative words more frequently (Rude et al., 2004). Currently, language analysis has been used to identify people with some types of mental disorders, such as schizophrenia (Minor et al., 2015) and obsessive-compulsive disorder (Oren et al., 2016). People with a general anxiety disorder also could be identified through their oral language patterns (Teferra et al., 2022) or written language patterns (Rook et al., 2022).

2.2.2. Language Pattern and Math Anxiety

Many studies have found links between anxiety and interpretation (Mathews & Mackintosh, 2000). Back in the 1980s, studies showed that people with high anxiety levels were more likely to endorse threatening interpretations when describing ambiguous situations or stimuli (Mathews et al., 1989). One study in 1992 suggested that higher anxiety levels were related to selective threatening meanings of ambiguous words (Richards & French, 1992). To date, many studies have found that anxious people tend to interpret ambiguities negatively (Calvo & Dolores Castillo, 2001). Anxious people are more likely to perceive a noise outside their window as a robber (threatening interpretation) rather than a wind (neutral interpretation) (Subar et al., 2022). What's more, this tendency was strongly correlated with their anxiety severity (Rozenman et al., 2014). Experiments with healthy individuals suggested that inducing experimental individuals to interpret ambiguous information negatively increased their anxiety levels (Ji et al., 2021).

According to the interpretation account theory (Ramirez, Shaw, & Maloney, 2018), how students interpret their math-related experiences and outcomes largely determined their MA level

besides avoidance tendencies, poor math skills and other factors. It is reasonable to hypothesise that students with MA use distinctive language patterns. Existing studies have examined the content specificity of interpretation bias for anxiety (Field & Lester, 2010). Although results preliminary support the content specificity hypothesis, no clear conclusions have been drawn about whether bias is strongest for matched domains of anxiety (Subar et al., 2022). Further uncovering the link between language patterns and MA may help to reveal the cause and development of MA.

2.3. Self-esteem

2.3.1. Introduction to Self-esteem

Self-esteem reflects people's subjective evaluation of their worth (Crocker & Major, 1989). It is a relatively stable individual trait across long periods with only slow, gradual changes (Orth & Robins, 2014). In other words, people with high self-esteem tend to have high self-esteem in the future and vice versa. Noteworthy, like most other psychological constructs, self-esteem is neither completely trait-like nor completely state-like (Rubin & Hewstone, 1998). But the state factors are comparatively smaller than the completely stable trait factor and autoregressive trait factors, which combined account for 84% of the reliable variance in latent self-esteem assessments (Donnellan et al., 2012). Thus, in general, self-esteem is a trait-like characteristic with relatively large stability (Kuster & Orth, 2013).

Self-esteem can predict people's success prospectively in some life domains such as health and work (Orth & Robins, 2014). High self-esteem is usually indicative of good psychological health, while low self-esteem to some extent predicts poor health, criminal behaviour, and limited economic prospects (Trzesniewski et al., 2006). Some studies support that low self-esteem contributes to depression and believe that improving self-esteem could reduce or even prevent depression (Orth & Robins, 2013). High self-esteem prospectively predicts better work outcomes, whereas work outcomes could not reflect self-esteem level (Kuster et al., 2013). In fact, many studies suggest that high self-esteem is a predictor of success rather than a result (Orth & Robins, 2014).

Self-esteem is influenced by a number of factors, such as culture (Schmitt & Allik, 2005), age and gender. Individuals' self-esteem level changes with age. Self-esteem usually increases first, from adolescence to middle adulthood, and then decreases, with a peak at age 50s to 60s (Orth & Robins, 2014). Compared with men, women have more negative attitudes towards themselves and have lower self-esteem (Bleidorn et al., 2016). The same is true for adolescent (Minev et al., 2018).

2.3.2. Self-esteem and Math Anxiety

For a long time, self-esteem was considered closely related to anxiety (Rosenberg, 1962), regardless of gender and age (Sowislo & Orth, 2013). Some studies suggested that the effect of self-esteem on anxiety is significantly higher than the effect of anxiety on self-esteem (Manna et al., 2016). However, other studies thought the effects between low self-esteem and anxiety were mutually and relatively balanced (Sowislo & Orth, 2013). Students with high self-esteem tend to fail without feeling bad about themselves (Brown, 2010). High self-esteem is a buffer for their negative emotions (Greenberg et al., 1992) and the development of anxiety. Studies

suggested that higher self-esteem can protect students against stressful life events, while students with lower self-esteem are more vulnerable to pressure and anxiety (Trzesniewski et al., 2006). This may be due to the fact that high self-esteem helps to reduce self-blame and catastrophizing as well as enhance acceptance and positive reappraisal (Doron et al., 2013). As a result, students with high self-esteem do not tend to have more negative perceptions of math after experiencing negative math-related experiences.

Students with high self-esteem are expected to use more positive statements when describing their previous unpleasant math-related experiences compared with students with low self-esteem. In other words, they may use more positive emotional words and fewer first-person singular pronouns (Rude et al., 2004). While students with low self-esteem may hard to impose adaptive interpretations on their previous unpleasant math-related experiences, which could lead to a self-fulling prophecy (Ramirez, Shaw, & Maloney, 2018). For example, one study found that people who underestimate their actual math skills unperformed in the following year (Meece et al., 1990). Thus, self-esteem may alter students' interpretations of previous math-related experiences, and then, based on the interpretation account theory, affect their MA development.

MA has been defined as feelings of apprehension and increased physiological reactivity when people deal with or are exposed to math (Luttenberger et al., 2018). The definition of MA conceived MA as a threat to self-esteem (Akin & Kurbanoglu, 2011). Some students seem to protect their self-esteem by devaluing activities they are not good at or are not confident in (Z. Wang et al., 2021). Put differently, students with MA may devalue math when they recall negative math-related memories to protect their self-esteem. Ramirez and colleagues perceived that, when events were assessed as threatening, students may have the motivation to re-edit their lives in order to maintain the story that they want to tell, and students with MA may ignore positive math-related experiences once they adopt a particularly negative narrative about their math-related abilities (Ramirez, Shaw, & Maloney, 2018). In the language patterns of students with MA, this may reflect in a lack of benign interpretation bias, which exists among low worriers, including both positive and neutral interpretations (Feng et al., 2019). Further exploring the relationship between MA and self-esteem helps to understand the interpretation account theory as well as the cause, development and treatment of MA.

A recent study of Chinese high school students revealed the different pathways from self-esteem to MA based on gender (Xie et al., 2019). This study concluded that there was a negative correlation between self-esteem and MA and that there were gender differences, suggesting that self-esteem had both direct and indirect effects on young men's MA levels and only indirect effects on young women's MA levels. It is not clear whether this gender difference only occurs among Chinese and is worthy of further exploration.

2.4. Curiosity

2.4.1. Introduction to Curiosity

Curiosity can be generally defined as the desire to explore new knowledge, ambiguous information or novel events (Kashdan et al., 2018). William James believed that curiosity was the desire to know what people didn't know (James, 1890). A common contemporary view of

curiosity is that it is a special form of information-seeking, although it is difficult to draw a formal distinction between curiosity and broader information-seeking (Kidd & Hayden, 2015). Intrinsic motivation, which is defined as the doing of an activity for its inherent satisfaction, helps to distinguish between curiosity and broader information-seeking (Oudeyer & Kaplan, 2009). Whether curiosity should be understood as a trait-like characteristic or a state characteristic has been inconclusive. The prevailing view is that the construct of curiosity contains both trait and situational elements (Levitt et al., 2009).

Curiosity can be helpful. It makes people pay more attention to an activity, allowing them to remember and process information better and making them more likely to persevere until they reach their goals (Silvia, 2006). For example, it enhances learning (Kang et al., 2009) and has a positive impact on learning outcomes (van Schijndel et al., 2018). Evidence showed that students learnt more when they were interested (Ainley et al., 2002), which is in line with perceptions. People are willing to spend more scarce resources for answers they are more curious about and curiosity may enhance memory for surprising new information (Kang et al., 2009). Curiosity can be dangerous too, which is related to exploratory behaviours with harmful consequences (Jovanović & Gavrilov-Jerković, 2014) such as indulgent consumption (Wiggin et al., 2019).

2.4.2. Curiosity and Math Anxiety

Many studies have found links between curiosity and anxiety. Low tolerance for uncertainties has been identified as one of the main characteristics of anxiety (Dugas et al., 1997) while curiosity requires the ability to face the uncertainties encountered in the process of exploration (Silvia, 2008). Anxiety has been shown to lead to a decline in curiosity (Kashdan & Roberts, 2004).

Curiosity serves as a counterweight to anxiety (Silvia, 2017). As previously stated, anxious people always avoid uncertainties while curiosity encourages people to explore unfamiliar things. In this study, lower levels of curiosity are expected to be associated with higher levels of MA. Although there are many different categories of curiosity, cognitive curiosity, which is defined as curiosity motivated by a lack of knowledge (Berlyne et al., 1954), is considered to be highly relevant to learning. Based on this, two types of cognitive curiosity are identified according to different knowledge-seeking behaviours. The first type of curiosity is called I-type curiosity and is described as a feeling of interest, which means approaching new information (Spielberger & Starr, 1994). The second type of curiosity is called D-type curiosity and is described as a feeling of deprivation, which means avoiding unpleasant states of anxiety (Loewenstein, 1994). I-type curiosity relates to mastery-oriented learning, while D-type curiosity links to failure-avoidance and success-orientation learning (Litman, 2010). Different types of curiosities may influence the development and severity of MA.

Curiosity can be understood as an underlying positive motivation for learning, including math. Asking questions and exploring are key behavioural markers of curiosity (Jirout & Klahr, 2012) and math education is about advocating creative problem-solving and giving students the opportunity to ask questions and explore (Peterson & Cohen, 2019). Studies showed that negative emotions such as MA can be reformed as more positive experiences (Maloney et al., 2013). For example, students may interpret their state positively as curiosity or negatively as confusion.

For the latter, they may tend to avoid math in order to avoid experiencing negative emotions (Muis et al., 2015) and were expected to have higher levels of MA.

2.5. Self-esteem and Curiosity

Self-esteem and curiosity are not entirely independent of each other. A study found that children with more unstable self-esteem had lower curiosity and less preference for challenge (Waschull & Kernis, 1996). One study proposed the concept of Intrapersonal Curiosity (InC) which belongs to D-type curiosity and is defined as the tendency to explore the nature of one's inner self and found it was associated with lower self-esteem, greater depression, and more social anxiety (Litman et al., 2017). In addition, self-esteem and curiosity are often considered as two separate independent variables to explore their effects on another dependent variable such as creativity. The relationship between self-esteem and curiosity has not been fully explored and researched.

Self-esteem is an important psychological resource that could buffer stress or negative emotions (Cast & Burke, 2002). Compared to people with high self-esteem, people with low self-esteem have less confidence and need more cognitive resources to buffer negative emotions (Y. Wang & Wang, 2016). Curiosity requires people to explore uncertainties (Silvia, 2008) and they may experience negative emotions such as worry and anxiety during the exploration process. High self-esteem helps to reduce the perception of threat and anxiety (Gass & Chang, 1989). To some extent, people need the confidence to feel they have sufficient capacity to deal with the novelty and ambiguity that they face during the exploration process (Kashdan et al., 2009). Thus, the relationship between high self-esteem and high curiosity is likely to be positive.

The Five-dimensional Curiosity Scale (5D-CS) is selected to measure students' curiosity levels in this study. This scale has five dimensions which are joyous exploration, deprivation sensitivity, stress tolerance, social curiosity, and thrill seeking (Kashdan et al., 2018). Curiosity is usually studied as a single dimension while individual differences have been overlooked. Particular dimensions of curiosity are especially linked to health whereas other dimensions are relatively less related to or unrelated to health (Kashdan et al., 2018).

People who score high on joyous exploration can derive positive emotions and meaning from learning new knowledge or new skills. This dimension of curiosity motivates people to explore new things, and people usually gain pleasure in the process of exploration (Kashdan et al., 2004). It is therefore hypothesized that students' scores on this dimension are negatively related to their MA levels. Deprivation sensitivity has the weakest link with the ability to deal with stress when facing novelties and helps the development of insights and knowledge while stress tolerance links to being less deterred by negative emotions when exploring ambiguities, and being willing to embrace the inherent anxiety of new things (Kashdan et al., 2018). It is therefore hypothesized that students' scores on deprivation sensitivity are positively related to their math performances while students' scores on stress tolerance are negatively related to their MA levels. Social curiosity might only be relevant to adaptive social functioning and thrill seeking means hunting for varied, risky and intense experiences (Kashdan et al., 2018). These two dimensions were therefore hypothesized to have near-zero correlations with MA levels and math performances.

In this study, whether self-esteem and curiosity independently influence the relationship between MA and language patterns would be tested. Also, whether self-esteem levels are positively related to curiosity levels would be tested.

3

Knowledge Gap and Research Method

3.1. Knowledge Gap

MA refers to the emotional responses of fear, stress and apprehension that many people experience when dealing with numbers or math-related situations (Ashcraft, 2002). In general, people who suffer from MA tend to avoid things related to math. It occurs not only in math courses but also in daily life related to math (Baumrind, 1978). According to the data collected by the Program for International Student Assessment (PISA) studies, more than 20% of students suffered from MA (OECD, 2013). It is a common problem among the population. Studies showed that people with MA have inadequate inhibitory mechanisms and their working memory resources are depleted by non-task-related distractions, resulting in poorer explicit memory performance (Hopko et al., 1998). MA influences reading speed negatively as well as increases errors in task solving (Luttenberger et al., 2018). As a result, MA prevents students from succeeding in STEM courses as well as reaching their full academic potential and achieving career success.

Given the importance of MA to education, many studies have been done related to the cause of MA. According to the interpretation account theory, people's development of MA is largely determined by how they interpret their previous math-related experiences and outcomes (Ramirez, Shaw, & Maloney, 2018). Language pattern reflects people's inner world (J. W. Pennebaker et al., 2003). As explained in the previous chapters, people with high MA may tend to have negative interpretation bias when describing their previous math-related experiences, while people with low MA may tend to have benign interpretation bias. Therefore, there is a probability that people with different levels of MA use distinctive language patterns.

Self-esteem is considered closely related to anxiety (Sowislo & Orth, 2013). High self-esteem helps to reduce self-blame as well as enhance acceptance and positive reappraisal (Doron et al., 2013). Students with high self-esteem are less likely to feel bad about themselves when facing failures and their high self-esteem buffers their negative emotions when recalling negative experiences (Brown, 2010). They may tend to positively interpret their negative math-related experiences (Ramirez, Shaw, & Maloney, 2018), which may be reflected in their language patterns. Students with high self-esteem are expected to use more positive statements when describing math-related experiences. Curiosity serves as a counterweight to anxiety (Silvia, 2017). It motivates people to explore new knowledge, ambiguous information or novel events

(Kashdan et al., 2018). Studies showed that negative emotions such as MA can be reformed as more positive experiences (Maloney et al., 2013). Students with MA may interpret their state negatively as confusion rather than positively as curiosity, which may be reflected in their language patterns. Thus, self-esteem and curiosity may alter the relationship between MA and language patterns.

Besides, examining whether people's math performance changed before and after an expressive writing task may contribute to gaining more insights into the interpretation account theory. Exploring the relationships between MA, language pattern, self-esteem, and curiosity helps to further understand the cause and development of MA.

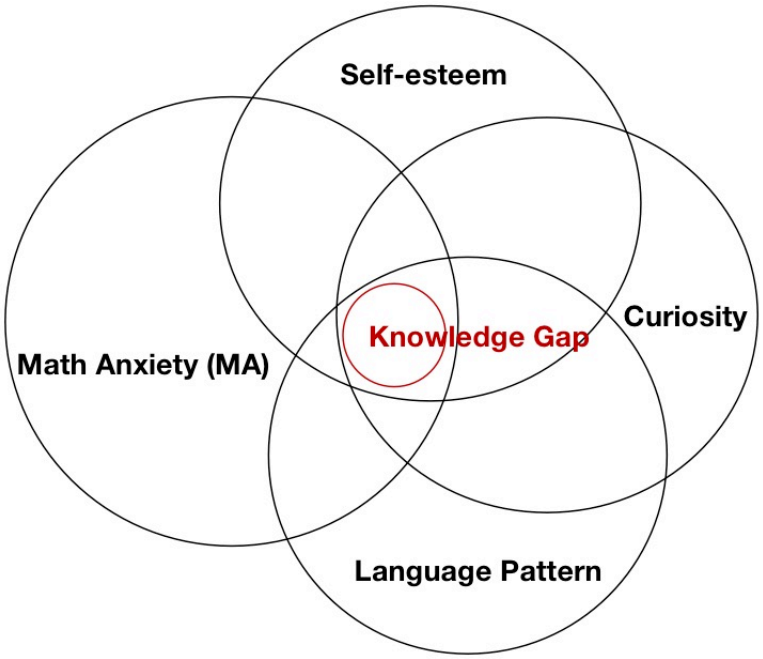

Figure 3.1: Knowledge Gap

3.2. Conceptual Model

This study focused on whether it is possible to identify people with MA from their language patterns and whether self-esteem and curiosity alter people's interpretations of previous math-related experiences. Figure 3.2 shows the relations among the four variables of this study: MA, language pattern, self-esteem, and curiosity.

Based on the conceptual model, four hypotheses had been derived in order to gain a better understanding of this study:

H1: There is a positive relationship between people's self-esteem levels and their curiosity levels.

H2: People with MA use distinctive language patterns when describing their experiences with math problems and challenges.

H3: Self-esteem alters the language patterns of people with MA when describing their experiences with math problems and challenges.

H4: Curiosity alters the language patterns of people with MA when describing their experiences with math problems and challenges.

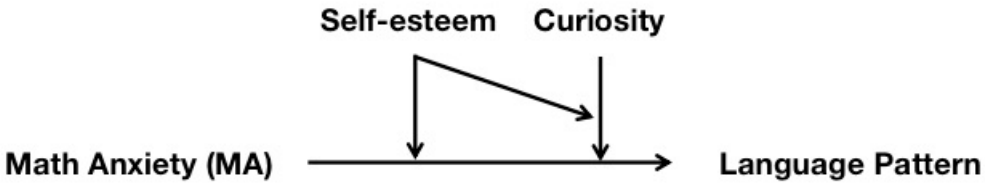

Figure 3.2: Conceptual Model

In this study, math performance was included as an extra variable. Two math tests were given in this study, before and after expressive writing. The purpose was to verify the effect of expressive writing on the math performance of people with different levels of MA.

3.3. Research Method

3.3.1. Procedure

An online experiment was employed to gather data. Participants first completed the Abbreviated Math Anxiety Scale (AMAS), the Rosenberg Self-Esteem Scale (RSES), and the Five-dimensional Curiosity Scale (5D-CS), followed by a writing task. In the writing task phase, participants were divided into two groups. One was the experimental group which described their previous math-related experiences. Another was the control group which finished a fake writing task unrelated to math. The topic for the fake writing task was describing the food they ate for their last meal. Demographics and educational levels were also assessed. LIWC2022 was used to analyze their language patterns.

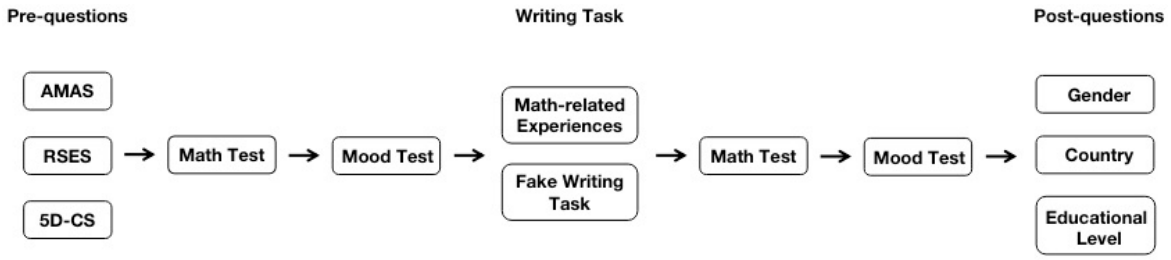

Figure 3.3: Survey Flow Chart

3.3.2. Measure

Abbreviated Math Anxiety Scale (AMAS)

People's MA level was measured through the Abbreviated Math Anxiety Scale (AMAS) (Hopko et al., 2003). This scale consists of nine items aimed at measuring people's MA levels in learning and test situations. Responses were required to respond based on how anxious they felt during given events on a 5-point scale from *not anxious at all* (1) to *very anxious* (5). A median split was used to classify people's MA levels. In this study, the internal consistency reliability of the scale was good (Cronbach's $\alpha = 0.884$).

Rosenberg Self-Esteem Scale (RSES)
People's self-esteem level was measured through the Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965), which is one of the most widely used measures. This scale consists of ten items and responses are given on a 4-point scale from *strongly disagree* (4) to *strongly agree* (1). A median split was used to classify people's self-esteem levels. In this study, the internal consistency reliability of the scale was acceptable (Cronbach's $\alpha = 0.735$).

Five-dimensional Curiosity Scale (5D-CS)
People's curiosity level was measured through the Five-dimensional Curiosity Scale (5D-CS) (Kashdan et al., 2018). This scale consists of twenty-five items aimed at measuring people's curiosity levels in five dimensions, which are joyous exploration, deprivation sensitivity, stress tolerance, social curiosity, and thrill seeking. Responses are given on a 7-point scale from *does not describe me at all* (1) to *completely describes me* (7). A median split was used to classify people's curiosity levels. In this study, the internal reliability of the scale was acceptable (Cronbach α were: 0.818; 0.767; 0.816; 0.731; 0.813). Table 3.4 below shows the high loading for 5 factors for each of the variables which theoretically assumed the internal structure of this scale.

Mood Test
The mood test was measured twice. After each math test, people received one question aimed to measure their current mood, which is *How do you feel right now?* Responses are given on a 9-point scale from *very bad* (1) to *very good* (9) (Rook, 2014).

Math Performance
This study consisted of two math tests, and each math test consisted of 7 math questions. Among 7 questions for each math test, 6 were selected from the GRE math test bank medium level and 1 was an arithmetic question (e.g. *100+5*7-10*). Thus, the first and the second math tests were considered as the same level of difficulty and were comparable. Each correct answer in the two math tests was counted as one point. The GRE math test is a standardized test in the United States and is designed to assess a candidate's potential for graduate or post-graduate study in math. Due to the high level of difficulty of GRE math questions, the correctness or incorrectness of the responses cannot be used to determine whether the participants were putting effort into these math problems. The correctness of relatively simple arithmetic questions was used to confirm participants solved these math questions seriously.

3.3.3. Analysis
Computerised text analysis is an efficient tool to use and can help researchers quickly analyse large amounts of texts (Mehl, 2006). The presence, intensity or frequency of certain words or features in texts can be analysed by software or programming languages. Linguistic Inquiry and Word Count (LIWC) is a computer program commonly used in analysing words in text format (Tausczik & Pennebaker, 2010). Based on n-gram language models, LIWC dictionaries, automatic image tagging, and bag-of-visual words, 91% accuracy was shown in predicting depressive symptoms through Twitter content (Safa et al., 2022). At first, LIWC aimed to discover the characteristics of writing about negative life experiences that predict subsequent health improvements. It is now used in multilingual contexts and in multiple research areas.

LIWC consists of an internal dictionary and software designed for word division and word

counting. It has several pre-defined categories within it and each word or word stem in the internal dictionary belongs to one or more categories. These categories have different meanings mostly based on psychological concepts. The software divides the words of the imported text by category and calculates the percentage of words found in each category. It first had four categories: 1) Negative emotion words; 2) Positive emotion words; 3) Causal words; and 4) Insight words (J. W. Pennebaker, 1997). After that, LIWC2001 (J. W. Pennebaker et al., 2001), LIWC2007 (J. Pennebaker et al., 2007), LIWC2015 (J. W. Pennebaker et al., 2015), and newest LIWC2022 (Boyd et al., 2022) were launched. In this study, LIWC2022 will be used to analyze students' language patterns, which contain 12,000 words and word stems, and 109 output categories.

Component Loadings

	RC1	RC2	RC3	RC4	RC5	Uniqueness
Q3-A_2	0.857					0.308
Q3-A_3	0.796					0.299
Q3-A_1	0.765					0.405
Q3-A_5	0.678					0.509
Q3-A_4	0.637					0.477
Q3-C_4		0.820				0.326
Q3-C_5		0.811				0.294
Q3-C_3		0.811				0.346
Q3-C_2		0.726				0.454
Q3-C_1		0.601				0.499
Q3-E_5			0.795			0.381
Q3-E_4			0.794			0.380
Q3-E_2			0.734			0.414
Q3-E_1			0.701			0.406
Q3-E_3			0.681			0.464
Q3-B_3				0.809		0.387
Q3-B_4				0.777		0.441
Q3-B_5				0.639		0.557
Q3-B_2				0.601		0.490
Q3-B_1				0.555		0.461
Q3-D_3					0.850	0.336
Q3-D_2					0.735	0.458
Q3-D_4					0.692	0.463
Q3-D_5					0.668	0.517
Q3-D_1					0.439	0.696

Note. Applied rotation method is promax.

Figure 3.4: 5D-CS Factor Analysis

4

Descriptive Results

4.1. Pre-Analysis

231 complete responses were collected and recorded in total. Among them, 17 responses were removed because participants did not finish the writing task correctly or seriously. They wrote down stories unrelated to the topic or comments about this questionnaire. Thus, 214 responses were seen as valid and used for further analysis. Table 4.1 shows the demographic analysis of this study. Table 4.2 below shows the personality analysis of this study.

Table 4.1: Demographic Analysis

Age Group	**Number and Percentage**
14~20	11 (5.1%)
21~30	126 (58.9%)
31~40	54 (25.2%)
41~50	15 (7.0%)
51~60	7 (3.3%)
Prefer not to disclose	1 (0.4%)
Gender	**Number**
Male	110
Female	102
Non-binary/Third Gender	2
Continent	**Number and Percentage**
Europe	83 (38.8%)
Asia	57 (26.6%)
Africa	38 (17.8%)
North America	18 (8.4%)
South America	13 (6.1%)
Oceania	3 (1.4%)
Prefer not to disclose	2 (0.9%)
Status	**Number**
Student	110
Non-student	104
Educational Level	**Number and Percentage**
Secondary Education	14 (6.5%)
Bachelor's Education	90 (42.1%)
Master's Education	86 (40.2%)
PhD Education	24 (11.2%)

Table 4.2: Personality Analysis

Type	Number	Mean± Std.
Low MA	105	21.06± 6.10
High MA	109	35.55± 3.71
Low SE	100	26.60± 2.75
High SE	114	34.08± 2.25
Low Joyous Exploration	107	4.16± 0.89
High Joyous Exploration	107	6.03± 0.48
Low Deprivation Sensitivity	107	3.86± 0.84
High Deprivation Sensitivity	107	5.70± 0.56
Low Social Curiosity	91	3.27± 0.82
High Social Curiosity	123	5.33± 0.72
Low Thrill Seeking	94	3.37± 0.70
High Thrill Seeking	120	5.29± 0.71
Low Stress Tolerance	97	2.80± 0.55
High Stress Tolerance	117	5.10± 1.11

4.2. Math Performance Analysis

8 participants failed to answer the arithmetic question correctly in the first math test but they all answered the arithmetic question correctly in the second math test. Given the very low probability that 8 participants who did not take these tests seriously answered the second arithmetic question correctly at random and at the same time, incorrect answers to the first arithmetic question were considered to be due to personal ability factors (e.g. calculation errors) rather than attitudinal factors (e.g. random selection of an option). Thus, these 8 responses were also considered valid. Table 4.3 below shows the results of the first and second math tests. Females in general had better math performance than males. In the expressive writing group and the control group, in general, people with low MA had better math performance than people with high MA. After the writing task, people with both low and high MA in the control group and people with low MA in the expressive writing group had better math performance. People with high MA in the expressive writing group had similar math performance in two math tests.

Table 4.3: Math Performance Analysis

Group	Math performance 1 Mean± Std.	Math performance 2 Mean± Std.
Total Sample	3.35± 1.24	-
Male	3.19± 1.17	-
Female	3.54± 1.29	-
Control Group	3.08± 0.96	3.43± 1.04
LMAs	3.54± 1.48	3.96± 1.48
HMAs	2.92± 0.62	3.24± 0.74
Expressive Writing Group	3.58± 1.40	3.80± 1.28
LMAs	3.65± 1.37	4.03± 1.31
HMAs	3.43± 1.46	3.32± 1.08

4.3. Correlation Analysis

Figure A.1 in Appendix A shows the correlation matrix for the variables in this study, which are self-esteem, MA, five dimensions of curiosity, and two math performances. First, MA was significantly and negatively correlated with math performance 1 (r = -0.178, $p < .01$)

and math performance 2 (r = -0.342, $p < .001$). This finding was consistent with previous studies. Second, self-esteem was significantly and positively correlated with four dimensions of curiosity, which were joyous exploration (r = 0.404, $p < .001$), deprivation sensitivity (r = 0.156, $p < .05$), thrill seeking (r = 0.329, $p < .001$), and stress tolerance (r = 0.385, $p < .001$), but no significant relationship with the fifth dimension, which was social curiosity. Third, MA was not significantly correlated with self-esteem. Fourth, MA was significantly and positively correlated with social curiosity (r = 0.158, $p < .05$), but had no significant relationship with the other four dimensions of curiosity. Finally, math performance 1 was significantly and positively correlated with math performance 2 (r = 0.568, $p < .001$), which was consistent with basic perceptions.

4.4. Language Pattern Analysis

In this study, participants were divided into two groups, which were the expressive writing group and the control group. For the expressive writing group, participants wrote down a paragraph or story about a math-related experience, while for the control group, participants wrote down a paragraph or story to describe the food that they had for their last dinner. The writing of the two groups was seen as a sample of people's language patterns and was analyzed through the software LIWC2022.

4.4.1. Word Count Analysis

As shown in Table 4.4 below, the expressive writing group and the control group had comparable sample sizes and average word counts. Both for the whole writing sample and for the two subgroups, the average word count was about 250.

Table 4.4: Word Count Analysis

	Total Sample	**Expressive Writing Group**	**Control Group**
Sample Size	214	116	98
Word Count	27~540	30~540	27~488
Mean± Std.	257± 139	240± 146	278± 126

4.4.2. LIWC2022 Descriptive Analysis

In this study, participants writing samples were all input into LIWC2022 and analyzed. Table 4.5 below shows the summary variables, linguistic dimensions, and psychological aspects of participants writing samples of the control and the expressive writing group as a whole. The top 25 most used word categories in the psychological processes were selected.

Table 4.5: Language Inventory Word Count (LIWC) Categories in the Present Study

Categories	Abbrev.	Examples	Word Density (%)
Summary Variables			
Word count	WC	Total word count	260.05 (not %)
Analytical thinking	Analytic	Metric of logical, formal thinking	65.39
Clout	Clout	Language of leadership, status	28.92
Authentic	Authentic	Perceived honesty, genuineness	65.34
Emotional tone	Tone	Degree or positive (negative) tone	68.74
Words per sentence	WPS	Average words per sentence	18.15 (not %)
Big words	BigWords	Percent words 7 letters or longer	24.32
Dictionary words	Dic	Percent words captured by LIWC	90.07
Linguistic Dimensions	Linguistic		67.34
Total function words	function	the, to, and, I	53.25
Total pronouns	pronoun	I, you, that, it	13.15
Personal pronouns	ppron	I, you, my, me	9.29
1st person singular	i	I, me, my, myself	6.59
1st person plural	we	we, our, us, lets	1.35
2nd person	you	you, your, u, yourself	0.22
3rd person singular	shehe	he, she, her, his	0.57
3rd person plural	they	they, their, them, themsel*	0.45
Impersonal pronouns	ipron	that, it, this, what	3.68
Determiners	det	the, at, that, my	15.93
Articles	article	a, an, the, alot	9.15
Numbers	number	one, two, first, once	0.61
Prepositions	prep	to, of, in, for	13.51
Auxiliary verbs	auxverb	is, was, be, have	6.20
Adverbs	adverb	so, just, about, there	4.24
Conjunctions	conj	and, but, so, as	7.45
Negations	negate	not, no, never, nothing	1.06
Common verbs	verb	is, was, be, have	13.37
Common adjectives	adj	more, very, other, new	6.43
Quantities	quantity	all, one, more, some	3.50
Psychological Processes			
Cognition	Cognition	is, was, but, are	11.89
Cognitive processes	cogproc	but, not, if, or, know	10.97
Perception	Perception	in, out, up, there	8.77
Past focus	focuspast	was, had, were, been	7.54
Social processes	Social	you, we, he, she	7.46
Affect	Affect	good, well, new, love	6.49
Lifestyle	Lifestyle	work, home, school, working	5.85
Drives	Drives	we, our, work, us	5.65
Physical	physical	medic*, food*, patients, eye*	5.31
Positive tone	tone_pos	good, well, new, love	5.19
Space	space	in, out, up, there	5.07
Work	work	work, school, working, class	4.55
Food	food	food*, drink*, eat, dinner*	4.45
Allure	allure	have, like, out, know	4.30
Time	time	when, now, then, day	4.27
Social referents	socrefs	you, we, he, she	4.23
Insight	insight	know, how, think, feel	3.83
Social behavior	socbehav	said, love, say, care	2.99
Affiliation	affiliation	we, our, us, help	2.66
Emotion	emotion	good, love, happy, hope	2.65
Differentiation	differ	but, not, if, or	2.42
Achievement	achieve	work, better, best, working	2.40
Present focus	focuspresent	is, are, I'm, can	2.02
Positive emotion	emo_pos	good, love, happy, hope	1.87
Motion	motion	go, come, went, came	1.38

5

Results

5.1. Self-esteem and Curiosity

As shown in Figure A.1, in this study, self-esteem was significantly and positively correlated with four dimensions of curiosity, which were joyous exploration ($r = 0.404$, $p < .001$), deprivation sensitivity ($r = 0.156$, $p < .05$), thrill seeking ($r = 0.329$, $p < .001$), and stress tolerance ($r = 0.385$, $p < .001$). This confirms Hypothesis 1 which stated that self-esteem levels had a positive relationship with curiosity.

5.2. Math Anxiety Affects Language Pattern

Table 5.1 shows the word categories which had significant correlations with MA levels. The whole analysis table is presented in Appendix B.

In the total sample, based on Table 5.1 columns 2 and 3, the word category articles ($r = 0.197$, $p < .05$) was significantly and positively correlated with low MA, while the word categories adverbs ($r = -0.200$, $p < .05$), negations ($r = -0.215$, $p < .05$), quantities ($r = -0.220$, $p < .05$), cognition ($r = -0.235$, $p < .05$), cognitive processes ($r = -0.223$, $p < .05$), positive tone ($r = 0.212$, $p < .05$), food ($r = 0.196$, $p < .05$), and differentiation ($r = -0.216$, $p < .05$) were significantly correlated with high MA. Among these word categories, MA's positive significant relationship with the word category positive tone and negative significant correlation with the word category differentiation was interesting since the interpretation account theory proposed that people with high MA tend to interpret their previous math-related experiences from a negative perspective. The significant correlation with the word category food was possibly due to the writing topic of the control group. Low MA and high MA were correlated with different word categories.

Expressive Writing Group

In the expressive writing group, based on Table 5.1 columns 6 and 7, the word categories articles ($r = 0.236$, $p < 0.5$) and insight ($r = 0.242$, $p < 0.5$) were significantly and positively correlated with low MA, while the word categories linguistic dimensions ($r = -0.346$, $p < 0.5$) and positive emotion ($r = 0.402$, $p < 0.5$) were significantly correlated with high MA.

Control Group

In the control group, based on Table 5.1 columns 4 and 5, the word categories numbers (r = -0.295, $p < .05$) and perception (r = -0.239, $p < 0.5$) were significantly correlated with high MA, while no word category is significantly correlated with low MA.

Table 5.1: Language Inventory Word Count (LIWC) and Math Anxiety (MA) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low MA	High MA	Low MA	High MA	Low MA	High MA
Linguistic	-0.070	-0.134	0.062	0.030	-0.113	-0.346*
article	0.197*	0.113	0.097	-0.090	0.236*	0.191
number	0.107	-0.129	-0.337	-0.295*	0.165	-0.061
adverb	-0.025	-0.200*	-0.034	-0.065	-0.020	-0.270
negate	0.006	-0.215*	-0.035	-0.135	0.021	-0.242
quantity	-0.028	-0.220*	0.211	-0.103	-0.097	-0.278
Cognition	0.026	-0.235*	0.109	-0.013	0.062	-0.302
cogproc	0.060	-0.223*	0.133	0.027	0.113	-0.300
Perception	0.085	-0.091	-0.152	-0.239*	0.213	-0.025
tone_pos	-0.171	0.212*	-0.275	0.080	0.152	0.270
food	0.079	0.196*	0.143	0.161	0.011	-0.149
insight	0.157	-0.094	0.209	0.121	0.242*	-0.019
differ	0.061	-0.216*	0.053	0.025	0.082	-0.308
emo_pos	-0.025	0.115	-0.096	-0.107	-0.013	0.402*

Text Examples

The text below is one example of an expressive writing response from a participant with a low score on MA in the expressive writing group. It describes an experience of encountering and solving a math-related difficulty. Words in bold belong to the word categories articles and insight.

*"It was during my first year of university when I experienced one of **the** most transformative moments in my journey with mathematics and algorithms. I was part of **a** study group that routinely tackled algorithmic challenges as **a** way to hone our problem-solving skills. One day, we were presented with **a** particularly intricate problem. Most of my peers started to simulate **the** problem and began optimizing their algorithms for better time **complexity**. That was **the** usual approach, after all. But as I delved deeper into **the** problem, I found myself moving in **a** different direction. Rather than simulating **the** problem and trying to incrementally optimize, I started looking for patterns and connections that might lead to **a** more direct **solution**. I was seeking **an** elegant, universal **answer**. After hours of examination and **exploration**, I made **a** breakthrough: I **discovered a** mathematical formula that could provide **the** final result for any given input. **The** moment was electrifying. My **discovery** bypassed **the** need for time-consuming simulations and intricate optimizations. Instead, this mathematical formula could swiftly and accurately **solve the** problem. This experience was **a** vivid reminder of **the** power and elegance of mathematics, and **how** it can provide **solutions** in unexpected ways. Ever since that day, I have carried this **lesson** with me. It has **informed** my approach to problem-solving, reminding me to **think** beyond **the** standard methods and seek out **the** underlying principles that govern **a** problem. This single experience from my first year of university has shaped my approach to algorithmic challenges, and it has reinforced my **belief** in **the** profound beauty and power of mathematics. "*

The text below is one example of an expressive writing response from a participant with a high score on MA in the expressive writing group. It contains more descriptions of feelings

about math compared with the previous example. The effort related to math was not elaborated as much as in the previous example. Words in bold belong to the word categories linguistic dimensions and positive emotion.

*"Mathematics, **a** subject **that** elicits **mixed** emotions **from** individuals, **has unfortunately stirred a** deep-seated disdain **within me**. **The** complexity **and** abstract nature **of the** subject **have** left **me** feeling frustrated **and** disconnected. **From my early educational** experiences, **I** struggled **to** grasp **the** concepts **presented to me**. **The** formulas **and** equations **seemed** convoluted, **and the** rigid rules stifled **my creativity**. **The** process **of** problem-solving **felt like an** arduous chore, draining **me of enthusiasm and** motivation. **Additionally**, **the** pressure **to perform well in** maths, **coupled with the constant** comparison **to** peers **who** seemingly effortlessly **excelled in the** subject, **only heightened my dislike**. **The** fear **of** failure **and the** anxiety associated **with** maths tests **and** examinations **further** reinforced **my** negative perception. **Moreover**, **the** disconnect **between the** theoretical concepts **and their practical** applications left **me questioning the** relevance **of** mathematics **in my everyday** life. **The** inability **to** discern **its direct** impact **on my personal** interests **and** pursuits **added to my** aversion. **While I** acknowledge **the** importance **of** mathematics **in various** fields **and the logical** reasoning **it** cultivates, **my** struggles **and negative** experiences **have** overshadowed **any** potential **appreciation**. **As a** result, **the** subject **has become a** source **of** frustration, anxiety, **and a** barrier **to my academic** aspirations. **However**, **I recognize that my dislike for** maths **is** subjective **and does not** diminish **its** significance **in the** world. **It is a personal** challenge **that I** strive **to overcome**, seeking alternative approaches **and** avenues **to** develop **a more positive and** constructive relationship **with the** subject."*

The text below is one example of an expressive writing response from a participant with a high score on MA in the control group. It contains more descriptions of feelings about math compared with the previous example. The effort related to math was not elaborated as much as in the previous example. Words in bold belong to the word categories numbers and perception.

*"Last night I **went** to a restaurant with a group of colleagues from my company. The restaurant is called barca. It's a tapas restaurant, and we ate a variety of small plates/dishes. We started with bread with aioli, chorizo and manchego, followed by a celery soup. All were amazing. The main course **contained** gambas, albondigas (small meatballs) and tacos. **In** addition we were served calamaris and patatas bravas with a special sauce. For dessert we had churros with a chocolate sauce. This all accompanied by a nice spanish **white** wine from **2017** (which is a good year, allegedly). It paired very well with the food. I was only a little disappointed with the lack of vegetarian options (I'm not vegetarian, but I do enjoy vegetables). We **closed** off with coffee and tea at the end, though I skipped this because I had had enough (and I don't sleep well from caffeine, I have been trying to quit coffee)."*

No examples of an expressive writing response from participants with a low score on MA from the control group are provided since no word category had a significant correlation with low MA.

5.3. Self-esteem Affects Language Pattern

Table 5.2 shows the word categories which had significant correlations with self-esteem levels. The whole analysis table is presented in Appendix B.

In the total sample, the word categories analytical thinking (r = 0.229, p < .05), emotional tone (r = 0.211, p < .05), total pronouns (r = -0.261, p < .01), personal pronouns (r = -0.319, p < .01), determiners (r = 0.308, p < .01), articles (r = 0.359, p < .001), numbers (r = -0.244, p <

.05), common verbs (r = -0.200, p < .05), affect (r = 0.214, p < .05), positive tone (r = 0.245, p < .05), space (r = -0.248, p < .05), and social referents (r = -0.241, p < .05) were significantly correlated with low self-esteem, while the word categories big words (r = -0.241, p < .001), linguistic dimensions (r = 0.207, p < .05), total function words (r = 0.265, p < .001), auxiliary verbs (r = 0.231, p < .05), conjunctions (r = 0.195, p < .05), quantities (r = 0.278, p < .01), cognitive processes (r = -0.198, p < .05), past focus (r = 0.230, p < .05), allure (r = 0.221, p < .05), and insight (r = -0.339, p < .001) were correlated with high self-esteem. Low self-esteem and high self-esteem thus came with different correlated word categories.

Expressive Writing Group
In the expressive writing group, the word categories total pronouns (r = -0.330, p < .05), personal pronouns (r = -0.411, p < .01), determiners (r = 0.264, p < .05), articles (r = 0.344, p < .01), perception (r = -0.303, p < .05), and space (r = -0.330, p < .05) were significantly correlated with low self-esteem, while the word categories total function words (r = 0.292, p < .05), auxiliary verbs (r = 0.273, p < .05), adverbs (r = 0.276, p < .05), quantities (r = 0.458, p < .001), cognitive processes (r = -0.312, p < .05), past focus (r = 0.307, p < .05), allure (r = 0.268, p < .05), and insight (r = -0.411, p < .01) were significantly correlated with high self-esteem.

Control Group
In the control group, the word categories emotional tone (r = 0.370, p < .05), determiners (r = 0.330, p < .05), articles (r = 0.321, p < .05), affect (r = 0.332, p < .05), positive tone (r = 0.361, p < .05), social behavior (r = 0.301, p < .05), and motion (r = 0.306, p < .05) were significantly correlated with low self-esteem, while no word category was correlated with high self-esteem.

Table 5.2: Language Inventory Word Count (LIWC) and Self-esteem (SE) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low SE	High SE	Low SE	High SE	Low SE	High SE
WC	0.229*	0.059	0.312*	0.171	0.179	-0.033
Analytic	0.229*	-0.155	0.191	-0.094	0.234	-0.223
Tone	0.211*	0.080	0.370*	-0.052	0.050	0.091
BigWords	0.117	-0.241**	0.259	-0.218	0.121	-0.229
Dic	-0.172	0.266**	-0.001	0.223	-0.257	0.281*
Linguistic	0.189	0.207*	-0.116	0.151	-0.204	0.251
function	-0.154	0.265**	-0.060	0.204	-0.169	0.292*
pronoun	-0.261**	0.050	-0.153	0.126	-0.330*	0.023
ppron	-0.319**	0.035	-0.205	0.088	-0.411**	0.013
det	0.308**	0.132	0.330*	0.079	0.264*	0.115
article	0.359***	0.026	0.321*	0.099	0.344**	-0.099
number	-0.244*	0.044	-0.238	-0.094	-0.215	0.097
auxverb	0.071	0.231*	-0.161	0.162	-0.029	0.273*
adverb	-0.162	0.145	-0.189	-0.073	-0.102	0.276*
conj	-0.135	0.195*	-0.072	0.118	-0.163	0.227
verb	-0.200*	0.137	-0.244	0.066	-0.165	0.191
quantity	-0.008	0.278**	0.062	0.031	0.020	0.458***
cogproc	-0.113	-0.198*	0.019	0.051	-0.018	-0.312*
Perception	-0.158	-0.145	0.087	-0.132	-0.303*	-0.174
focuspast	-0.036	0.230*	-0.081	0.078	-0.095	0.307*
Affect	0.214*	0.120	0.332*	0.009	0.083	0.141
tone_pos	0.245*	0.109	0.361*	-0.018	0.079	0.148
space	-0.248*	-0.125	0.026	-0.127	-0.330*	-0.086
allure	-0.136	0.221*	-0.162	0.113	-0.167	0.268*
socrefs	-0.241*	0.018	-0.168	0.133	-0.222	-0.014
insight	-0.017	-0.339***	0.182	-0.232	0.131	-0.411**
socbehav	0.068	-0.034	0.301*	0.144	-0.067	-0.116
motion	0.092	-0.143	0.306*	-0.259	-0.013	-0.122

Text Examples

The text below is one example of an expressive writing response from a participant with a low score on self-esteem. It describes a relatively negative previous math-related experience. Words in bold belong to the word categories total pronouns, personal pronouns, determiners, articles, perception, and space.

*"**I** have always been **good** at mathematics ever since **I** was young. **The** entire family boasted of producing **excellent** mathematicians and **I carried the** badge on **my** sleeves. **All** was **well in my** junior high school and **I** was always **top** of class, until **my first** year of senior high school when **I** was selected to take part **in a** maths contest. **The** name of **the** contest was [...] and **it** had individuals from **all over the world** taking part **in it**. **I** honestly prepared **well** for **the** contest, **backed up** by **the** tremendous **confidence that I** had **in my** ability. **My** teachers and colleagues knew **that I** was definitely going to ace **the** paper. On **the** day of **the** contest **I** polished **up the** areas **I** thought would be **a challenge**, since **I** had **gone** through **some** past papers of **the** competition. So **the** drama began right after **I** was handed **the** exam paper while **in the** exam **room**. **I** literally froze. **I went** through **the** entire question paper and **I saw** stars. **It** took **me** about **fifteen** minutes to **regain my senses** and begin **the** paper. Needless to say, **it** gave **me a** thorough whipping. **I** have never performed so dismally **in an** exam **in my** entire life. However, **this opened my eyes** to **the** fact **that one** can be so **much** prepared for **something** but fail at **it** altogether. Mental preparation is **what** really matters. **I** froze because **I** had not prepared **myself** mentally for **the***

*event. **I** only thought **that** being **good** at mathematics would be **enough** to make **me sail** through. **The** subsequent years were favorable to **me** and **I** really did perform **well**, having had an experience of **what the** contest is **all** about."*

The text below is one example of an expressive writing response from a participant with a high score on self-esteem. It contains more feelings about math, and provides two relatively negative math-related experiences, also using emotion words. Words in bold belong to the word categories total function words, auxiliary verbs, adverbs, quantities, cognitive processes, past focus, allure, and insight.

*"**From** elementary school **to** high school, **I was quite** confident **with my** math skills, **even if I met some difficulties**, **I could** overcome **it through many** way. **By** asking teachers **or** classmates **or** taking **extra** training classes **to** help **me** improving **my** math. **However**, **when I entered to the** undergraduate, **I started learning calculus**, **this** course **is much** harder **than any other** mathematic subject **that I ever took**. **I was** struggling **with learning it**, **and the** undergraduate **is not like** high school, **nobody will** care **about your** actual **learning results**, **only myself**. **When I was** frustrated **by calculus**, **I didn't work well on the** weekly assignment, **and finally** gain **a really** bad grade **for it**, **but luckily I passed it**. **When I was in the second year of** undergraduate, **there is another** course **called multiplied-calculus**, **which is even** harder **than the calculus**. **But luckily I still passed this** course **but with a really low** grade, **then I** swear **I won't** study **any other** mathematic course **anymore**."*

5.4. Curiosity Affects Language Pattern

5.4.1. Joyous Exploration Affects Language Pattern

Table 5.3 shows the word categories which had significant correlations with joyous exploration levels. The whole analysis table is presented in Appendix B.

In the total sample, the word category total function words (r = 0.219, p < .05) was significantly correlated with low joyous exploration, while the word categories analytical thinking (r = -0.275, p < .01), linguistic dimensions (r = 0.232, p < .05), total function words (r = 0.241, p < .05), total pronouns (r = 0.192, p < .05), determiners (r = -0.330, p < .001), articles (r = -0.292, p < .01), numbers (r = 0.203, p < .05), auxiliary verbs (r = 0.267, p < .01), adverbs (r = 0.214, p < .05), common verbs (r = 0.208, p < .05), quantities (r = 0.239, p < .05), cognition (r = 0.246, p < .05), cognitive processes (r = 0.240, p < .05), affect (r = -0.192, p < .05), physical (r = -0.269, p < .01), work (r = 0.204, p < .05), food (r = -0.273, p < .01), differentiation (r = 0.232, p < .05), present focus (r = 0.217, p < .05), and causation (r = 0.339, p < .001) were significantly correlated with high joyous exploration.

Expressive Writing Group

In the expressive writing group, no word category was significantly correlated with low joyous exploration, while the word categories 2nd person (r = -0.297, p < .05), determiners (r = -0.305, p < .05), and cause (r = 0.350, p < .05) were significantly correlated with high joyous exploration.

Control Group

In the control group, the word categories total function words (r = 0.377, p < .05), quantities (r = 0.365, p < .05), social behavior (r = 0.323, p < .05), and insight (r = 0.427, p < .01) were significantly correlated with low joyous exploration, while the word category work (r = -0.258,

$p < .05$) was significantly correlated with high joyous exploration.

Table 5.3: Language Inventory Word Count (LIWC) and Joyous Exploration (JE) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low JE	High JE	Low JE	High JE	Low JE	High JE
Analytic	-0.009	-0.275**	-0.071	-0.084	0.030	-0.284
Linguistic	0.152	0.232*	0.262	0.059	0.084	0.245
function	0.219*	0.241*	0.377*	0.120	0.140	0.238
pronoun	0.101	0.192*	0.090	0.033	0.114	0.178
you	0.058	-0.134	0.167	0.010	0.036	-0.297*
det	0.185	-0.330***	0.196	-0.122	0.158	-0.305*
article	0.099	-0.292**	0.014	-0.026	0.121	-0.227
number	0.021	0.203*	0.081	0.002	0.043	0.139
auxverb	0.063	0.267**	0.244	0.155	-0.038	0.280
adverb	0.029	0.214*	0.045	0.047	0.035	0.165
verb	0.046	0.208*	0.190	0.064	-0.056	0.197
quantity	0.081	0.239*	0.365*	-0.014	-0.033	0.211
Cognition	-0.001	0.246*	0.227	-0.058	0.008	0.039
cogproc	-0.0003	0.240*	0.154	-0.055	0.042	0.029
Affect	-0.154	-0.192*	-0.253	0.053	-0.131	-0.086
physical	0.003	-0.269**	-0.189	-0.023	0.009	0.123
work	-0.080	0.204*	0.066	-0.258*	-0.044	-0.066
food	0.044	-0.273**	-0.106	-0.039	0.103	0.056
socrefs	0.115	0.086	0.323*	0.206	0.035	-0.123
insight	-0.001	0.023	0.427**	-0.146	-0.002	-0.273
differ	0.041	0.232*	0.026	-0.013	0.084	0.146
focuspresent	-0.104	0.217*	-0.108	0.073	-0.091	0.160
cause	0.099	0.339***	0.192	0.019	0.098	0.350*

Text Examples

The text below is one example of an expressive writing response from a participant with a high score on joyous exploration. It describes a math exam and feelings about it from a relatively objective perspective. Words in bold belong to the word categories 2nd person, determiners, and cause.

*"When I was in high school, as **a** student from [...], **the** difficulty of **the** math section in **the** national college entrance examination (gaokao) was well-known. During regular mock tests, we would often encounter questions **that** went beyond **the** syllabus. **Once** we got stuck on **a** particular question, especially in **the first** half of **the** exam, it would greatly **affect our** mindset. We would feel **that** we couldn't solve **the** previous questions, and **the** ones ahead would only get harder. As **a result**, **our** mindset would crumble, and at **the** same time, **the** two-hour exam didn't **allow** us to spend **too much** time on **a single** question. We would be **forced** to give up on answering **that** question and move on to others. However, at **that** moment, **you** would already have **a** rough estimation of **your** score, knowing **that** it wouldn't be high **this** time."*

No examples of an expressive writing response from participants with a low score on joyous exploration are provided since no word category had a significant correlation with low joyous exploration.

5.4.2. Deprivation Sensitivity Affects Language Pattern

Table 5.4 shows the word categories which had significant correlations with deprivation sensitivity levels. The whole analysis table is presented in Appendix B.

In the total sample, the word categories determiners ($r = 0.216$, $p < .05$), past focus ($r = 0.270$, $p < .01$), positive emotion ($r = 0.234$, $p < .05$), and motion ($r = 0.236$, $p < .05$) were significantly correlated with low deprivation sensitivity, while the word categories analytical thinking ($r = -0.198$, $p < .05$), linguistic dimensions ($r = 0.197$, $p < .05$), total function words ($r = 0.191$, $p < .05$), 1st person singular ($r = 0.206$, $p < .05$), auxiliary verbs ($r = 0.198$, $p < .05$), conjunctions ($r = 0.197$, $p < .05$), and common adjectives ($r = 0.209$, $p < .05$) were significantly correlated with high deprivation sensitivity.

Expressive Writing Group

In the expressive writing group, the word categories total pronouns ($r = 0.271$, $p < .05$), personal pronouns ($r = 0.384$, $p < .01$), 1st person singular ($r = 0.351$, $p < .01$), and food ($r = -0.424$, $p < .001$) were significantly correlated with low deprivation sensitivity, while the word categories analytical thinking ($r = -0.351$, $p < .01$), big words ($r = -0.277$, $p < .05$), linguistic dimensions ($r = 0.367$, $p < .01$), total function words ($r = 0.304$, $p < .05$), 1st person singular ($r = 0.294$, $p < .05$), article ($r = -0.298$, $p < .05$), auxiliary verbs ($r = 0.286$, $p < .05$), conjunctions ($r = 0.383$, $p < .05$), common verbs ($r = 0.330$, $p < .05$), and time ($r = 0.315$, $p < .05$) were significantly correlated with high deprivation sensitivity.

Control Group

In the control group, the word categories determiners ($r = 0.346$, $p < .05$), drives ($r = 0.313$, $p < .05$), physical ($r = -0.335$, $p < .05$), positive tone ($r = 0.343$, $p < .05$), food ($r = -0.322$, $p < .05$), present focus ($r = -0.494$, $p < .001$), and motion ($r = 0.309$, $p < .05$) were significantly correlated with low deprivation sensitivity, while no word category was significantly correlated with high deprivation sensitivity.

Table 5.4: Language Inventory Word Count (LIWC) and Deprivation Sensitivity (DS) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low DS	High DS	Low DS	High DS	Low DS	High DS
WC	0.176	-0.148	0.413**	0.119	-0.007	-0.298*
Analytic	-0.001	-0.198*	0.112	0.016	-0.100	-0.351**
BigWords	-0.115	-0.151	0.116	0.104	-0.163	-0.277*
Dic	0.142	0.207*	0.089	-0.180	0.194	0.390**
Linguistic	0.108	0.197*	0.065	-0.028	0.159	0.367**
function	0.170	0.191*	0.212	0.009	0.177	0.304*
pronoun	0.097	0.117	-0.057	0.025	0.271*	0.210
ppron	0.136	0.145	-0.074	0.073	0.384**	0.203
i	0.140	0.206*	-0.173	0.063	0.351**	0.294*
det	0.216*	-0.141	0.346*	-0.045	0.085	-0.248
article	0.149	-0.132	0.157	0.065	0.059	-0.298*
auxverb	0.062	0.198*	-0.059	0.048	0.131	0.286*
conj	0.119	0.197*	0.201	-0.191	0.036	0.383**
verb	0.100	0.142	0.009	-0.123	0.183	0.330*
adj	-0.098	0.209*	-0.229	0.246	-0.012	0.201
focuspast	0.270**	0.085	0.233	-0.077	0.250	0.224
Drives	-0.022	-0.053	0.313*	-0.014	-0.128	-0.075
physical	-0.009	0.052	-0.335*	0.068	-0.152	0.004
tone_pos	0.180	0.066	0.343*	-0.018	-0.026	0.149
food	-0.027	0.033	-0.322*	0.031	-0.424***	-0.087
time	0.014	0.122	-0.018	-0.135	0.020	0.315*
focuspresent	-0.167	0.092	-0.494***	0.003	-0.008	0.137
emo_pos	0.234*	0.051	0.223	-0.083	0.189	0.157
motion	0.236*	0.012	0.309*	-0.133	0.172	0.085

Text Examples

The text below is one example of an expressive writing response from a participant with a low score on deprivation sensitivity. It describes a relatively negative math-related experience and feelings about math. Words in bold belong to the word categories total pronouns, personal pronouns, 1st person singular, and food.

*"9*9 multiplication table is mandatory to remember at elementary school, and* ***i*** *hated* ***it*** *when* ***i*** *was a child, for that summer,* ***i*** *cried while trying to memories* ***it*** *since* ***my*** *parents are pressuring* ***me****. Many foreigners came up and trying to let loose of* ***my*** *parents saying don't do* ***that****,* ***its*** *summer break. well, after memorizing the table,* ***it*** *does come in handy, and I also noticed* ***that*** *many people* ***who*** *don't know the table cant really calculate the basic multiplication by head. Although, dozens of people are good at maths,* ***I*** *can't say the table improves* ***your*** *ability to solve mathematical questions,* ***it*** *actually has nothing to do with maths except for* ***what you*** *are trying to remember is numbers instead of words."*

The text below is one example of an expressive writing response from a participant with a high score on deprivation sensitivity. It describes a relatively positive math-related experience. Words in bold belong to the word categories linguistic dimensions, total function words, 1st person singular, article, auxiliary verbs, conjunctions, common verbs, and time.

*"****This is an*** *authentic story* ***of me****,* ***totally real****.* ***When I enter the*** *senior* ***high school****,* ***I could not*** *catch* ***the*** *step* ***of my*** *math teacher* ***so my*** *math* ***is rather poor****.* ***But the*** *math teacher* ***kept*** *teaching* ***at a super rapid speed****,* ***so I kind of gave up the*** *math subject.* ***However****,* ***things have taken a turn when I enter*** *senior 2.* ***Our*** *math*

teacher ***changed to a very handsome young*** *man* ***that*** *year,* ***who taught in great*** *detail* ***and with much*** *patience.* ***There was something*** *captivating* ***about the*** *way* ***he explained complex*** *ideas,* ***and I couldn't*** *help* ***but be*** *drawn* ***to him****. Determined* ***to*** *impress* ***him and prove myself, I made a firm*** *decision* ***to take*** *math* ***seriously****. I moved my seat* ***to the*** *side* ***of the*** *podium,* ***ensuring I had a*** *front-row view* ***of his*** *teachings.* ***I*** *diligently* ***took*** *notes* ***during*** *class* ***and spent hours practicing*** *problems* ***after*** *school.* ***Luckily, All my hard work paid off, and I began to make*** *remarkable* ***progress in*** *math.* ***I noticed that he started to take notice of me too****. When I had something unclear,* ***he would explain*** *gently* ***and*** *in detail,* ***just for me, whether in*** *class* ***or in his*** *office* ***after*** *class.* ***Yes, so****, math* ***became my*** *advantage* ***eventually****. He became more than just an educator,* ***he became a*** *friend* ***and*** *mentor.* ***The beautiful*** *memories* ***of that*** *time* ***will always hold a special*** *place* ***in my*** *heart.* ***Even though our*** *paths* ***have*** *diverged* ***since then, he will forever*** *remain* ***an*** *influential figure* ***in my*** *life.* ***His*** *dedication* ***and*** *belief* ***in me*** *ignited* ***a*** *passion* ***for*** *math* ***that continues to this day****. And while he may not realize it, his impact* ***goes far beyond the*** *classroom.* ***He*** *instilled* ***in me the*** *importance* ***of*** *perseverance,* ***hard work, and the*** *power* ***of a caring*** *teacher."*

5.4.3. Social Curiosity Affects Language Pattern

Table 5.5 shows the word categories which had significant correlations with social curiosity levels. The whole analysis table is presented in Appendix B.

In the total sample, no word category was significantly correlated with low social curiosity, while the word category adverbs ($r = 0.203$, $p < .05$) was significantly correlated with high social curiosity.

Expressive Writing Group

In the expressive writing group, no word category was significantly correlated with low social curiosity, while the word categories linguistic dimensions ($r = 0.278$, $p < .05$), total function words ($r = 0.298$, $p < .05$), and adverbs ($r = 0.264$, $p < .05$) were significantly correlated with high social curiosity.

Control Group

In the control group, the word categories drives ($r = -0.358$, $p < .05$) and affiliation ($r = -0.344$, $p < .05$) were significantly correlated with low social curiosity, while the word category determiners ($r = -0.270$, $p < .05$) was significantly correlated with high social curiosity.

Table 5.5: Language Inventory Word Count (LIWC) and Social Curiosity (SC) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low SC	High SC	Low SC	High SC	Low SC	High SC
Dic	-0.216*	0.140	-0.373*	0.031	-0.122	0.213
Linguistic	-0.069	0.169	-0.157	0.072	-0.013	0.278*
function	-0.105	0.161	-0.217	-0.018	-0.051	0.298*
det	-0.027	-0.064	0.083	-0.270*	-0.110	0.022
adverb	-0.049	0.203*	-0.173	0.194	-0.0001	0.264*
Drives	-0.119	-0.024	-0.358*	0.077	-0.030	-0.096
affiliation	-0.173	0.003	-0.344*	0.130	-0.074	-0.144

Text Examples

The text below is one example of an expressive writing response from a participant with a high score on social curiosity. It describes an experience of working hard for math and finally

getting good results. Words in bold belong to the word categories linguistic dimensions, total function words, and adverbs.

*"Mehn Failing **a** math test **can be a challenging and** discouraging experience, **but it can also** serve **as a turning** point **and a**n opportunity **for** growth. failure **in a** math test **ultimately made me stronger in the** subject. **I have always** struggled **with** math. **Despite my best** efforts, **i consistently found myself** scoring **poorly on** tests **and** struggling **to** grasp **key** concepts. **It was a constant** source **of** frustration **and** self-doubt. **One day**, **i** received the results **of a particularly important** math test, **and it was** devastating. **I had** failed, **and my** dreams **of** improving **in** math skills **and** pursuing **a** math-related career **felt** shattered. **But instead of giving up**, **i decided to use this** failure **as a** catalyst **for** change. **I** sought guidance **from my** math teacher, **asking for extra** help **and** clarification **on the** topics **i found challenging**. **The** teacher **recognized my** determination **and** provided **additional** resources, recommended **online** tutorials, **and** offered one-on-one tutoring sessions. **I also** adopted **a** growth mindset, understanding **that** intelligence **and** mathematical abilities **could be** developed **with** effort **and** perseverance.**i** embraced **the** idea **that** mistakes **and** failures **were** stepping stones **to** success **rather than** indicators **of** incompetence. **With a** newfound determination, **I actually** immersed **myself in** math practice **and I spent extra** time **working through** problem sets, seeking **out challenging** math puzzles, **and** participating **in** math competitions **and** clubs. **I** sought opportunities **to** apply math **to** real-life situations **and discovered its** relevance **and** practicality. **Along the** way, **I later discovered the** power **of** perseverance **and resilience**. **I** faced **so many** setbacks **and** encountered **difficult** problems, **but am** determined **and I** refused **to let them** deter **me**. **I saw each** mistake **as a valuable** learning opportunity, analyzing **her** errors, **and** adjusting **her** approach. **My hard work and** dedication **started to** pay off. **Slowly but surely**, **i began to see** improvements **in my** math skills. **The** topics **that once seemed** insurmountable **became more** understandable, **and my** confidence **grew**. **I went from** failing tests **to** achieving **passing** grades **and eventually excelling in** math. **Through this** transformative journey, **not only did I** developed **a solid** foundation **in** mathematics **but also** gained invaluable life skills.**i learned the** importance **of resilience**, determination, **and the** ability **to learn from** failures. **My** experience **taught me that** success **in** math, **like many other** endeavors, requires effort, perseverance, **and the** belief **in** one's own potential. **In the** end, failing **that initial** math test **became the** catalyst **for my** transformation **and ultimate** success **in the** subject. **My** journey exemplifies **the** idea **that** failure **can be a** stepping stone **to** growth **and that with the** right mindset **and** dedication, **anyone can overcome** obstacles **and** excel **in** mathematics."*

No examples of an expressive writing response from a participant with a low score on social curiosity is provided, since no word category had a significant correlation with low social curiosity.

5.4.4. Thrill Seeking Affects Language Pattern

Table 5.6 shows the word categories which had significant correlations with thrill seeking levels. The whole analysis table is presented in Appendix B.

In the total sample, the word categories total pronouns (r = -0.207, $p < .05$), personal pronouns (r = -0.212, $p < .05$), 3rd person plural (r = -0.247, $p < .05$), past focus (r = 0.292, $p < .01$), social processes (r = -0.254, $p < .05$), and social behavior (r = -0.266, $p < .01$) were significantly correlated with low thrill seeking, while the word categories analytical thinking (r = -0.182, $p < .05$), big words (r = -0.193, $p < .05$), linguistic dimensions (r = 0.238, $p < .01$), total function words (r = 0.257, $p < .01$), auxiliary verbs (r = 0.243, $p < .01$), adverbs (r = 0.182, $p < .05$), common verbs (r = 0.221, $p < .05$), quantities (r = 0.186, $p < .05$), positive tone (r = -0.181, $p < .05$), allure (r = 0.193, $p < .05$), and time (r = 0.211, $p < .05$) were significantly

correlated with high thrill seeking.

Expressive Writing Group
In the expressive writing group, the word categories analytical thinking ($r = 0.306$, $p < .05$), linguistic dimensions ($r = -0.298$, $p < .05$), total pronouns ($r = -0.393$, $p < .01$), 3rd person plural ($r = -0.380$, $p < .01$), impersonal pronouns ($r = -0.289$, $p < .05$), past focus ($r = 0.305$, $p < .05$), social processes ($r = -0.446$, $p < .01$), social behavior ($r = -0.455$, $p < .001$), and differentiation ($r = -0.359$, $p < .05$) were significantly correlated with low thrill seeking, while the word categories big words ($r = -0.280$, $p < .05$), linguistic dimensions ($r = 0.322$, $p < .01$), total function words ($r = 0.342$, $p < .01$), auxiliary verbs ($r = 0.345$, $p < .01$), common verbs ($r = 0.284$, $p < .05$), and insight ($r = -0.301$, $p < .05$) were significantly correlated with high thrill seeking.

Control Group
In the control group, the word categories impersonal pronouns ($r = 0.366$, $p < .05$), common verbs ($r = 0.307$, $p < .05$), cognition ($r = 0.512$, $p < .001$), cognitive processes ($r = 0.486$, $p < .001$), physical ($r = -0.320$, $p < .05$), food ($r = -0.301$, $p < .05$), and insight ($r = 0.418$, $p < .01$) were significantly correlated with low thrill seeking, while the word categories cognition ($r = 0.336$, $p < .05$), cognitive processes ($r = 0.331$, $p < .05$), affect ($r = -0.304$, $p < .05$), lifestyle ($r = -0.386$, $p < .01$), positive tone ($r = -0.315$, $p < .05$), and cause ($r = 0.322$, $p < .05$) were significantly correlated with high thrill seeking.

Table 5.6: Language Inventory Word Count (LIWC) and Thrill Seeking (TS) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low TS	High TS	Low TS	High TS	Low TS	High TS
WC	0.149	-0.169	0.331*	-0.260	0.002	-0.135
Analytic	0.151	-0.182*	-0.084	-0.151	0.306*	-0.211
BigWords	0.103	-0.193*	0.163	-0.027	0.123	-0.280*
Linguistic	-0.101	0.238**	0.213	0.114	-0.298*	0.322**
function	-0.082	0.257**	0.210	0.082	-0.248	0.342**
pronoun	-0.207*	0.130	-0.004	0.159	-0.393**	0.118
ppron	-0.212*	0.100	-0.144	0.107	-0.278	0.102
they	-0.247*	-0.042	0.111	-0.224	-0.380**	0.005
ipron	-0.062	0.109	0.366*	0.198	-0.289*	0.063
auxverb	-0.059	0.243**	0.189	0.024	-0.225	0.345**
adverb	0.040	0.182*	0.155	0.190	0.009	0.193
verb	0.004	0.221*	0.307*	0.118	-0.228	0.284*
quantity	-0.075	0.186*	0.224	0.142	-0.232	0.229
Cognition	-0.015	0.032	0.512***	0.336*	-0.151	-0.029
cogproc	0.001	-0.010	0.486***	0.331*	-0.106	-0.114
focuspast	0.292**	0.126	0.246	0.067	0.305*	0.174
Social	-0.254*	-0.013	0.120	-0.007	-0.446**	-0.012
Affect	0.030	-0.159	0.069	-0.304*	-0.032	-0.154
Lifestyle	0.037	-0.080	0.040	-0.386**	0.202	-0.040
physical	-0.041	0.032	-0.320*	0.005	-0.004	0.099
tone_pos	0.072	-0.181*	0.042	-0.315*	0.048	-0.212
food	-0.035	0.018	-0.301*	0.014	0.129	-0.011
allure	-0.088	0.193*	0.133	0.131	-0.266	0.230
time	0.139	0.211*	0.071	0.203	0.190	0.223
socrefs	-0.266**	0.015	0.123	0.039	-0.455***	0.010
insight	0.067	-0.174	0.418**	0.046	0.087	-0.301*
differ	-0.163	0.043	0.211	0.219	-0.359*	0.005
cause	0.092	0.150	0.291	0.322*	0.001	0.129

Text Examples

The text below is one example of an expressive writing response from a participant with a low score on thrill seeking. It describes a relatively negative math-related experience. Words in bold belong to the word categories linguistic dimensions, total pronouns, 3rd person plural, impersonal pronouns, past focus, social processes, social behavior, and differentiation.

*"**There was one** time **my high school had organized a** school math competition. **Since I was considered to be really** good **at** math, **my teacher sought me out outside of our** lessons **to ask me to represent my** class. **I was flattered, but I told her that I have no** intentions **of** competing. **I had no** interest **in taking part in** competitions **such as that one, as I felt they were a** waste **of** time **and I had little to** gain **from them**. **However, she would hear none of it**. **She insisted that I had to enter, and that it would be a** illogical **for me not to**. **In the** end **I gave in**. **However, when the** time **came, I did extremely poorly, as I did not wish to be there and could not** focus **on the** tasks **we were given**. **Afterwards I felt like utter** garbage, **questioning if I really am** good **at** math, **or if it is just that my classmates are worse**. **My teacher must have felt bad after seeing my** scores, **and so she sought me out again, and apologized to me for** forcing **me to attend when I did not want to**. **She never asked me again to** compete, **but she still insisted that I am really** good **at** math, **I just need to want it for myself**."*

The text below is one example of an expressive writing response from a participant with a

high score on thrill seeking. It describes a relatively positive math-related experience. Words in bold belong to the word categories linguistic dimensions, total function words, auxiliary verbs, common verbs, and insight.

*"**During my high school years**, **I had a** math teacher **who was known for his** passion **and** enthusiasm **for the** subject. **He had a unique** way **of making** math **come alive and** capturing **our** attention. **One day**, **he** introduced **us to the concept of** logarithms. **At first**, **it seemed like a complex and unfamiliar** territory, **but our** teacher **was determined to make it understandable and enjoyable**. **He started by explaining the** basics, breaking **down the definition of** logarithms **and their** relationship **to** exponential functions. **He drew** diagrams **on the** board, showing **us how** logarithms **could** transform **complicated calculations into simpler** ones. **To** reinforce **our understanding**, **he gave us a variety of** real-world problems **to solve using** logarithms. **We tackled everything from** population growth **to** measuring **the** intensity **of** earthquakes. **It was fascinating to see how** logarithms **could** simplify **these complex** scenarios. **But what truly made this** math experience memorable **was the** interactive activity **our** teacher **organized**. **He** divided **us into small** groups **and gave each** group **a** set **of** logarithmic equations **to solve**. **We were** encouraged **to** collaborate, discuss **our** approaches, **and find creative solutions**. **As we** dove **into the** task, **the** classroom buzzed **with** energy. **We** engaged **in lively** discussions, debating **different** strategies **and exploring various** methods **to solve the** problems. **It was** amazing **to** witness **the collective** intelligence **of our** group **as we** combined **our** strengths **and learned from one another**. **After some** time, **our** teacher **asked each** group **to** present **their solutions**. **We were** amazed **at the diverse** range **of** approaches **and insights that** emerged. **It was a powerful** reminder **that there is often more than one** way **to solve a** mathematical problem, **and each** approach offers **its** own **unique perspective**. **That day**, **I not only** gained **a solid understanding of** logarithms **but also realized the** value **of** collaboration **and the** joy **of learning** math together. **It was a** math experience **that** transcended **the** classroom, **leaving a lasting** impression **on me and** instilling **a** love **for exploration** and teamwork **in** mathematics."*

5.4.5. Stress Tolerance Affects Language Pattern

Table 5.7 shows the word categories which had significant correlations with stress tolerance levels. The whole analysis table is presented in Appendix B.

In the total sample, the word categories past focus (r = 0.233, p < .05), insight (r = 0.234, p < .05), and achievement (r = 0.207, p < .05) were significantly correlated with low stress tolerance, while the word categories authentic (r = -0.255, p < .01), emotional tone (r = 0.231, p < .05), determiners (r = 0.205, p < .05), articles (r = 0.265, p < .01), numbers (r = -0.183, p < .05), cognition (r = -0.343, p < .001), cognitive processes (r = -0.357, p < .001), affect (r = 0.231, p < .05), lifestyle (r = -0.223, p < .05), physical (r = 0.255, p < .01), positive tone (r = 0.273, p < .01), work (r = -0.251, p < .01), food (r = 0.245, p < .01), insight (r = -0.303, p < .001), differentiation (r = -0.216, p < .05), present focus (r = -0.198, p < .05), and cause (r = 0.212, p < .05) were significantly correlated with high stress tolerance.

Expressive Writing Group

In the expressive writing group, the word categories words per sentence (r = -0.362, p < .01) and numbers (r = -0.299, p < .05) were significantly correlated with low stress tolerance, while the word categories cognition (r = -0.296, p < .05) and cognitive processes (r = -0.324, p < .05) were significantly correlated with high stress tolerance.

Control Group

In the control group, no word category was significantly correlated with low stress tolerance, while the word category 3rd person singular ($r = 0.303$, $p < .05$) was significantly correlated with high stress tolerance.

Table 5.7: Language Inventory Word Count (LIWC) and Stress Tolerance (ST) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low ST	High ST	Low ST	High ST	Low ST	High ST
Authentic	0.176	-0.255**	0.132	-0.120	0.030	-0.106
Tone	-0.103	0.231*	-0.027	0.172	0.023	0.030
WPS	-0.167	0.006	-0.070	0.053	-0.362**	-0.151
shehe	0.032	-0.036	0.220	0.303*	-0.079	-0.055
det	-0.130	0.205*	-0.095	0.182	-0.026	-0.060
article	-0.103	0.265**	-0.078	0.150	0.033	-0.046
number	-0.126	-0.183*	0.004	-0.234	-0.299*	-0.048
Cognition	0.127	-0.343***	-0.083	0.083	-0.059	-0.296*
cogproc	0.128	-0.357***	-0.078	0.047	-0.084	-0.324*
focuspast	0.233*	0.165	0.007	0.029	-0.219	0.194
Affect	-0.072	0.231*	-0.175	0.124	0.178	0.021
Lifestyle	0.123	-0.223*	-0.221	0.043	-0.116	0.059
physical	-0.124	0.255**	0.284	-0.182	0.064	0.238
tone_pos	-0.139	0.273**	-0.167	0.158	0.154	-0.020
work	0.160	-0.251**	-0.199	-0.009	-0.147	0.073
food	-0.126	0.245**	0.265	-0.190	0.109	0.184
insight	0.234*	-0.303***	-0.176	0.075	0.135	-0.235
differ	0.035	-0.216*	0.124	-0.031	-0.194	-0.173
achieve	0.207*	-0.097	-0.136	-0.254	0.187	-0.017
focuspresent	0.177	-0.198*	0.131	-0.222	0.159	0.001
cause	0.064	0.212*	0.029	-0.109	-0.011	0.008

Text Examples

The text below is one example of an expressive writing response from a participant with a low score on stress tolerance. It describes math-related experiences with relatively neutral emotions. Words in bold belong to the word category numbers.

*"Having studied maths for nearly **20** years, my memories of primary school maths are now stuck with the unit "**1**" and the chicken and rabbit cage in Year **6**. I don't know how I managed to figure out how many rabbits and chickens there were, and I even wondered how many feet a chicken had and how many feet a rabbit had. When I was an undergraduate, I saw a whistle blowing method on the internet to solve the chicken and rabbit cage problem, which was quite interesting. Alas, I have to say that if I were to reopen my **sixth** grade maths exercises, I probably wouldn't be able to do them without equations anymore. Then came the **first** year of maths. The **first** term of Year **7** seemed to me to be reduced to rational numbers and equations, which were not very different from Year **6** maths, so it was a bridging course. The **second** semester of Year **7** had the most basic geometry, and I only remember some topics related to angles, but I have forgotten the details, after all, it has been a long time since I had contact with junior high school mathematics. I spent the whole summer at home looking at plane geometry, especially congruent triangles, quadrilaterals and so on."*

The text below is one example of an expressive writing response from a participant with a high score on stress tolerance. It describes a relatively negative math-related experience. Words in

bold belong to the word categories cognition and cognitive processes.

*"I **recall** crying whilst my brother was attempting to **explain** math **problems** to me and **how** to **solve** them. He **would explain** them in a way that he **understood** them, **which** was a hard way for me to **understand**. I **would** cry out of desperation and him getting frustrated that I was **not** getting them right. Our mum **would** enter the room and tell him to be more patient with me and to continue supporting me. He **would** get even angrier that he is **made** to sit with me and **explain** stuff to me and me **not** getting it at the **same** time."*

5.5. Self-esteem Moderates the Relationship between Math Anxiety and Language Pattern

Table 5.8 shows word categories which have significant correlations with self-esteem levels in the expressive writing group. The whole analysis table is presented in Appendix B.

Expressive Writing Group

In the expressive writing group, among people with low MA, the word categories analytical thinking ($r = 0.333$, $p < .05$), total pronouns ($r = -0.427$, $p < .01$), personal pronouns ($r = -0.455$, $p < .01$), articles ($r = 0.431$, $p < .01$), negations ($r = -0.315$, $p < .05$), space ($r = -0.322$, $p < .05$), and differentiation ($r = -0.338$, $p < .05$) were significantly correlated with low self-esteem, while the word categories total function words ($r = 0.327$, $p < .05$), numbers ($r = 0.326$, $p < .05$), quantities ($r = 0.521$, $p < .001$), cognition ($r = -0.376$, $p < .05$), cognitive process ($r = -0.408$, $p < .01$), allure ($r = 0.332$, $p < .05$), and insight ($r = -0.472$, $p < .01$) were significantly correlated with high self-esteem.

Among people with high MA, the word categories clout ($r = -0.599$, $p < .05$), 1st person plural ($r = -0.0.599$, $p < .05$), determiners ($r = 0.511$, $p < .05$), affiliation ($r = -0.526$, $p < .05$), and achievement ($r = 0.512$, $p < .05$) were significantly correlated with low self-esteem, while the word category impersonal pronouns ($r = -0.563$, $p < .05$), physical ($r = 0.495$, $p < .05$), and anxiety emotion ($r = 0.436$, $p < .05$) were significantly correlated with high self-esteem.

Control Group

In the control group, among people with low MA, high SE was significantly correlated with the word category work ($r = 0.580$, $p < .05$) in the psychological processes dimension even if the writing topic was about describing food, which was a descriptive topic and unrelated to personal effort or personal achievement. No word category was correlated with low SE in the psychological processes dimension among people with low MA. In the linguistic dimension, among people with low MA, the word category personal pronouns ($r = -0.678$, $p < .001$), especially the word category 1st personal singular ($r = -0.596$, $p < .05$), was significantly and negatively correlated with low SE which means they were less focus on themselves. High SE was significantly and positively correlated with the word categories 3rd person plural ($r = 0.648$, $p < .05$) and impersonal pronouns ($r = 0.600$, $p < .05$).

Among people with high MA, in the psychological processes dimension, low SE was significantly and positively correlated with the word categories affect ($r = 0.480$, $p < .01$), positive tone ($r = 0.489$, $p < .01$), social behavior ($r = 0.427$, $p < .05$), and motion ($r = 0.516$, $p < .01$) and negatively correlated with the word category present focus ($r = -0.145$, $p < .05$). High SE was significantly and positively correlated with the word category differentiation ($r = 0.359$, p

< .05). In the linguistic dimension, low SE was significantly correlated with the word category negations (r = -0.433, p < .05), while the same results did not occur with high SE.

Table 5.8: Language Inventory Word Count (LIWC) and Self-esteem (SE) Correlations for Math Anxiety (MA)

Abbrev.	Low MA		High MA	
	Low SE	High SE	Low SE	High SE
Analytic	0.333*	-0.260	0.210	0.061
Clout	-0.002	-0.172	-0.599*	0.183
Dic	-0.405**	0.312	0.212	0.107
function	-0.256	0.327*	0.047	0.053
pronoun	-0.427**	0.030	-0.034	-0.201
ppron	-0.455**	-0.054	-0.331	0.011
we	0.104	-0.252	-0.599*	-0.062
ipron	0.068	0.127	0.355	-0.536*
det	0.244	0.126	0.511*	0.215
article	0.431**	-0.123	0.322	0.203
number	-0.244	0.326*	0.059	-0.062
negate	-0.315*	-0.072	-0.304	0.003
quantity	-0.023	0.521***	0.296	-0.041
Cognition	-1.08	-0.376*	0.068	-0.120
cogproc	-1.03	-0.408**	0.186	-0.234
physical	0.049	0.176	-0.229	0.495*
space	-0.322*	-0.115	-0.180	-0.041
allure	-0.184	0.332*	-0.297	0.035
insight	0.153	-0.472**	0.041	-0.230
affiliation	0.045	-0.195	-0.526*	-0.047
differ	-0.338*	-0.058	-0.004	0.210
achieve	0.113	0.063	0.512*	0.013
emo_anx	0.154	-0.162	0.095	0.436*

Text Examples

Table 5.9 shows text examples that reflect these features.

Table 5.9: Text Examples for Word Categories Correlated with High and Low Levels of Self-esteem

Level	Abbrev.	Text Example
Low	we	As **we** navigated through the bustling marketplace...
	affiliation	**Our** math teacher changed to a very handsome young man that year...
	achieve	He instilled in me the importance of perseverance, **hard work**, and...
	det	I just remembered **some** of **my** math teachers were tough to me.
High	ipron	**This** was the second exam out of 6, and if I did not write well...
	physical	It allowed us to visually **grasp** complex relationships between...
	emo_anx	Honestly, math subject and math teachers are equally **terrifying** to me.

5.6. Curiosity Moderates the Relationship between Math Anxiety and Language Pattern

5.6.1. Joyous Exploration Moderates the Relationship between Math Anxiety and Language Pattern

Table 5.10 shows the word categories which had significant correlations with joyous exploration levels in the expressive writing group. The whole analysis table is presented in Appendix

A.

Expressive Writing Group
Among people with low MA, the word category achievement (r = -0.340, $p < .05$) was significantly correlated with low joyous exploration, while the word categories 2nd person (r = -0.432, $p < .05$) and causation (r = 0.368, $p < .05$) were significantly correlated with high joyous exploration. Among people with high MA, the word category determiners (r = 0.410, $p < .05$) was significantly correlated with low joyous exploration, while the word categories analytical thinking (r = -0.632, $p < .05$), authentic (r = 0.554, $p < .05$), words per sentence (r = 0.737, $p < .01$), adverbs (r = 0.697, $p < .01$), conjunctions (r = 0.622, $p < .05$), negations (r = 0.596, $p < .05$), common adjectives (r = 0.689, $p < .01$), cognition (r = 0.627, $p < .05$), cognitive process (r = 0.586, $p < .05$), and differentiation (r = 0.667, $p < .05$) were significantly correlated with high joyous exploration.

Control Group
Among people with low MA, the word category anxiety (r = -0.632, $p < .05$) was significantly correlated with low joyous exploration, while word category work (r = -0.578, $p < .05$) was significantly correlated with high joyous exploration. Among people with high MA, no word category was significantly correlated with high joyous exploration, while the word categories physical (r = -0.681, $p < .001$), food (r = -0.581, $p < .01$), insight (r = 0.540, $p < .01$), and motion (r = 0.564, $p < .01$) were significantly correlated with low joyous exploration.

Table 5.10: Language Inventory Word Count (LIWC) and Joyous Exploration (JE) Correlations for Math Anxiety (MA)

Abbrev.	Low MA		High MA	
	Low JE	High JE	Low JE	High JE
Analytic	-0.060	-0.174	0.333	-0.632*
Authentic	-0.028	-0.010	0.148	0.554*
WPS	-0.066	-0.020	-0.011	0.737**
you	-0.050	-0.432*	0.059	0.348
det	0.076	-0.255	0.410*	-0.474
adverb	0.055	0.038	-0.033	0.697**
conj	-0.093	0.139	-0.131	0.622*
negate	0.191	-0.008	-0.360	0.596*
adj	-0.259	0.071	0.008	0.698**
Cognition	-0.023	-0.172	0.018	0.627*
cogproc	-0.005	-0.179	0.138	0.586*
differ	0.160	-0.073	-0.107	0.677*
achieve	-0.340*	0.115	0.200	-0.322
cause	0.123	0.368*	0.106	0.175

5.6.2. Deprivation Sensitivity Moderates the Relationship between Math Anxiety and Language Pattern

Table 5.11 shows the word categories which had significant correlations with deprivation sensitivity levels in the expressive writing group. The whole analysis table is presented in Appendix A.

Expressive Writing Group

Among people with low MA, low deprivation sensitivity was significantly correlated with the word categories clout (r = -0.332, p < .05), personal pronouns (r = 0.414, p < .01), 1st person singular (r = 0.439, p < .01), 1st person plural (r = -0.327, p < .05), past focus (r = 0.330, p < .05), food (r = -0.405, p < .01), and affiliation (r = -0.371, p < .05), while high deprivation sensitivity was significantly correlated with the word categories analytical thinking (r = -0.398, p < .05), big words (r = -0.433, p < .01), linguistic dimensions (r = 0.483, p < .01), auxiliary verbs (r = 0.391, p < .05), auxiliary verbs (r = 0.391, p < .05), conjunctions (r = 0.444, p < .01), common verbs (r = 0.473, p < .01), and time (r = 0.365, p < .05). Among people with high MA, low deprivation sensitivity was significantly correlated with the word category food (r = -0.657, p < .01), while high deprivation sensitivity was significantly correlated with the word categories 3rd person plural (r = 0.588, p < .05), affect (r = 0.676, p < .01), and positive emotion (r = 0.596, p < .01).

Control Group

Among people with low MA, the word categories quantities (r = 0.740, p < .01) and present focus (r = -0.648, p < .05) was significantly correlated with low deprivation sensitivity, while the word category number (r = 0.710, p < .01) was significantly correlated with high deprivation sensitivity. Among people with high MA, high deprivation sensitivity was significantly correlated with the word categories social (r = 0.375, p < .05), physical (r = -0.477, p < .01), food (r = -0.443, p < .05), and motion (r = 0.447, p < .05), while low deprivation sensitivity was significantly correlated with the word category common adjectives (r = 0.347, p < .05).

Table 5.11: Language Inventory Word Count (LIWC) and Deprivation Sensitivity (DS) Correlations for Math Anxiety (MA)

Abbrev.	Low MA		High MA	
	Low DS	High DS	Low DS	High DS
WC	-0.070	-0.398*	0.202	-0.096
Analytic	-0.130	-0.432**	0.006	-0.144
Clout	-0.332*	-0.244	0.164	-0.239
BigWords	-0.261	-0.433**	0.002	0.061
Dic	0.256	0.478**	0.066	0.147
Linguistic	0.211	0.483**	0.063	0.001
function	0.204	0.423**	0.142	0.012
ppron	0.414**	0.246	0.315	0.041
i	0.439**	0.276	0.094	0.253
we	-0.327*	-0.148	0.326	-0.396
they	-0.064	-0.115	-0.033	0.588*
auxverb	0.178	0.391*	0.007	0.121
conj	0.016	0.444**	0.046	0.180
verb	0.246	0.473**	0.015	0.020
focuspast	0.330*	0.239	0.135	0.142
Affect	0.043	0.093	0.069	0.676**
food	-0.405**	-0.044	-0.657**	-0.150
time	0.124	0.365*	-0.225	0.125
affiliation	-0.371*	-0.090	0.338	-0.350
emo_pos	0.195	-0.019	0.114	0.596**

5.6.3. Social Curiosity Moderates the Relationship between Math Anxiety and Language Pattern

Table 5.12 shows the word categories which had significant correlations with social curiosity levels in the expressive writing group. The whole analysis table is presented in Appendix A.

Expressive writing Group

Among people with low MA, low social curiosity was significantly correlated with the word category work (r = -0.319, p < .05), while high social curiosity was significantly correlated with the word categories analytical thinking (r = -0.354, p < .05), total function words (r = 0.410, p < .05), total pronouns (r = 0.321, p < .05), auxiliary verbs (r = 0.331, p < .05), negations (r = 0.406, p < .05), and differentiation (r = 0.351, p < .05). Among people with high MA, low social curiosity was significantly correlated with the word categories perception (r = -0.596, p < .05) and space (r = -0.632, p < .05), while high social curiosity was significantly correlated with the word category 3rd person plural (r = 0.533, p < .01).

Control Group

Among people with low MA, no word category was significantly correlated with both high and low social curiosity. Among people with high MA, low social curiosity was significantly correlated with the word categories drives (r = -0.435, p < .05) and affiliation (r = -0.394, p < .05), while high social curiosity was significantly correlated with the word categories adverbs (r = 0.412, p < .01), physical (r = 0.416, p < .01), time (r = 0.406, p < .01), and cause (r = 0.309, p < .05).

Table 5.12: Language Inventory Word Count (LIWC) and Social Curiosity (SC) Correlations for Math Anxiety (MA)

Abbrev.	Low MA		High MA	
	Low SC	High SC	Low SC	High SC
Analytic	0.088	-0.354*	-0.272	-0.015
function	-0.124	0.410*	0.421	0.162
pronoun	-0.026	0.321*	0.059	-0.063
they	0.032	0.115	0.287	0.533**
adverb	-0.044	0.331*	0.323	0.095
negate	-0.009	0.406*	0.285	-0.044
Perception	-0.095	-0.022	-0.596*	-0.228
space	-0.120	-0.020	-0.632*	-0.047
work	-0.319*	-0.277	0.019	0.206
differ	-0.033	0.351*	0.149	0.164

5.6.4. Thrill Seeking Moderates the Relationship between Math Anxiety and Language Pattern

Table 5.13 shows the word categories which had significant correlations with thrill seeking levels in the expressive writing group. The whole analysis table is presented in Appendix A.

Expressive Writing Group

Among people with low MA, low thrill seeking was significantly correlated with the word categories clout (r = -0.382, p < .05), 1st person plural (r = -0.354, p < .05), 3rd person plural (r = -0.359, p < .05), quantities (r = -0.447, p < .01), social (r = -0.468, p < .01), and social referents (r = -0.543, p < .001), while high thrill seeking was significantly correlated with the

word categories big words (r = -0.431, p < .01), linguistic dimensions (r = 0.403, p < .01), total function words (r = 0.462, p < .01), auxiliary verbs (r = 0.413, p < .01), common verbs (r = 0.366, p < .05), quantities (r = 0.359, p < .05), perception (r = -0.340, p < .05), space (r = -0.308, p < .05), and allure (r = 0.461, p < .01). Among people with high MA, low thrill seeking was significantly correlated with the word categories analytical thinking (r = 0.722, p < .01), emotional tone (r = 0.529, p < .05), linguistic dimensions (r = 0.-0.562, p < .05), total function words (r = -0.638, p < .05), total pronouns (r = -0.625, p < .05), personal pronouns (r = -0.593, p < .05), articles (r = 0.598, p < .05), common verbs (r = -0.576, p < .05), cognition (r = -0.529, p < .05), cognitive process (r = -0.567, p < .05), allure (r = -0.589, p < .05), differentiation (r = -0.680, p < .01), and achievement (r = 0.595, p < .05), while high thrill seeking was significantly correlated with the word category insight (r = -0.568, p < .01).

Control Group

Among people with low MA, low thrill seeking was significantly correlated with the word categories cognition (r = 0.559, p < .05) and cognitive processes (r = 0.546, p < .05), while high thrill seeking was significantly correlated with the word categories 1st person plural (r = -0.763, p < .01), lifestyle (r = -0.696, p < .05), and affiliation (r = -0.669, p < .05). Among people with high MA, low thrill seeking was significantly correlated with the word categories cognition (r = 0.423, p < .05) and cognitive processes (r = 0.391, p < .05), while high thrill seeking was significantly correlated with the word categories cognition (r = 0.437, p < .05), cognitive processes (r = 0.378, p < .05), and lifestyle (r = -0.317, p < .05).

Table 5.13: Language Inventory Word Count (LIWC) and Thrill Seeking (TS) Correlations for Math Anxiety (MA)

Abbrev.	Low MA		High MA	
	Low TS	High TS	Low TS	High TS
Analytic	0.079	-0.280	0.722**	-0.154
Clout	-0.382*	-0.113	0.053	-0.145
Tone	-0.106	-0.234	0.529*	-0.183
BigWords	0.002	-0.431**	0.442	-0.013
Dic	-0.092	0.336*	-0.395	-0.026
Linguistic	-0.203	0.403**	-0.562*	0.096
function	-0.086	0.462**	-0.638*	0.124
pronoun	-0.276	0.137	-0.625*	0.010
ppron	-0.110	0.115	-0.593*	0.040
we	-0.354*	-0.015	-0.065	-0.142
they	-0.359*	-0.102	-0.391	0.377
article	0.011	-0.002	0.598*	-0.104
auxverb	0.007	0.413**	-0.508	0.274
verb	-0.044	0.366*	-0.576*	0.070
quantity	-0.447**	0.359*	0.181	-0.302
Cognition	-0.059	-0.0002	-0.529*	-0.036
cogproc	0.002	-0.116	-0.567*	-0.063
Perception	-0.251	-0.340*	-0.071	-0.047
Social	-0.468**	-0.054	-0.397	0.158
space	-0.304	-0.308*	0.032	0.144
allure	-0.111	0.461**	-0.589*	-0.051
socrefs	-0.543***	-0.013	-0.335	0.166
insight	0.100	-0.216	0.035	-0.568**
differ	-0.213	-0.137	-0.680**	0.308
achieve	-0.042	-0.140	0.595*	-0.384

5.6.5. Stress Tolerance Moderates the Relationship between Math Anxiety and Language Pattern

Table 5.14 shows the word categories which had significant correlations with stress tolerance levels in the expressive writing group. The whole analysis table is presented in Appendix A.

Expressive Writing Group

Among people with low MA, low stress tolerance was significantly correlated with the word categories lifestyle (r = -0.363, p < .05) and work (r = -0.370, p < .05), while high stress tolerance was significantly correlated with the word categories cognition (r = -0.306, p < .05) and cognitive processes (r = -0.332, p < .05). Among people with high MA, low stress tolerance was significantly correlated with the word categories big words (r = 0.411, p < .05), total function words (r = -0.408, p < .05), number (r = -0.507, p < .05) and cognitive processes (r = -0.425, p < .05), while no word category was significantly correlated high stress tolerance.

Control Group

Among people with low MA, low stress tolerance was significantly correlated with the word category 1st person singular (r = -0.591, p < .05), while no word category was significantly correlated with high stress tolerance. Among people with high MA, no word category was significantly correlated with low stress tolerance, while high stress tolerance was significantly correlated with the word categories 1st person plural (r = 0.338, p < .05), 3rd person singular

($r = 0.324$, $p < .05$), number ($r = -0.347$, $p < .05$), social ($r = 0.369$, $p < .05$), drives ($r = 0.355$, $p < .05$), social referents ($r = 0.390$, $p < .05$), and present focus ($r = -0.342$, $p < .05$).

Table 5.14: Language Inventory Word Count (LIWC) and Stress Tolerance (ST) Correlations for Math Anxiety (MA)

Abbrev.	Low MA		High MA	
	Low ST	High ST	Low ST	High ST
WPS	-0.379*	-0.166	-0.366	0.090
BigWords	-0.044	-0.183	0.411*	0.284
function	0.020	0.118	-0.408*	-0.120
number	-0.046	-0.047	-0.507*	-0.163
Cognition	0.117	-0.306*	-0.338	-0.304
cogproc	0.139	-0.332*	-0.425*	-0.338
Lifestyle	-0.363*	0.131	0.217	-0.296
work	-0.370*	0.180	0.176	-0.323

5.6.6. Summary

As shown in Table 5.15, high MA people with a high score on MA and a high score on different types of curiosity used different word categories when expressing math-related experiences.

Table 5.15: Word Categories Correlated with Different Types of High Curiosity

Joyous Exploration	Deprivation Sensitivity	Social Curiosity	Thrill Seeking	Stress Tolerance
Analytic (-)	3rd person plural	3rd person plural	Insight	-
Authenic	Affect			
WPS	Positive Emotion			
adverb				
conj				
negate				
adj				
Cognition				
cogproc				
differ				

Table 5.16 shows text examples that reflect these features.

Table 5.16: Text Examples for Word Categories Correlated with High Level of Curiosity

Curiosity Dimension	Abbrev.	Text Example
Joyous Exploration	adverb	**well**, after memorizing the table...
	conj	**Although**, dozens of people are good at maths...
	negate	...it actually has **nothing** to do with maths...
	adj	**Many** foreigners came up and trying to let **loose** of my parents saying...
	Cognition	...is mandatory to **remember** at elementary school...
	cogproc	...I also **noticed** that many people...
	differ	Math is honestly **not** my cup of tea.
Deprivation Sensitivity	they	...but **they** appeared equally perplexed. ...made it difficult for me to relate **them** to real-world applications...
	Affect	...would forever shape me into a **better** person.
	emo_pos	...but also in the **courage** to venture into the unknown. It was a **thrilling** dance with numbers and symbols...
Social Curiosity	they	While other children spent **their** days playing and running around... ...with my classmates if **they** weren't attentive or didn't answer right. ...between the theoretical concepts and **their** practical applications...
Thrill Seeking	insight	In short, math was boring and **meaningless**. I just **remembered** some of my math teachers were tough to me.
Stress Tolerance	-	-

6

General Discussion

An online experiment was conducted, in which MA was the independent variable, self-esteem, and five dimensions of curiosity were the moderating variables, and language pattern was the dependent variable. The results showed that MA affects people's language patterns. Meanwhile, self-esteem and five dimensions of curiosity moderated the relationships between MA and language patterns. Self-esteem and curiosity were correlated with each other according to the results. Besides, this study included math performance as an extra component. The results showed that people's math performance was improved after expressive writing regardless of the topic. This chapter will further discuss these findings based on the results of analyses in previous chapters in terms of scientific and practical relevance. The limitations and future work will also be discussed.

6.1. Scientific Relevance

Math Anxiety Affects Language Pattern

Current studies focused on exploring the potential benefits to math performance of expressive writing interventions, while paying less attention to type of language people use to describe MA. Previous studies showed that the word categories insight, anxiety, and cause drive benefits of expressive writing when expressing an upcoming math test. These word categories have also been shown to reduce the performance gap between people with high and low MA (D. Park et al., 2014). In the present study, people with low MA also used more articles and insightful words when expressing previous math-related experiences. This, to some extent, was in line with previous studies. The word category insight might be an important indicator for identifying differences in language patterns and revealing causes of MA development. In the previous study, these three word categories were important markers of emotional processing and found that higher use of these three word categories in expressive writing helped people with high MA get better math performance later (D. Park et al., 2014). The finding that people with low MA used more insightful words in the present study indicated that people who better understand their emotional experience could apply more effective emotion regulations (Boden et al., 2012) and end up with lower levels of MA. People with high MA used more positive emotional words. This could be seen as an implication that they keep their anxious thoughts in their mind, which harmed the free up of their working memory. Two word categories that were previously investigated (anxiety and cause) were not significant in this study. One potential reason was that this study was not restricted to a specific math-related topic and

people were free to write all their experiences. Some people wrote down positive experiences, thereby blurring out the emotional processes of people with high and low MA when faced with anxieties. Besides, according to further analysis based on curiosity, this result may be due to the effects of different deprivation sensitivity levels. People with high MA and high deprivation sensitivity used more positive emotional words. In this study, people with high and low MA used different word categories when expressing previous math-related experiences. This finding did not support the interpretation account theory (Ramirez, Shaw, & Maloney, 2018).

Self-esteem Moderates the Relationship between Math Anxiety and Language Pattern
Previous studies have found links between self-esteem levels and language patterns. For example, it is possible to detect people's self-esteem levels from their tweets (Orehek & Human, 2017). Another study identified 17 word categories satisfying the criterion of self-personality ratings (Fast & Funder, 2008) and two of them overlapped with this study (the word categories article and anxiety emotion). High MA and low MA people with different levels of self-esteem used different word categories when expressing math-related experiences. Low self-esteem may hinder people's emotional expression (Luerssen et al., 2017). People with high MA and low self-esteem, in the present study, used more the word categories achievement and determiners, while using less the word categories clout, 1st person plurals and affiliation. Their texts reflected that they were not keen on leadership and status (as measured by the word category clout) but on achievements when expressing math-related experiences. Using less the word category 1st person plural means making less social references to friends, groups, and communities (Neff, 2011). The word category affiliation contains words emphasizing groups and helpfulness (such as we, our, us, and help). This finding was consistent with the results of previous studies that self-esteem and affiliation have a negative relationship with each other (Zimbardo & Formica, 1963). Their texts reflected less about teams when expressing math-related experiences. People with high MA and high self-esteem used more physical and anxiety emotion words, while using less impersonal pronouns. Self-esteem serves an anxiety-buffering function in response to threat (Greenberg et al., 1992) and may make them more comfortable in expressing negative emotions. High self-esteem may help people to be more upfront about the anxiety-provoking parts of their past math-related experiences and to be able to write about their anxieties without avoiding or hiding them.

Curiosity Moderates the Relationship between Math Anxiety and Language Pattern
Less attention has been given to the link between curiosity and language pattern. This study was the first attempt to explore the relationship between curiosity, MA, and language pattern. Curiosity motivates people to explore different possibilities and actives cognitive processes (Hagtvedt et al., 2019). This was evident in the dimension of joyous exploration. People with high MA and high joyous exploration used more words per sentence, adverbs, conjunctions, negations, common adjectives, cognition, cognitive processes, differentiation and authentic words, but used less analytical thinking words. The active use of cognitive words, in general, indicates people's endeavour and ability to build causal relationships and identify meanings in order to complete coherent narratives (Zheng et al., 2019). The process of the active reinterpretation of previous stressful events, which is reflected by cognitive words, could bring benefits to mental health, such as reducing anxiety levels (Alparone et al., 2015). The word category analytical thinking stands for logical and formal thinking. Its negative correlation with high joyous exploration, therefore, seemed reasonable within this study. In the present study, high joyous exploration appeared to have encouraged people with high MA to find meanings in pre-

vious math-related experiences and helped them construct coherent narratives. The use of 3rd person plurals indicated people's tendency to group people into actual or non-actual groups (J. W. Pennebaker et al., 2008). High social curiosity further reflects this feature. Deprivation sensitivity motivates people to fill knowledge gaps due to the discomfort of not knowing and the urge to reduce tension which might help the development of insights. In the present study, people with high MA and high deprivation sensitivity used more 3rd person plurals, affect, and positive emotion words. The use of 3rd person plural indicated that people put themselves into a larger group against another actual (or non-actual) group (J. W. Pennebaker et al., 2008). The frequent use of 3rd person plurals in the dimension of social curiosity might manifest in describing other people's situations rather than only focusing on one's own status or feelings. People with high deprivation sensitivity expressed higher proportions of positive coping with difficulties (Birenbaum et al., 2019). This might be the basis of the frequent use of positive emotional words in the deprivation sensitivity dimension. People with high MA and high social curiosity also used more 3rd person plurals. People with high social curiosity wanted to know what other people were thinking and doing, and this might aspire them to group people. People with high social curiosity tended to describe situations involving other people when expressing math-related experiences or emphasized different groups through 3rd person plurals when describing people or things. Thrill seeking and stress tolerance are two new scales introduced by Kashdan and colleagues in 2018 (Kashdan et al., 2018). Fewer studies are meant to explore these two dimensions of curiosity. People with high thrill seeking, in general, are keen on novelties, which have a duality result of impulsive problems. The present study found high MA and high thrill seeking led to less use of insightful words. High stress tolerance did not show significant correlations with the word categories. The results of this study can be further explored in the future.

Math performance

In this study, people were shown to have better or similar math performance after writing down their previous math-related experience and unrelated topic about food. One possible reason for this could be that, even though two math tests were thought of as having the same difficulty level according to the GRE difficulty levels, the second math test could have been simpler or more in line with the math ability of the respondents in this study. However, this was not sufficient to explain the results of people with high MA. Solving these complex math questions in this study requires working memory, an important cognitive resource, which will be harmed by worries and intrusive thoughts (Ashcraft & Kirk, 2001). Previous studies showed that writing down one's worries about and before an upcoming exam helped increase scores by reducing anxieties and negative thoughts (Ramirez & Beilock, 2011). Vikrant and colleagues also identified that writing about thoughts and feeling before taking a math test helped get higher scores compared with sitting quietly (Jaltare & Moghe, 2020). It is worth noting that Daniel A and colleagues' study did not support the benefits of expressive writing on math outcomes (Scheibe et al., 2022). The results of this study were complex. In the expressive writing group, although the math scores of people with low MA improved after the expressive writing, people with high MA had similar scores, which even led to a further math performance gap between them.

When people recalled their past experiences, their attention was diverted from math tests and they distanced themselves from their current anxiety which could protect cognitive processing from being disrupted by MA (Kross & Ayduk, 2011). Even for people in the expressive writing

group, recalling previous math-related experiences would trigger more content (e.g. memories about math teachers) than thinking about the upcoming math exam. The working memory resource availability was increased and, accordingly, people have better math performance in the math test. This reasoning, however, also failed to explain the results of people with high MA. One potential reason is that people with anxiety have a recall bias for threatening words (Reidy & Richards, 1997). Thus, people with high MA may pay more attention to previous threatening situations which could trigger more worries and anxieties. However, the analysis results of language patterns did not support this possibility. Instead, in the expressive writing group, the high MA level had a significant and positive correlation with the positive emotion word category. Another potential reason was that people with high MA have particular difficulty employing working memory in math-related situations (Shi & Liu, 2016). This could explain why people with high MA in the control group improved their scores after the writing task rather than the expressive writing group. People in the control group completely diverted their attention from math during the writing task while people in the expressive writing group still focused on math-related situations. Besides, high MA weakens people's ability to suppress extraneous thoughts. As a result, people with high MA in the expressive writing group more suffered from anxiety-induced worrying intrusive thoughts than people with low MA, which lead to the poor math performance of people with high MA.

6.2. Practical Relevance

The insights from this study could provide guidance to math teachers. First, this study offered new insights into the development of MA. According to the interpretation account theory (Ramirez & Beilock, 2011), the positive or negative way to interpret previous math-related experiences is the influence factor in the development of MA. However, this study did not find evidence for this point of view. This study found that people had better math performance after expressive writing and this change also occurred in the control group. This finding was documented before. One study found that after expressive writing intervention for three days, high school students' MA levels were reduced both in the experimental group and the control group (Hines et al., 2016). Thus, expressive writing can be used to help people reduce their MA and improve their math performance.

Expressive writing is beneficial for stress management and cognitive changes (Smyth et al., 2008). It is possible to predict people's MA levels according to their language patterns since this study found some word categories were significantly correlated with MA levels. The diagnosis of MA through language patterns would become more accurate with the inclusion of other two variables such as self-esteem and curiosity. For example, the word category articles was better suited for the diagnosis of low MA for people with low self-esteem. Influenced by the Internet, text-based communication and analytic methods are well developed (Nadelson et al., 2013). The correlations between word categories in writing and high or low levels of MA found in this study could provide the basis for further remote diagnosis of MA through e-medicine.

6.3. Limitations

As the topic of expressive writing was broad and was not specified to negative math-related experiences for the experimental group in this study, some people chose to write about their

positive math-related challenges. Some people described the experience of being selected for a math competition and being excited about it. This may therefore have blurred out the word categories (such as positive emotional words) that people used when interpreting their past math-related experiences. In retrospect, restricting the topic of writing to a difficult or negative math-related experience could have provided a better analysis of the perspectives from which people interpreted their math-related experiences (describing overcoming difficulties or describing the impact of difficulties) than the topic in the current study, as well as a more accurate analysis of some of the word categories (e.g. positive emotional words). This may also help to identify the worry component of people with high MA (D. Park et al., 2014).

As an online experiment, this study failed to monitor whether people were answering questions seriously, especially for answering math questions. This could have affected the accuracy of measuring math performance. People may not have calculated carefully due to tiredness or impatience as it may result in testing a lower level of math than their true level of math, especially for the second math test positioned after the first math test and expressive writing. Also, due to the nature of an online experiment, this study failed to monitor whether participants are in the same situation. It may be that some people are in a quiet environment while others are in a noisy one. This may have an effect on their concentration when answering questionnaires or solving math problems.

Besides, the current study did not remeasure people's MA levels after expressive writing and did not have groups that change the order of these two math tests. Thus, it was unable to identify the reasons why students generally perform better on the second math test.

6.4. Future Work

Further studies could add new values to the current study in many ways. Here are some examples.

Further studies could use Electroencephalogram (EEG) to monitor people's brain activities. Currently, there is a belief that MA interferes with cognition processing and thus underachievement in math by impairing working memory (Ashcraft, 2002). Comparing whether the state of people's brain activities is different when solving complex math problems before and after expressive writing can help to further identify the reasons why MA affects people's math performance and to further explore the causes of MA.

Further studies could also include academic anxiety, which can become more detrimental over time (Hooda & Saini, 2017) and test anxiety, which can lead to scholastic underachievement (Zeidner, 2007), as new variables since MA should be distinguished from other related types of anxiety. Measuring participants' other related anxiety levels helps to target the exploration of the causes of MA and its impact on math performance. This may be interesting because test anxiety is also related to self-esteem since taking exams is considered as a specific situation that potentially threatens people's self-esteem (Krispenz et al., 2019).

7

Conclusion

MA can impair people's math performance and cause them to tend to avoid things related to math (Ashcraft & Krause, 2007). Since math is one of the foundations of this high-tech society, this will undoubtedly result in them being at a disadvantage on standardised tests and in their subsequent careers (Ahmed, 2018). Surprisingly, the causes of MA and effective interventions for it are still being explored. This study focused on exploring the relationship between MA and language patterns. Self-esteem and curiosity were also included in order to further explore the personality differences in language patterns of people with different MA levels. With these two variables, the accuracy of linguistic recognition of MA could be improved. Math performance was also included as an extra variable in order to explore the influence of MA and expressive writing.

This study showed that expressive writing could help people have better math performance. Expressive writing before math exams can be seen as an effective way of improving math performance. Moreover, this study identified several word categories that significantly correlate with MA levels. Some of these word categories were expected to be more effective in identifying people with MA through their language patterns when the levels of self-esteem and curiosity were added. These insights can be used to develop technological tools to linguistically diagnose MA in the future.

The hypotheses proposed in this study have all been accepted:

Table 7.1: Hypotheses Results

N	Hypotheses	Results
H1	People's self-esteem levels have a positive relationship with their curiosity levels.	Accepted
H2	People with MA use distinctive language patterns when describing their experiences with math problems and challenges.	Accepted
H3	Self-esteem alters the language patterns of people with MA when describing their experiences with math problems and challenges.	Accepted
H4	Curiosity alters the language patterns of people with MA when describing their experiences with math problems and challenges.	Accepted

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A

Correlation Analysis

The correlation matrix for the variables in this study, which were self-esteem, MA, five dimensions of curiosity, and two math performances, is displayed in the following Figure A.1.

Pearson's Correlations

Variable		Math Anxiety	Self-esteem	Joyous Exploration	Deprivation Sensitivity	Social Curiosity	Thrill Seeking	Stress Tolerance	Math Performace 1	Math Performace 2
1. Math Anxiety	Pearson's r	—								
2. Self-esteem	Pearson's r	0.043	—							
3. Joyous Exploration	Pearson's r	0.011	0.404***	—						
4. Deprivation Sensitivity	Pearson's r	0.035	0.156*	0.402***	—					
5. Social Curiosity	Pearson's r	0.158*	−0.087	0.059	0.053	—				
6. Thrill Seeking	Pearson's r	0.016	0.329***	0.256***	0.306***	0.128	—			
7. Stress Tolerance	Pearson's r	0.091	0.385***	0.122	−0.141*	0.048	0.148*	—		
8. Math Performace 1	Pearson's r	−0.178**	−0.056	−0.108	−0.119	0.087	−0.219**	0.007	—	
9. Math Performace 2	Pearson's r	−0.342***	0.043	0.016	−0.063	0.038	−0.074	0.092	0.568***	—

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

Figure A.1: Correlation Matrix

B

Language Pattern Analysis

The correlations of MA level, self-esteem level, and curiosity level with the word categories in this study are shown in the following tables.

Table B.1: Complete Version of Language Inventory Word Count (LIWC) and Math Anxiety (MA) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low MA	High MA	Low MA	High MA	Low MA	High MA
WC	-0.036	0.106	0.041	-0.038	-0.057	0.178
Analytic	0.087	0.151	0.026	-0.020	0.117	0.285
Clout	-0.002	-0.056	-0.207	-0.079	0.058	-0.019
Authentic	0.107	-0.069	0.350	0.038	0.039	-0.095
Tone	-0.162	0.186	-0.225	0.044	-0.151	0.209
WPS	0.082	0.001	0.060	-0.101	0.114	0.176
BigWords	-0.081	0.110	-0.137	0.062	-0.049	0.282
Dic	-0.054	-0.029	0.138	0.115	-0.110	-0.207
Linguistic	-0.070	-0.134	0.062	0.030	-0.113	-0.346*
function	-0.081	-0.130	0.021	0.005	-0.110	-0.274
pronoun	-0.035	-0.046	0.077	0.062	-0.082	-0.168
ppron	-0.055	-0.013	0.107	0.114	-0.135	-0.167
i	0.002	0.092	0.243	0.165	-0.093	-0.018
we	-0.061	-0.080	-0.205	-0.078	-0.010	-0.107
you	0.186	-0.106	0.213	-0.108	0.184	-0.100
shehe	-0.018	-0.030	-0.223	0.154	0.014	-0.078
they	-0.130	0.010	-0.227	-0.038	-0.118	0.135
ipron	0.024	-0.092	-0.046	-0.102	0.057	-0.043
det	0.095	0.074	0.135	-0.125	0.077	0.134
article	0.197*	0.113	0.097	-0.090	0.236*	0.191
number	0.107	-0.129	-0.337	-0.295*	0.165	-0.061
prep	-0.088	0.120	-0.082	0.012	-0.074	0.265
auxverb	-0.076	0.125	-0.161	0.002	-0.060	-0.210
adverb	-0.025	-0.200*	-0.034	-0.065	-0.020	-0.270
conj	-0.078	0.078	0.002	0.162	-0.120	-0.025
negate	0.006	-0.215*	-0.035	-0.135	0.021	-0.242
verb	-0.087	-0.126	-0.156	0.012	-0.065	-0.281
adj	-0.013	-0.065	0.031	0.186	-0.042	-0.302
quantity	-0.028	-0.220*	0.211	-0.103	-0.097	-0.278
Psychological Processes						
Cognition	0.026	-0.235*	0.109	-0.013	0.062	-0.302
cogproc	0.060	-0.223*	0.133	0.027	0.113	-0.300
Perception	0.085	-0.091	-0.152	-0.239*	0.213	-0.025
focuspast	-0.089	0.036	-0.040	0.083	-0.142	-0.240
Social	-0.141	-0.022	-0.047	0.040	-0.161	-0.014
Affect	-0.116	0.173	-0.248	0.064	-0.077	0.190
Lifestyle	-0.043	-0.089	-0.087	-0.155	-0.004	0.138
Drives	-0.129	0.094	-0.120	0.007	-0.120	0.240
physical	0.081	0.157	0.172	0.099	-0.014	-0.134
tone_pos	-0.171	0.212*	-0.275	0.080	0.152	0.270
space	0.076	-0.134	-0.066	-0.190	0.159	-0.001
work	-0.014	-0.131	0.054	-0.216	0.029	0.068
food	0.079	0.196*	0.143	0.161	0.011	-0.149
allure	-0.095	-0.081	-0.195	-0.017	-0.071	-0.197
time	0.084	-0.063	0.156	-0.050	0.049	-0.135
socrefs	-0.102	-0.045	-0.128	0.001	-0.085	-0.006
insight	0.157	-0.094	0.209	0.121	0.242*	-0.019
socbehav	-0.109	0.051	0.124	0.100	-0.179	-0.008
affiliation	-1.09	0.029	0.114	-0.023	0.113	0.025
emotion	-0.011	0.022	-0.052	0.083	-0.011	0.060
differ	0.061	-0.216*	0.053	0.025	0.082	-0.308
achieve	-0.111	0.080	-0.124	-0.031	-0.101	0.240
focuspresent	0.089	-0.129	-0.056	-0.094	0.144	-0.078
emo_pos	-0.025	0.115	-0.096	-0.107	-0.013	0.402*
motion	0.049	-0.013	-0.040	-0.019	0.087	-0.087
cause	-0.148	0.030	-0.133	0.006	-0.144	0.216
emo_anx	0.063	-0.033	-0.031	-0.050	0.087	0.017

Table B.2: Complete Version of Language Inventory Word Count (LIWC) and Self-esteem (SE) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low SE	High SE	Low SE	High SE	Low SE	High SE
WC	0.229*	0.059	0.312*	0.171	0.179	-0.033
Analytic	0.229*	-0.155	0.191	-0.094	0.234	-0.223
Clout	-0.100	-0.028	-0.013	0.070	-0.116	-0.083
Authentic	-0.114	-0.106	-0.097	-0.071	-0.009	-0.085
Tone	0.211*	0.080	0.370*	-0.052	0.050	0.091
WPS	-0.057	-0.060	0.089	-0.069	-0.138	-0.104
BigWords	0.117	-0.241**	0.259	-0.218	0.121	-0.229
Dic	-0.172	0.266**	-0.001	0.223	-0.257	0.281*
Linguistic	0.189	0.207*	-0.116	0.151	-0.204	0.251
function	-0.154	0.265**	-0.060	0.204	-0.169	0.292*
pronoun	-0.261**	0.050	-0.153	0.126	-0.330*	0.023
ppron	-0.319**	0.035	-0.205	0.088	-0.411**	0.013
i	-0.179	0.039	-0.174	0.030	-0.196	0.045
we	-0.081	-0.049	-0.080	0.048	-0.065	-0.145
you	-0.001	-0.021	0.062	0.139	-0.030	-0.046
shehe	-0.075	0.049	0.090	-0.052	-0.075	0.105
they	-0.149	0.036	0.038	0.174	-0.168	0.035
ipron	0.034	0.049	0.075	0.151	0.043	0.024
det	0.308**	0.132	0.330*	0.079	0.264*	0.115
article	0.359***	0.026	0.321*	0.099	0.344**	-0.099
number	-0.244*	0.044	-0.238	-0.094	-0.215	0.097
prep	-0.026	-0.157	0.046	-0.122	-0.032	-0.162
auxverb	0.071	0.231*	-0.161	0.162	-0.029	0.273*
adverb	-0.162	0.145	-0.189	-0.073	-0.102	0.276*
conj	-0.135	0.195*	-0.072	0.118	-0.163	0.227
negate	-0.156	-0.015	-0.191	0.120	-0.132	-0.027
verb	-0.200*	0.137	-0.244	0.066	-0.165	0.191
adj	0.075	-0.019	0.081	-0.009	0.080	-0.007
quantity	-0.008	0.278**	0.062	0.031	0.020	0.458***
Psychological Processes						
Cognition	-0.122	-0.167	0.055	0.062	-0.046	-0.252
cogproc	-0.113	-0.198*	0.019	0.051	-0.018	-0.312*
Perception	-0.158	-0.145	0.087	-0.132	-0.303*	-0.174
focuspast	-0.036	0.230*	-0.081	0.078	-0.095	0.307*
Social	-0.164	-0.004	0.010	0.139	-0.206	-0.054
Affect	0.214*	0.120	0.332*	0.009	0.083	0.141
Lifestyle	-0.101	-0.051	0.120	-0.112	-0.007	0.046
Drives	-0.025	-0.006	-0.097	0.065	0.073	-0.039
physical	0.096	0.116	-0.091	0.015	-0.001	0.218
tone_pos	0.245*	0.109	0.361*	-0.018	0.079	0.148
space	-0.248*	-0.125	0.026	-0.127	-0.330*	-0.086
work	-0.139	-0.029	0.045	0.143	-0.033	0.067
food	0.107	0.085	-0.070	-0.012	0.032	0.074
allure	-0.136	0.221*	-0.162	0.113	-0.167	0.268*
time	-0.115	0.149	-0.110	0.069	-0.140	0.194
socrefs	-0.241*	0.018	-0.168	0.133	-0.222	-0.014
insight	-0.017	-0.339***	0.182	-0.232	0.131	-0.411**
socbehav	0.068	-0.034	0.301*	0.144	-0.067	-0.116
affiliation	-0.103	-0.015	-0.195	0.072	-0.086	-0.125
emotion	0.115	0.101	0.176	0.074	-0.0001	0.067
differ	-0.169	0.016	-0.109	0.136	-0.120	0.013
achieve	0.057	-0.001	0.162	0.057	0.152	0.032
focuspresent	-0.066	-0.102	-0.183	0.00003	0.006	-0.099
emo_pos	0.128	0.119	0.213	0.067	-0.087	0.102
motion	0.092	-0.143	0.306*	-0.259	-0.013	-0.122
cause	-0.142	-0.123	-0.092	0.046	-0.120	-0.147
emo_anx	0.074	0.022	0.074	-0.060	0.100	-0.002

Table B.3: Complete Version of Language Inventory Word Count (LIWC) and Joyous Exploration (JE) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low JE	High JE	Low JE	High JE	Low JE	High JE
WC	0.006	-0.067	0.248	0.147	-0.127	-0.042
Analytic	-0.009	-0.275**	-0.071	-0.084	0.030	-0.284
Clout	0.077	-0.074	0.261	0.184	-0.001	-0.259
Authentic	-0.028	0.127	0.005	-0.166	-0.001	0.123
Tone	-0.081	-0.094	0.051	0.117	-0.196	0.054
WPS	-0.117	-0.055	-0.174	-0.097	-0.059	0.047
BigWords	-0.094	-0.052	-0.103	-0.047	-0.054	-0.149
Dic	0.103	0.149	0.274	-0.013	0.004	0.199
Linguistic	0.152	0.232*	0.262	0.059	0.084	0.245
function	0.219*	0.241*	0.377*	0.120	0.140	0.238
pronoun	0.101	0.192*	0.090	0.033	0.114	0.178
ppron	0.070	0.187	0.041	0.103	0.089	0.108
i	-0.031	0.126	-0.142	-0.064	0.029	0.190
we	0.079	0.013	0.298	0.178	-0.063	-0.092
you	0.058	-0.134	0.167	0.010	0.036	-0.297*
shehe	0.159	0.021	0.247	0.180	0.164	-0.138
they	0.031	0.155	0.275	0.007	0.030	0.209
ipron	0.110	0.071	0.202	-0.112	0.094	0.120
det	0.185	-0.330***	0.196	-0.122	0.158	-0.305*
article	0.099	-0.292**	0.014	-0.026	0.121	-0.227
number	0.021	0.203*	0.081	0.002	0.043	0.139
prep	0.134	0.010	0.119	0.022	0.180	-0.032
auxverb	0.063	0.267**	0.244	0.155	-0.038	0.280
adverb	0.029	0.214*	0.045	0.047	0.035	0.165
conj	0.076	0.172	0.284	0.107	-0.088	0.206
negate	-0.045	0.161	-0.043	-0.008	-0.037	0.119
verb	0.046	0.208*	0.190	0.064	-0.056	0.197
adj	-0.075	0.107	0.054	-0.042	-0.141	0.169
quantity	0.081	0.239*	0.365*	-0.014	-0.033	0.211
Psychological Processes						
Cognition	-0.001	0.246*	0.227	-0.058	0.008	0.039
cogproc	-0.0003	0.240*	0.154	-0.055	0.042	0.029
Perception	-0.007	-0.161	-0.038	-0.130	0.024	-0.127
focuspast	0.169	0.001	0.282	0.005	0.049	0.140
Social	0.087	0.052	0.257	0.164	0.012	-0.112
Affect	-0.154	-0.192*	-0.253	0.053	-0.131	-0.086
Lifestyle	-0.100	0.188	0.274	-0.090	-0.141	-0.064
Drives	-0.067	0.056	0.185	0.113	-0.180	-0.060
physical	0.003	-0.269**	-0.189	-0.023	0.009	0.123
tone_pos	-0.116	-0.163	-0.049	0.117	-0.227	0.007
space	0.035	0.095	0.117	-0.088	0.037	0.022
work	-0.080	0.204*	0.066	-0.258*	-0.044	-0.066
food	0.044	-0.273**	-0.106	-0.039	0.103	0.056
allure	-0.022	0.081	0.118	-0.020	-0.128	0.201
time	-0.022	-0.005	-0.044	-0.107	-0.031	-0.037
socrefs	0.115	0.086	0.323*	0.206	0.035	-0.123
insight	-0.001	0.023	0.427**	-0.146	-0.002	-0.273
socbehav	0.0001	-0.033	0.082	0.021	-0.033	-0.040
affiliation	0.056	-0.045	0.197	0.165	-0.062	-0.099
emotion	-0.004	-0.124	-0.164	0.052	0.060	-0.062
differ	0.041	0.232*	0.026	-0.013	0.084	0.146
achieve	-0.189	0.122	0.032	-0.045	-0.232	-0.014
focuspresent	-0.104	0.217*	-0.108	0.073	-0.091	0.160
emo_pos	0.037	-0.090	-0.008	0.154	0.008	-0.013
motion	0.114	-0.077	0.226	-0.001	0.039	0.093
cause	0.099	0.339***	0.192	0.019	0.098	0.350*
emo_anx	0.077	-0.052	0.070	-0.109	0.094	-0.053

Table B.4: Complete Version of Language Inventory Word Count (LIWC) and Deprivation Sensitivity (DS) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low DS	High DS	Low DS	High DS	Low DS	High DS
WC	0.176	-0.148	0.413**	0.119	-0.007	-0.298*
Analytic	-0.001	-0.198*	0.112	0.016	-0.100	-0.351**
Clout	-0.091	-0.130	0.161	0.060	-0.206	-0.243
Authentic	0.062	0.022	0.040	-0.092	0.199	0.156
Tone	0.041	0.042	0.249	0.052	-0.145	0.016
WPS	0.005	-0.085	-0.078	-0.150	0.071	-0.018
BigWords	-0.115	-0.151	0.116	0.104	-0.163	-0.277*
Dic	0.142	0.207*	0.089	-0.180	0.194	0.390**
Linguistic	0.108	0.197*	0.065	-0.028	0.159	0.367**
function	0.170	0.191*	0.212	0.009	0.177	0.304*
pronoun	0.097	0.117	-0.057	0.025	0.271*	0.210
ppron	0.136	0.145	-0.074	0.073	0.384**	0.203
i	0.140	0.206*	-0.173	0.063	0.351**	0.294*
we	-0.070	-0.131	0.136	0.016	-0.189	-0.241
you	0.001	0.027	0.027	-0.038	0.005	0.075
shehe	0.106	-0.008	0.126	0.028	0.143	-0.012
they	-0.022	0.016	0.198	-0.135	-0.052	0.076
ipron	-0.030	-0.032	0.029	-0.081	-0.014	0.007
det	0.216*	-0.141	0.346*	-0.045	0.085	-0.248
article	0.149	-0.132	0.157	0.065	0.059	-0.298*
number	0.058	-0.012	0.197	0.133	0.074	-0.015
prep	0.022	-0.073	0.237	-0.061	-0.060	-0.078
auxverb	0.062	0.198*	-0.059	0.048	0.131	0.286*
adverb	-0.104	0.161	-0.170	0.016	-0.043	0.265
conj	0.119	0.197*	0.201	-0.191	0.036	0.383**
negate	0.015	0.119	-0.113	0.062	0.081	0.151
verb	0.100	0.142	0.009	-0.123	0.183	0.330*
adj	-0.098	0.209*	-0.229	0.246	-0.012	0.201
quantity	-0.092	0.106	0.272	0.074	-0.220	0.152
Psychological Processes						
Cognition	-0.016	-0.003	-0.175	-0.081	0.217	0.078
cogproc	-0.028	-0.045	-0.283	-0.100	0.233	0.005
Perception	-0.014	-0.087	0.210	-0.209	-0.158	-0.001
focuspast	0.270**	0.085	0.233	-0.077	0.250	0.224
Social	0.049	0.059	0.231	-0.059	-0.018	0.131
Affect	0.159	0.102	0.224	-0.055	0.074	0.236
Lifestyle	-0.159	-0.034	0.039	-0.144	-0.129	0.017
Drives	-0.022	-0.053	0.313*	-0.014	-0.128	-0.075
physical	-0.009	0.052	-0.335*	0.068	-0.152	0.004
tone_pos	0.180	0.066	0.343*	-0.018	-0.026	0.149
space	-0.129	-0.071	0.156	-0.191	-0.226	0.005
work	-0.155	-0.040	-0.030	-0.086	-0.096	-0.012
food	-0.027	0.033	-0.322*	0.031	-0.424***	-0.087
allure	0.064	0.064	-0.012	-0.135	0.084	0.169
time	0.014	0.122	-0.018	-0.135	0.020	0.315*
socrefs	0.014	0.019	0.193	-0.014	-0.035	0.052
insight	0.048	-0.157	0.266	-0.011	0.191	-0.233
socbehav	0.139	0.111	0.211	-0.110	0.103	0.212
affiliation	-0.003	-0.109	0.217	-0.032	-0.187	-0.186
emotion	0.167	0.050	0.073	-0.099	0.186	0.161
differ	-0.044	0.104	-0.156	0.034	0.077	0.167
achieve	-0.026	0.047	0.260	0.043	-0.015	0.079
focuspresent	-0.167	0.092	-0.494***	0.003	-0.008	0.137
emo_pos	0.234*	0.051	0.223	-0.083	0.189	0.157
motion	0.236*	0.012	0.309*	-0.133	0.172	0.085
cause	-0.066	-0.068	-0.021	-0.172	-0.009	0.004
emo_anx	0.125	-0.030	0.274	-0.141	0.101	-0.002

Table B.5: Complete Version of Language Inventory Word Count (LIWC) and Social Curiosity (SC) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low SC	High SC	Low SC	High SC	Low SC	High SC
WC	-0.153	-0.083	-0.279	-0.089	-0.093	-0.119
Analytic	0.111	-0.114	0.218	-0.067	0.044	-0.191
Clout	-0.011	0.011	-0.163	0.131	0.051	-0.076
Authentic	-0.180	-0.029	-0.142	0.042	-0.248	-0.032
Tone	-0.086	-0.057	-0.033	-0.079	-0.121	-0.122
WPS	0.121	0.038	-0.171	0.009	-0.092	0.080
BigWords	0.114	-0.171	0.194	-0.119	0.083	-0.181
Dic	-0.216*	0.140	-0.373*	0.031	-0.122	0.213
Linguistic	-0.069	0.169	-0.157	0.072	-0.013	0.278*
function	-0.105	0.161	-0.217	-0.018	-0.051	0.298*
pronoun	-0.133	0.069	-0.280	0.005	-0.025	0.165
ppron	-0.169	0.063	-0.272	0.037	-0.091	0.113
i	-0.158	0.027	-0.172	-0.005	-0.149	0.058
we	-0.116	-0.004	-0.275	0.120	-0.041	-0.118
you	0.061	0.040	0.092	0.071	0.064	0.017
shehe	0.077	-0.007	-0.094	-0.120	0.128	0.044
they	0.078	0.102	0.223	-0.147	0.060	0.222
ipron	0.001	0.028	-0.206	-0.072	0.101	0.109
det	-0.027	-0.064	0.083	-0.270*	-0.110	0.022
article	0.111	-0.078	0.167	-0.231	0.112	-0.061
number	0.115	0.128	0.300	-0.058	0.074	0.218
prep	0.037	0.010	0.173	0.101	-0.050	-0.047
auxverb	-0.053	0.036	-0.149	-0.087	0.006	0.126
adverb	-0.049	0.203*	-0.173	0.194	-0.0001	0.264*
conj	-0.102	0.167	-0.109	0.204	-0.100	0.138
negate	0.036	0.002	0.031	-0.050	0.037	0.038
verb	0.006	0.086	-0.160	-0.018	0.108	0.201
adj	0.099	0.141	0.298	0.201	0.008	0.107
quantity	-0.079	0.039	0.186	0.086	-0.212	0.055
Psychological Processes						
Cognition	0.099	0.018	0.035	-0.044	0.160	0.188
cogproc	0.117	-0.001	0.065	-0.069	0.185	0.161
Perception	-0.033	-0.039	0.248	-0.049	-0.180	-0.039
focuspast	0.051	-0.041	-0.044	-0.090	0.132	-0.061
Social	-0.152	0.025	-0.281	-0.001	-0.093	0.060
Affect	-0.106	-0.077	-0.202	-0.188	-0.065	-0.055
Lifestyle	-0.104	-0.094	-0.126	-0.029	-0.185	-0.065
Drives	-0.119	-0.024	-0.358*	0.077	-0.030	-0.096
physical	-0.012	0.114	-0.012	0.183	0.001	-0.105
tone_pos	-0.100	-0.063	-0.123	-0.129	-0.102	-0.134
space	-0.115	-0.077	0.092	-0.139	-0.213	0.007
work	-0.100	-0.117	-0.076	-0.108	-0.235	-0.096
food	0.008	0.129	0.083	0.196	-0.028	-0.117
allure	-0.137	0.084	-0.205	0.008	-0.097	0.122
time	-0.117	0.106	-0.274	0.126	-0.051	0.099
socrefs	-0.123	0.052	-0.301	0.071	-0.058	0.068
insight	0.125	-0.088	-0.031	0.047	0.203	-0.082
socbehav	-0.116	-0.010	-0.150	-0.114	-0.094	0.045
affiliation	-0.173	0.003	-0.344*	0.130	-0.074	-0.144
emotion	-0.049	0.022	-0.161	-0.162	0.040	0.125
differ	0.047	0.071	0.114	-0.132	-0.003	0.217
achieve	0.011	0.043	-0.122	0.007	0.032	0.108
focuspresent	-0.007	0.002	-0.039	0.058	0.007	0.015
emo_pos	-0.060	0.044	-0.143	-0.124	-0.005	0.177
motion	-0.069	0.020	-0.083	0.051	-0.060	-0.012
cause	0.089	0.011	-0.048	0.189	0.141	-0.059
emo_anx	0.148	-0.035	0.036	-0.143	0.211	0.003

Table B.6: Complete Version of Language Inventory Word Count (LIWC) and Thrill Seeking (TS) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low TS	High TS	Low TS	High TS	Low TS	High TS
WC	0.149	-0.169	0.331*	-0.260	0.002	-0.135
Analytic	0.151	-0.182*	-0.084	-0.151	0.306*	-0.211
Clout	-0.091	-0.082	0.140	-0.011	-0.226	-0.120
Authentic	0.017	0.013	0.104	0.126	0.032	-0.050
Tone	0.053	-0.131	-0.088	-0.234	0.122	-0.135
WPS	-0.046	0.141	0.063	0.163	-0.146	0.135
BigWords	0.103	-0.193*	0.163	-0.027	0.123	-0.280*
Dic	-0.012	0.176	0.246	0.126	-0.158	0.203
Linguistic	-0.101	0.238**	0.213	0.114	-0.298*	0.322**
function	-0.082	0.257**	0.210	0.082	-0.248	0.342**
pronoun	-0.207*	0.130	-0.004	0.159	-0.393**	0.118
ppron	-0.212*	0.100	-0.144	0.107	-0.278	0.102
i	-0.083	0.084	-0.231	0.069	0.068	0.091
we	-0.075	0.010	0.181	0.092	-0.232	-0.048
you	-0.008	-0.060	0.128	-0.059	-0.090	-0.062
shehe	-0.101	0.070	0.077	0.123	-0.167	0.070
they	-0.247*	-0.042	0.111	-0.224	-0.380**	0.005
ipron	-0.062	0.109	0.366*	0.198	-0.289*	0.063
det	0.140	0.040	0.191	0.029	0.058	0.038
article	0.194	-0.051	0.068	-0.074	0.268	-0.072
number	0.187	-0.003	0.153	0.189	0.263	-0.014
prep	0.111	-0.031	0.047	-0.216	0.192	0.086
auxverb	-0.059	0.243**	0.189	0.024	-0.225	0.345**
adverb	0.040	0.182*	0.155	0.190	0.009	0.193
conj	0.029	0.085	0.034	0.089	0.004	0.084
negate	-0.121	-0.002	0.209	0.134	-0.193	-0.038
verb	0.004	0.221*	0.307*	0.118	-0.228	0.284*
adj	-0.115	0.036	-0.071	0.014	-0.132	0.052
quantity	-0.075	0.186*	0.224	0.142	-0.232	0.229
Psychological Processes						
Cognition	-0.015	0.032	0.512***	0.336*	-0.151	-0.029
cogproc	0.001	-0.010	0.486***	0.331*	-0.106	-0.114
Perception	0.008	-0.085	0.245	0.075	-0.180	-0.191
focuspast	0.292**	0.126	0.246	0.067	0.305*	0.174
Social	-0.254*	-0.013	0.120	-0.007	-0.446**	-0.012
Affect	0.030	-0.159	0.069	-0.304*	-0.032	-0.154
Lifestyle	0.037	-0.080	0.040	-0.386**	0.202	-0.040
Drives	0.066	-0.064	0.141	-0.013	0.052	-0.086
physical	-0.041	0.032	-0.320*	0.005	-0.004	0.099
tone_pos	0.072	-0.181*	0.042	-0.315*	0.048	-0.212
space	-0.063	-0.115	0.203	-0.076	-0.183	-0.135
work	0.010	-0.053	-0.001	-0.116	0.178	-0.069
food	-0.035	0.018	-0.301*	0.014	0.129	-0.011
allure	-0.088	0.193*	0.133	0.131	-0.266	0.230
time	0.139	0.211*	0.071	0.203	0.190	0.223
socrefs	-0.266**	0.015	0.123	0.039	-0.455***	0.010
insight	0.067	-0.174	0.418**	0.046	0.087	-0.301*
socbehav	-0.061	-0.072	0.107	-0.084	-0.154	-0.065
affiliation	-0.069	-0.037	0.033	0.014	-0.180	-0.082
emotion	-0.029	-0.100	-0.080	-0.134	0.024	-0.127
differ	-0.163	0.043	0.211	0.219	-0.359*	0.005
achieve	0.152	-0.115	0.217	-0.220	0.238	-0.108
focuspresent	-0.182	-0.047	-0.008	0.056	-0.260	-0.065
emo_pos	0.034	-0.107	-0.168	-0.177	0.191	-0.135
motion	0.014	-0.067	0.125	0.084	-0.058	-0.156
cause	0.092	0.150	0.291	0.322*	0.001	0.129
emo_anx	0.040	0.037	0.197	-0.030	0.024	0.067

Table B.7: Complete Version of Language Inventory Word Count (LIWC) and Stress Tolerance (ST) Correlations

Abbrev.	Pooled Results		Control Group		Expressive Writing	
	Low ST	High ST	Low ST	High ST	Low ST	High ST
WC	-0.057	0.118	-0.208	0.239	0.077	-0.207
Analytic	0.040	0.165	-0.067	0.158	0.086	-0.071
Clout	0.014	0.117	-0.273	0.166	0.133	0.086
Authentic	0.176	-0.255**	0.132	-0.120	0.030	-0.106
Tone	-0.103	0.231*	-0.027	0.172	0.023	0.030
WPS	-0.167	0.006	-0.070	0.053	-0.362**	-0.151
BigWords	0.159	-0.106	-0.142	0.028	0.148	-0.121
Dic	-0.092	0.003	-0.013	0.072	-0.080	0.054
Linguistic	-0.110	-0.55	-0.083	-0.009	-0.106	0.078
function	-0.171	0.020	-0.070	0.131	-0.191	0.101
pronoun	-0.013	-0.112	0.076	0.020	-0.087	-0.038
ppron	-0.009	-0.077	0.111	0.043	-0.080	-0.014
i	-0.014	-0.087	0.221	-0.054	-0.098	-0.036
we	-0.090	0.127	-0.268	0.127	0.037	0.115
you	0.078	-0.072	0.001	-0.111	0.109	0.037
shehe	0.032	-0.036	0.220	0.303*	-0.079	-0.055
they	0.091	-0.099	0.026	-0.119	0.043	0.028
ipron	-0.015	-0.112	-0.048	-0.050	-0.041	-0.049
det	-0.130	0.205*	-0.095	0.182	-0.026	-0.060
article	-0.103	0.265**	-0.078	0.150	0.033	-0.046
number	-0.126	-0.183*	0.004	-0.234	-0.299*	-0.048
prep	0.020	0.073	-0.098	0.178	0.011	0.051
auxverb	-0.064	-0.028	-0.025	-0.071	-0.035	0.142
adverb	-0.091	-0.170	-0.023	-0.253	-0.158	0.165
conj	-0.106	0.011	0.120	0.056	-0.159	0.023
negate	0.128	-0.179	0.153	-0.161	0.091	-0.071
verb	-0.089	-0.091	-0.088	-0.082	-0.036	0.097
adj	0.143	-0.156	0.002	-0.176	0.124	-0.203
quantity	0.081	-0.152	0.077	-0.219	0.032	0.158
Psychological Processes						
Cognition	0.127	-0.343***	-0.083	0.083	-0.059	-0.296*
cogproc	0.128	-0.357***	-0.078	0.047	-0.084	-0.324*
Perception	-0.037	0.110	-0.244	0.085	0.050	-0.020
focuspast	0.233*	0.165	0.007	0.029	-0.219	0.194
Social	0.023	0.020	-0.184	0.234	0.096	-0.006
Affect	-0.072	0.231*	-0.175	0.124	0.178	0.021
Lifestyle	0.123	-0.223*	-0.221	0.043	-0.116	0.059
Drives	0.043	0.074	-0.283	0.238	0.194	0.079
physical	-0.124	0.255**	0.284	-0.182	0.064	0.238
tone_pos	-0.139	0.273**	-0.167	0.158	0.154	-0.020
space	0.042	-0.060	-0.167	0.041	-0.031	0.031
work	0.160	-0.251**	-0.199	-0.009	-0.147	0.073
food	-0.126	0.245**	0.265	-0.190	0.109	0.184
allure	-0.057	-0.018	-0.029	-0.084	0.048	0.013
time	-0.091	-0.036	0.099	-0.129	-0.155	0.184
socrefs	0.020	0.004	-0.179	0.205	0.044	0.030
insight	0.234*	-0.303***	-0.176	0.075	0.135	-0.235
socbehav	0.013	0.023	-0.120	0.147	0.118	-0.080
affiliation	-0.144	0.179	-0.266	0.148	0.065	0.096
emotion	-0.099	0.105	-0.092	-0.001	0.120	-0.052
differ	0.035	-0.216*	0.124	-0.031	-0.194	-0.173
achieve	0.207*	-0.097	-0.136	-0.254	0.187	-0.017
focuspresent	0.177	-0.198*	0.131	-0.222	0.159	0.001
emo_pos	-0.147	0.162	-0.040	0.012	0.079	-0.025
motion	-0.009	0.001	-0.078	0.062	0.004	-0.225
cause	0.064	0.212*	0.029	-0.109	-0.011	0.008
emo_anx	-0.018	0.008	-0.029	0.077	-0.032	0.031

The correlations of self-esteem level and curiosity level with the word categories at different MA levels in this study are shown in the following tables.

Table B.8: Complete Version of Language Inventory Word Count (LIWC) and Self-esteem (SE) Correlations for Math Anxiety (MA)

Abbrev.	Control Group				Expressive Writing			
	Low MA		High MA		Low MA		High MA	
	Low SE	High SE	Low SE	High SE	Low SE	High SE	Low SE	High SE
WC	0.128	0.270	0.587***	0.037	0.281	-0.055	-0.048	0.206
Analytic	0.395	-0.545	0.173	0.092	0.333*	-0.260	0.210	0.061
Clout	-0.300	-0.099	0.181	0.134	-0.002	-0.172	-0.599*	0.183
Authentic	-0.344	0.168	-0.004	-0.162	-0.035	-0.147	0.068	-0.160
Tone	0.339	0.008	0.517**	-0.120	0.029	0.095	0.277	0.064
WPS	-0.070	-0.401	0.219	-0.023	-0.165	-0.025	0.002	-0.138
BigWords	0.565*	-0.616*	0.169	-0.051	0.205	-0.254	-0.106	0.017
Dic	-0.291	0.707*	0.073	0.006	-0.405**	0.312	0.212	0.107
Linguistic	-0.444	0.605*	-0.009	-0.064	-0.304	0.282	0.171	-0.015
function	-0.460	0.685*	0.073	-0.042	-0.256	0.327*	0.047	0.053
pronoun	-0.678**	0.525	0.012	-0.091	-0.427**	0.030	-0.034	-0.201
ppron	-0.778**	0.345	-0.007	-0.039	-0.455**	-0.054	-0.331	0.011
i	-0.596*	0.376	-0.029	-0.098	-0.262	0.047	0.149	-0.132
we	-0.417	-0.037	0.125	0.086	0.104	-0.252	-0.599*	-0.062
you	-0.475	0.345	0.176	-0.087	-0.074	-0.094	0.141	0.026
shehe	0.177	-0.329	0.144	0.078	-0.100	0.138	0.039	0.232
they	0.220	0.648*	-0.081	-0.142	-0.178	0.171	0.386	0.063
ipron	0.141	0.600*	0.056	-0.185	0.068	0.127	0.355	-0.536*
det	0.558*	0.167	0.347	-0.031	0.244	0.126	0.511*	0.215
article	0.619*	0.004	0.247	0.123	0.431**	-0.123	0.322	0.203
number	0.335	0.245	-0.311	-0.249	-0.244	0.326*	0.059	-0.062
prep	0.009	-0.395	0.152	0.043	-0.015	-0.123	0.041	-0.287
auxverb	-0.372	0.644*	-0.127	-0.086	-0.068	0.280	-0.081	0.190
adverb	0.007	0.072	-0.195	-0.109	-0.174	0.312	0.146	-0.034
conj	0.154	0.237	-0.216	0.057	-0.176	0.210	-0.191	0.241
negate	-0.421	0.203	-0.433*	0.065	-0.315*	-0.072	-0.304	0.003
verb	0.195	0.531	-0.191	-0.113	-0.230	0.171	0.003	0.144
adj	-0.104	0.026	-0.027	0.010	0.011	0.036	0.318	-0.042
quantity	0.346	0.255	0.116	-0.062	-0.023	0.521***	0.296	-0.041
Psychological Processes								
Cognition	0.070	0.103	0.052	0.003	-1.08	-0.376*	0.068	-0.120
cogproc	0.092	-0.014	-0.071	0.048	-1.03	-0.408**	0.186	-0.234
Perception	0.346	-0.277	0.084	-0.048	-0.286	-0.190	-0.242	-0.155
focuspast	-0.235	0.385	-0.027	-0.106	-0.073	0.226	-0.116	0.421
Social	-0.230	0.142	0.180	0.035	-0.208	-0.181	-0.330	0.320
Affect	0.265	-0.100	0.480**	0.064	0.081	0.115	-0.026	0.401
Lifestyle	0.082	-0.168	0.180	-0.036	0.020	0.025	-0.078	0.120
Drives	0.289	-0.087	0.105	0.115	0.134	-0.093	-0.088	0.094
physical	0.115	-0.017	0.278	0.139	0.049	0.176	-0.229	0.495*
tone_pos	0.360	-0.111	0.498**	0.015	0.034	0.161	0.193	0.201
space	0.184	-0.299	0.064	0.029	-0.322*	-0.115	-0.180	-0.041
work	0.089	0.580*	0.019	-0.028	-0.029	0.039	-0.001	0.141
food	0.088	-0.011	-0.264	0.077	0.072	0.058	-0.132	-0.213
allure	-0.467	0.437	-0.030	-0.162	-0.184	0.332*	-0.297	0.035
time	-0.136	0.515	-0.165	-0.157	-0.131	0.155	-0.095	0.126
socrefs	-0.409	0.158	-0.035	0.140	-0.207	-0.138	-0.372	0.318
insight	0.192	-0.269	0.273	-0.272	0.153	-0.472**	0.041	-0.230
socbehav	0.149	0.105	0.427*	0.146	-0.112	-0.203	-0.021	0.320
affiliation	-0.521	-0.076	0.030	0.129	0.045	-0.195	-0.526*	-0.047
emotion	-0.138	-0.037	0.360	0.110	-0.009	0.029	-0.131	0.374
differ	0.195	-0.115	-0.353	0.359*	-0.338*	-0.058	-0.004	0.210
achieve	0.351	0.032	0.177	0.035	0.113	0.063	0.512*	0.013
focuspresent	-0.062	0.099	-0.145*	-0.034	-0.044	-0.100	-0.044	-0.134
emo_pos	0.061	0.058	0.347	0.053	-0.095	0.040	0.091	0.361
motion	-0.003	-0.313	0.516**	-0.219	-0.027	-0.189	0.099	0.089
cause	0.128	0.269	-0.221	-0.069	-0.163	-0.206	0.239	-0.274
emo_anx	0.363	-0.330	0.051	-0.033	0.154	-0.162	0.095	0.436*

Table B.9: Complete Version of Language Inventory Word Count (LIWC) and Joyous Exploration (JE) Correlations for Math Anxiety (MA)

Abbrev.	Control Group				Expressive Writing			
	Low MA		High MA		Low MA		High MA	
	Low JE	High JE	Low JE	High JE	Low JE	High JE	Low JE	High JE
WC	-0.062	0.293	0.446*	0.209	0.091	0.109	-0.031	-0.367
Analytic	-0.208	0.024	-0.062	-0.010	-0.060	-0.174	0.333	-0.632*
Clout	0.380	0.279	0.124	0.181	0.027	-0.173	-0.055	-0.530
Authentic	-0.087	-0.323	0.157	-0.146	-0.028	-0.010	0.148	0.554*
Tone	0.006	0.524	-0.005	0.019	-0.192	0.259	-0.093	-0.545
WPS	-0.544	0.222	0.024	-0.089	-0.066	-0.020	-0.011	0.737**
BigWords	-0.201	-0.043	-0.186	0.030	-0.139	-0.076	0.156	-0.329
Dic	0.415	0.069	0.301	-0.102	-0.072	0.121	0.104	0.457
Linguistic	0.278	-0.032	0.311	0.015	0.069	0.181	0.036	0.454
function	0.213	0.100	0.544**	0.060	0.189	0.147	-0.017	0.498
pronoun	0.021	0.118	0.216	-0.062	0.178	0.084	-0.012	0.523
ppron	-0.017	0.119	0.188	0.051	0.143	0.001	0.008	0.530
i	-0.262	-0.057	0.105	-0.106	0.044	0.112	-0.009	0.441
we	0.404	0.210	0.213	0.171	-0.012	-0.062	-0.207	-0.234
you	0.328	0.109	-0.004	0.019	-0.050	-0.432*	0.059	0.348
shehe	0.254	0.251	0.234	0.151	0.188	-0.126	0.156	-0.155
they	0.303	-0.215	0.230	0.009	0.003	0.140	0.300	0.505
ipron	0.114	0.046	0.233	-0.253	0.166	0.121	-0.037	0.038
det	0.022	0.101	0.239	-0.132	0.076	-0.255	0.410*	-0.474
article	-0.072	0.103	-0.022	0.020	-0.017	-0.145	0.395	-0.472
number	0.030	0.029	0.015	0.062	0.128	0.202	-0.075	-0.085
prep	-0.135	0.264	0.344	0.039	0.229	-0.016	0.172	-0.133
auxverb	0.276	0.188	0.409*	0.070	0.052	0.221	-0.328	0.430
adverb	0.015	-0.116	0.225	-0.012	0.055	0.038	-0.033	0.697**
conj	0.485	0.029	0.136	0.066	-0.093	0.139	-0.131	0.622*
negate	0.272	0.022	-0.392	-0.059	0.191	-0.008	-0.360	0.596*
verb	0.265	0.117	0.200	-0.037	-0.042	0.167	-0.203	0.226
adj	0.189	-0.346	0.002	0.011	-0.259	0.071	0.008	0.698**
quantity	0.587*	-0.247	0.310	-0.014	-0.023	0.282	0.028	-0.474
Psychological Processes								
Cognition	0.132	0.029	0.325	-0.059	-0.023	-0.172	0.018	0.627*
cogproc	0.065	-0.0002	0.247	-0.046	-0.005	-0.179	0.138	0.586*
Perception	-0.341	0.068	0.045	-0.183	0.162	-0.029	-0.174	-0.448
focuspast	0.371	-0.086	0.248	-0.011	0.167	0.126	-0.081	0.179
Social	0.164	0.194	0.269	0.169	0.039	-0.167	-0.085	0.092
Affect	-0.506	0.271	-0.089	0.035	-0.248	-0.095	-0.017	0.088
Lifestyle	0.303	-0.252	0.166	-0.056	-0.191	-0.237	-0.003	0.423
Drives	0.040	0.318	0.214	0.113	-0.232	0.035	0.009	-0.382
physical	0.395	-0.058	-0.681***	-0.088	0.142	0.123	-0.275	0.212
tone_pos	-0.183	0.448	0.057	0.054	-0.286	0.180	-0.106	-0.505
space	-0.212	0.008	0.262	-0.108	0.121	0.097	0.043	-0.432
work	-0.137	-0.578*	0.195	-0.158	-0.051	-0.213	0.012	0.399
food	0.426	-0.117	-0.581**	-0.107	0.149	0.051	-0.059	0.040
allure	0.156	0.064	0.060	-0.129	-0.161	0.173	-0.280	0.234
time	0.066	-0.195	-0.119	-0.132	0.015	-0.083	-0.090	0.106
socrefs	0.469	0.292	0.130	0.167	0.052	-0.219	-0.014	0.120
insight	0.222	-0.009	0.540**	-0.155	-0.084	-0.263	0.281	-0.380
socbehav	-0.266	-0.031	0.393	0.106	0.016	-0.062	-0.162	0.240
affiliation	0.222	0.341	0.118	0.145	-0.007	-0.004	-0.206	-0.433
emotion	-0.429	0.324	0.042	0.027	-0.028	-0.062	0.051	-0.006
differ	0.359	-0.369	-0.311	0.136	0.160	-0.073	-0.107	0.677*
achieve	-0.284	0.069	0.132	-0.015	-0.340*	0.115	0.200	-0.322
focuspresent	-0.002	0.207	-0.096	-0.083	-0.116	0.197	-0.236	-0.065
emo_pos	0.002	0.491	-0.134	0.095	-0.042	0.005	0.172	-0.341
motion	-0.127	-0.031	0.564**	0.056	0.091	-0.086	0.064	-0.088
cause	0.258	0.260	0.153	-0.165	0.123	0.368*	0.106	0.175
emo_anx	-0.632*	0.102	0.224	-0.110	0.045	-0.243	0.091	0.331

Table B.10: Complete Version of Language Inventory Word Count (LIWC) and Deprivation Sensitivity (DS) Correlations for Math Anxiety (MA)

Abbrev.	Control Group				Expressive Writing			
	Low MA		High MA		Low MA		High MA	
	Low DS	High DS	Low DS	High DS	Low DS	High DS	Low DS	High DS
WC	0.237	0.284	0.397*	0.262	-0.070	-0.398*	0.202	-0.096
Analytic	0.006	0.302	-0.067	0.012	-0.130	-0.432**	0.006	-0.144
Clout	0.222	0.257	0.095	0.105	-0.332*	-0.244	0.164	-0.239
Authentic	0.249	0.040	0.166	-0.100	0.234	0.103	0.146	0.232
Tone	0.130	0.027	0.142	0.137	-0.218	-0.015	0.028	-0.004
WPS	-0.377	0.356	-0.045	-0.153	0.041	0.010	0.174	-0.085
BigWords	0.273	0.334	-0.215	0.092	-0.261	-0.433**	0.002	0.061
Dic	0.023	-0.274	0.288	-0.179	0.256	0.478**	0.066	0.147
Linguistic	0.184	-0.059	0.254	-0.028	0.211	0.483**	0.063	0.001
function	0.082	0.171	0.474**	-0.055	0.204	0.423**	0.142	0.012
pronoun	-0.257	0.003	0.251	0.009	0.303	0.286	0.207	-0.031
ppron	-0.263	-0.050	0.258	0.088	0.414**	0.246	0.315	0.041
i	-0.402	-0.188	0.191	0.070	0.439**	0.276	0.094	0.253
we	0.192	0.500	0.186	0.023	-0.327*	-0.148	0.326	-0.396
you	-0.065	NaN	0.122	-0.012	-0.057	0.107	0.022	-0.054
shehe	-0.035	0.111	0.213	0.038	0.188	-0.009	0.048	0.040
they	0.333	-0.189	0.180	-0.254	-0.064	-0.115	-0.033	0.588*
ipron	-0.104	0.068	0.092	-0.178	0.017	0.087	-0.065	-0.129
det	0.229	0.462	0.214	-0.119	0.175	-0.205	-0.031	-0.297
article	0.054	0.394	-0.004	0.046	0.089	-0.295	0.031	-0.224
number	0.170	0.710**	0.078	0.076	0.057	0.223	0.274	-0.264
prep	0.288	0.195	0.055	-0.094	-0.120	-0.147	0.256	-0.001
auxverb	-0.189	-0.207	0.268	0.049	0.178	0.391*	0.007	0.121
adverb	-0.130	0.145	0.136	-0.091	0.038	0.313	-0.183	0.144
conj	0.473	-0.481	0.147	-0.160	0.016	0.444**	0.046	0.180
negate	0.101	-0.142	-0.291	0.037	0.162	0.183	-0.029	0.096
verb	0.126	-0.373	0.162	-0.088	0.246	0.473**	0.015	0.020
adj	0.019	-0.119	-0.239	0.347*	0.054	0.199	-0.271	0.294
quantity	0.740**	-0.039	0.203	-0.019	-0.229	0.161	-0.080	0.019
Psychological Processes								
Cognition	-0.410	0.300	-0.025	-0.216	0.207	0.113	0.290	0.039
cogproc	-0.480	0.271	-0.154	-0.226	0.220	0.045	0.337	-0.032
Perception	0.379	0.074	-0.095	-0.217	-0.133	0.062	-0.153	-0.224
focuspast	0.370	-0.416	0.282	-0.016	0.330*	0.239	0.135	0.142
Social	0.004	0.103	0.375*	-0.034	-0.134	0.138	0.207	0.145
Affect	0.059	0.013	0.218	0.018	0.043	0.093	0.069	0.676**
Lifestyle	0.020	0.181	0.240	-0.195	-0.084	-0.186	-0.249	0.401
Drives	0.230	0.265	0.279	0.015	-0.206	-0.112	0.089	-0.065
physical	-0.014	-0.489	-0.477**	0.207	-0.225	0.070	-0.086	-0.012
tone_pos	0.294	-0.034	0.204	0.067	-0.113	0.030	0.105	0.453
space	0.140	0.321	0.162	-0.234	-0.230	0.050	-0.099	-0.274
work	-0.205	0.481	0.205	-0.173	-0.028	-0.188	0.273	0.337
food	-0.010	-0.487	-0.443*	0.093	-0.405**	-0.044	-0.657**	-0.150
allure	-0.012	-0.075	0.136	-0.120	0.178	0.274	-0.171	-0.034
time	0.317	-0.246	-0.004	-0.119	0.124	0.365*	-0.225	0.125
socrefs	0.144	0.350	0.275	-0.020	-0.164	0.015	0.224	0.138
insight	0.382	0.405	0.094	-0.050	0.126	-0.298	0.434	-0.079
socbehav	-0.100	-0.157	0.332	-0.035	0.070	-0.188	0.121	0.341
affiliation	0.168	0.133	0.237	-0.008	-0.371*	-0.090	0.338	-0.350
emotion	-0.459	0.351	0.336	-0.137	0.201	-0.069	0.082	0.410
differ	0.022	0.178	-0.248	-0.118	0.006	0.190	0.184	0.194
achieve	0.244	0.437	0.046	0.038	0.0002	-0.062	-0.070	0.299
focuspresent	-0.648*	-0.256	-0.252	0.015	-0.053	0.308	-0.017	-0.101
emo_pos	-0.102	0.177	0.297	-0.096	0.195	-0.019	0.114	0.596**
motion	0.293	0.166	0.447*	-0.088	0.278	0.103	-0.160	-0.006
cause	-0.088	-0.228	-0.018	-0.263	0.035	-0.038	-0.132	-0.052
emo_anx	0.149	0.139	0.278	-0.124	0.246	-0.111	-0.163	0.146

Table B.11: Complete Version of Language Inventory Word Count (LIWC) and Social Curiosity (SC) Correlations for Math Anxiety (MA)

Abbrev.	Control Group				Expressive Writing			
	Low MA		High MA		Low MA		High MA	
	Low SC	High SC	Low SC	High SC	Low SC	High SC	Low SC	High SC
WC	-0.336	-0.234	-0.223	-0.165	-0.028	-0.040	-0.376	-0.305
Analytic	0.097	0.132	0.215	-0.233	0.088	-0.354*	-0.272	-0.015
Clout	-0.050	-0.299	-0.193	0.244	0.025	-0.027	0.113	-0.253
Authentic	-0.012	0.096	-0.225	0.047	-0.201	0.004	-0.374	-0.139
Tone	-0.151	-0.231	-0.012	-0.068	-0.128	-0.138	-0.139	-0.284
WPS	-0.284	0.042	0.008	-0.047	-0.123	0.009	0.021	0.192
BigWords	0.291	-0.234	0.121	-0.147	0.150	-0.270	-0.347	-0.050
Dic	-0.246	-0.024	-0.405*	0.133	-0.129	0.196	0.443	0.223
Linguistic	-0.129	0.180	-0.111	0.058	-0.105	0.300	0.527	0.207
function	-0.167	0.086	-0.155	-0.052	-0.124	0.410*	0.421	0.162
pronoun	-0.111	-0.130	-0.312	0.079	-0.026	0.321*	0.059	-0.063
ppron	-0.155	-0.005	-0.290	0.090	-0.114	0.207	0.115	-0.011
i	-0.151	0.211	-0.141	-0.060	-0.145	0.089	-0.132	-0.025
we	-0.053	-0.326	-0.386	0.259	0.009	0.032	-0.179	-0.387
you	0.033	-0.032	0.114	0.120	-0.174	-0.054	0.266	0.175
shehe	-0.267	-0.207	-0.039	-0.112	0.149	-0.018	0.075	0.190
they	0.463	-0.210	0.244	0.113	0.032	0.115	0.287	0.533**
ipron	0.053	-0.252	-0.276	0.014	0.143	0.213	-0.039	-0.102
det	0.203	-0.278	-0.038	-0.487***	-0.154	0.014	0.031	-0.041
article	0.069	-0.154	0.187	-0.373*	0.053	-0.115	0.270	0.024
number	0.330	-0.228	0.270	-0.068	0.083	0.240	0.056	0.243
prep	-0.047	0.385	0.243	-0.172	-0.041	-0.177	-0.078	0.152
auxverb	-0.191	-0.204	-0.004	0.017	-0.090	0.130	0.496	0.229
adverb	-0.096	0.175	-0.099	0.300*	-0.044	0.331*	0.323	0.095
conj	0.011	0.172	-0.212	0.284	-0.132	0.248	0.154	-0.051
negate	0.162	-0.110	-0.029	0.041	-0.009	0.406*	0.285	-0.044
verb	-0.197	-0.094	-0.097	0.061	0.033	0.160	0.467	0.261
adj	0.273	0.234	0.405*	0.062	0.042	0.102	-0.144	0.255
quantity	0.393	-0.014	0.418	0.258	-0.238	0.029	-0.057	-0.108
Psychological Processes								
Cognition	0.230	-0.043	-0.043	-0.097	0.169	0.276	0.176	0.015
cogproc	0.235	-0.050	-0.024	-0.120	0.204	0.224	0.128	0.038
Perception	-0.031	0.050	0.272	-0.235	-0.095	-0.022	-0.596*	-0.228
focuspast	0.115	-0.346	-0.156	0.095	0.194	-0.192	-0.121	0.074
Social	-0.217	-0.182	-0.255	0.033	-0.177	0.046	0.123	0.156
Affect	-0.112	-0.327	-0.231	-0.243	-0.051	-0.065	-0.226	0.047
Lifestyle	-0.007	-0.0001	-0.113	-0.077	-0.232	-0.276	0.012	0.280
Drives	-0.231	-0.263	-0.435*	0.164	-0.008	-0.049	-0.181	-0.381
physical	0.195	0.066	-0.152	0.412**	-0.032	-0.118	0.250	-0.028
tone_pos	-0.069	-0.248	-0.172	-0.177	-0.114	-0.088	-0.128	-0.256
space	-0.326	-0.135	0.183	-0.216	-0.120	-0.020	-0.632*	-0.047
work	-0.051	-0.310	0.017	-0.028	-0.319*	-0.277	0.019	0.206
food	0.153	0.103	0.050	0.416**	-0.051	-0.073	0.171	-0.221
allure	-0.143	-0.197	-0.199	0.164	-0.195	0.306	0.510	-0.080
time	-0.407	-0.111	-0.239	0.406**	-0.083	-0.014	0.190	0.115
socrefs	-0.160	-0.172	-0.340	0.151	-0.146	0.056	0.166	0.142
insight	0.322	-0.031	-0.233	0.020	0.242	-0.019	-0.034	-0.264
socbehav	-0.156	-0.069	-0.099	-0.240	-0.070	-0.003	-0.339	0.193
affiliation	-0.218	-0.139	-0.394*	0.202	-0.051	-0.005	-0.165	-0.392
emotion	-0.181	-0.229	-0.107	-0.230	0.039	0.227	0.008	0.172
differ	0.430	-0.016	-0.096	-0.198	-0.033	0.351*	0.149	0.164
achieve	-0.122	-0.337	-0.195	0.078	0.071	0.116	-0.171	-0.221
focuspresent	-0.069	-0.016	0.083	0.253	-0.117	0.208	0.372	-0.119
emo_pos	-0.201	-0.153	-0.094	-0.184	-0.037	0.219	0.129	-0.010
motion	-0.280	0.215	-0.067	-0.133	-0.045	-0.067	-0.173	-0.098
cause	0.186	-0.035	-0.191	0.309*	0.163	-0.121	0.147	0.003
emo_anx	0.282	-0.321	-0.110	-0.173	0.294	-0.182	-0.065	0.293

Table B.12: Complete Version of Language Inventory Word Count (LIWC) and Thrill Seeking (TS) Correlations for Math Anxiety (MA)

Abbrev.	Control Group				Expressive Writing			
	Low MA		High MA		Low MA		High MA	
	Low TS	High TS	Low TS	High TS	Low TS	High TS	Low TS	High TS
WC	0.312	-0.202	0.154	-0.243	-0.069	-0.176	0.167	-0.131
Analytic	-0.149	0.141	-0.123	-0.119	0.079	-0.280	0.722**	-0.154
Clout	0.085	-0.726*	0.055	0.156	-0.382*	-0.113	0.053	-0.145
Authentic	0.164	0.254	0.003	0.022	0.049	-0.074	-0.095	-0.027
Tone	-0.127	-0.180	-0.142	-0.226	-0.106	-0.234	0.529*	-0.183
WPS	-0.028	0.397	0.078	0.246	-0.315	0.158	0.069	0.221
BigWords	0.322	0.186	-0.116	0.009	0.002	-0.431**	0.442	-0.013
Dic	0.216	-0.221	0.280	0.148	-0.092	0.336*	-0.395	-0.026
Linguistic	0.178	-0.313	0.245	0.149	-0.203	0.403**	-0.562*	0.096
function	0.076	-0.269	0.318	0.125	-0.086	0.462**	-0.638*	0.124
pronoun	-0.306	-0.210	0.188	0.153	-0.276	0.137	-0.625*	0.010
ppron	-0.466	-0.167	0.125	0.086	-0.110	0.115	-0.593*	0.040
i	-0.433	0.536	0.068	-0.088	0.212	0.107	-0.266	-0.013
we	-0.099	-0.763**	0.164	0.282	-0.354*	-0.015	-0.065	-0.142
you	NaN	0.112	0.059	-0.258	-0.051	-0.097	-0.253	-0.014
shehe	-0.040	0.136	0.101	0.132	-0.099	0.076	-0.209	0.093
they	0.106	-0.506	0.218	-0.215	-0.359*	-0.102	-0.391	0.377
ipron	0.338	-0.130	0.278	0.233	-0.289	0.099	-0.323	-0.053
det	0.191	0.279	-0.022	0.096	-0.214	0.189	0.335	-0.294
article	0.145	0.282	-0.144	-0.054	0.011	-0.002	0.598*	-0.104
number	0.374	0.010	-0.002	0.248	0.259	-0.091	0.236	0.144
prep	-0.147	-0.028	0.138	-0.214	0.169	0.061	0.234	0.048
auxverb	0.177	-0.416	0.335	0.023	0.007	0.413**	-0.508	0.274
adverb	0.225	-0.003	0.289	0.176	0.042	0.258	-0.184	0.121
conj	0.210	-0.031	-0.010	0.104	0.115	0.049	-0.240	0.206
negate	0.507	0.153	-0.009	0.073	0.055	-0.101	-0.340	0.174
verb	0.429	-0.428	0.230	0.164	-0.044	0.366*	-0.576*	0.070
adj	-0.135	-0.090	0.170	-0.041	-0.127	-0.053	-0.065	0.390
quantity	0.367	-0.096	0.212	0.103	-0.447**	0.359*	0.181	-0.302
Psychological Processes								
Cognition	0.559*	0.256	0.423*	0.437**	-0.059	-0.0002	-0.529*	-0.036
cogproc	0.546*	0.395	0.391*	0.378*	0.002	-0.116	-0.567*	-0.063
Perception	0.319	0.170	-0.191	0.114	-0.251	-0.340*	-0.071	-0.047
focuspast	0.234	-0.386	0.248	0.107	0.289	0.223	0.297	-0.002
Social	0.032	-0.463	0.097	0.142	-0.468**	-0.054	-0.397	0.158
Affect	0.066	-0.211	-0.086	-0.275	0.123	-0.201	-0.149	0.024
Lifestyle	0.221	-0.696*	-0.163	-0.317*	0.103	-0.176	0.299	0.339
Drives	-0.046	-0.581	0.092	0.173	-0.231	-0.084	0.458	-0.306
physical	-0.225	0.195	-0.271	-0.266	0.153	0.105	-0.014	0.094
tone_pos	0.103	-0.321	-0.147	-0.257	-0.035	-0.253	0.274	-0.219
space	0.202	-0.060	-0.017	-0.080	-0.304	-0.308*	0.032	0.144
work	0.038	-0.518	-0.041	-0.036	0.083	-0.218	0.289	0.301
food	-0.181	0.118	-0.207	-0.178	0.238	-0.002	0.251	-0.205
allure	0.148	-0.430	0.005	0.247	-0.111	0.461**	-0.589*	-0.051
time	0.255	0.106	-0.138	0.183	0.178	0.229	0.127	0.207
socrefs	-0.007	-0.539	0.070	0.169	-0.543***	-0.013	-0.335	0.166
insight	0.438	-0.128	0.265	0.143	0.100	-0.216	0.035	-0.568**
socbehav	0.109	-0.097	0.087	0.004	-0.078	-0.192	-0.235	0.236
affiliation	-0.159	-0.669*	0.025	0.198	-0.315	-0.014	0.057	-0.238
emotion	-0.208	-0.138	-0.036	-0.066	0.222	-0.160	-0.283	0.055
differ	0.508	0.182	0.001	0.210	-0.213	-0.137	-0.680**	0.308
achieve	0.130	0.003	0.077	-0.242	-0.042	-0.140	0.595*	-0.384
focuspresent	0.059	-0.014	0.107	-0.001	-0.188	-0.019	-0.303	-0.089
emo_pos	-0.187	-0.309	-0.223	-0.076	0.138	-0.175	0.326	-0.054
motion	0.099	-0.117	0.017	0.208	-0.213	-0.200	0.336	-0.200
cause	0.410	0.376	0.227	0.287	0.103	0.103	-0.468	0.020
emo_anx	0.008	0.399	0.188	-0.027	0.264	-0.181	-0.049	0.417

Table B.13: Complete Version of Language Inventory Word Count (LIWC) and Stress Tolerance (ST) Correlations for Math Anxiety (MA)

Abbrev.	Control Group				Expressive Writing			
	Low MA		High MA		Low MA		High MA	
	Low ST	High ST	Low ST	High ST	Low ST	High ST	Low ST	High ST
WC	-0.387	-0.348	0.042	0.194	-0.058	-0.283	0.264	0.257
Analytic	-0.289	-0.337	0.088	0.042	-0.017	-0.135	0.178	0.384
Clout	-0.278	-0.452	-0.227	0.293	-0.016	0.084	0.341	0.084
Authentic	0.161	0.252	0.110	-0.104	0.076	-0.066	-0.053	-0.487
Tone	-0.207	-0.382	0.145	0.130	0.026	-0.036	0.004	0.382
WPS	-0.315	0.255	0.061	-0.127	-0.379*	-0.166	-0.366	0.090
BigWords	-0.106	-0.468	-0.076	-0.037	-0.044	-0.183	0.411*	0.284
Dic	0.082	0.303	-0.095	0.133	0.019	0.107	-0.218	-0.288
Linguistic	-0.315	0.208	-0.007	0.120	0.057	0.082	-0.338	-0.076
function	-0.410	0.236	0.076	0.255	0.020	0.118	-0.408*	-0.120
pronoun	0.164	0.043	0.015	0.159	0.067	-0.033	-0.366	0.016
ppron	0.220	0.109	0.037	0.208	-0.010	0.025	-0.206	-0.099
i	0.237	0.400	0.140	-0.038	-0.028	-0.018	-0.242	-0.106
we	-0.591*	-0.415	-0.202	0.338*	-0.065	0.207	0.166	-0.449
you	0.213	-0.078	-0.091	-0.127	0.200	0.005	0.129	0.144
shehe	0.386	-0.219	0.166	0.324*	0.094	-0.084	-0.178	0.185
they	-0.025	-0.318	0.071	0.170	0.019	-0.010	0.113	0.476
ipron	-0.097	-0.171	-0.048	-0.054	0.161	-0.096	-0.314	0.202
det	-0.502	-0.379	0.282	0.130	0.039	-0.105	-0.095	0.198
article	-0.656*	-0.309	0.211	0.070	0.085	-0.102	-0.013	0.350
number	-0.588*	-0.398	0.187	-0.347*	-0.046	-0.047	-0.507*	-0.163
prep	-0.309	-0.288	0.109	0.106	-0.072	0.025	0.118	0.266
auxverb	0.036	0.388	-0.125	0.045	0.181	0.199	-0.214	-0.182
adverb	-0.129	0.383	-0.027	-0.279	-0.079	0.227	-0.279	-0.388
conj	0.149	0.413	0.057	0.080	-0.061	0.036	-0.237	-0.269
negate	0.315	-0.005	-0.096	-0.206	0.314	-0.069	0.039	-0.226
verb	0.008	0.287	-0.142	0.024	0.078	0.122	-0.199	-0.025
adj	0.135	0.303	0.280	-0.171	0.191	-0.190	0.061	-0.431
quantity	0.053	-0.090	-0.007	-0.046	-0.073	0.175	0.214	-0.231
Psychological Processes								
Cognition	-0.039	0.100	-0.105	-0.022	0.117	-0.306*	-0.338	-0.304
cogproc	-0.060	0.172	-0.098	-0.085	0.139	-0.332*	-0.425*	-0.338
Perception	-0.354	-0.267	-0.043	-0.050	-0.034	-0.075	0.179	-0.038
focuspast	0.256	-0.012	-0.146	0.144	-0.281	0.260	-0.171	-0.444
Social	-0.087	-0.378	-0.164	0.369*	0.055	-0.001	0.160	0.102
Affect	-0.204	-0.350	-0.086	0.084	0.285	-0.001	0.145	0.452
Lifestyle	0.041	0.208	-0.290	0.233	-0.363*	0.131	0.217	-0.296
Drives	-0.256	-0.514	-0.213	0.355*	0.110	0.121	0.303	-0.133
physical	0.376	0.325	0.060	-0.196	0.066	0.267	0.098	-0.013
tone_pos	-0.218	-0.448	-0.069	0.146	0.191	-0.092	0.116	0.458
space	-0.265	-0.222	0.020	0.011	-0.078	0.025	0.014	-0.217
work	-0.249	0.287	-0.125	0.017	-0.370*	0.180	0.176	-0.323
food	0.378	0.380	0.007	-0.171	0.001	0.221	0.241	-0.217
allure	0.095	-0.124	-0.048	0.023	0.034	0.039	0.080	-0.240
time	0.247	0.239	-0.027	-0.063	-0.181	0.180	-0.117	-0.211
socrefs	-0.100	-0.356	-0.152	0.390*	0.011	0.058	0.086	0.036
insight	-0.231	-0.156	-0.054	-0.035	0.052	0.215	0.269	-0.090
socbehav	-0.009	-0.280	-0.138	0.145	0.113	-0.118	0.149	0.268
affiliation	-0.238	-0.463	-0.224	0.300	-0.038	0.200	0.191	-0.355
emotion	-0.146	-0.007	-0.023	-0.143	0.106	-0.042	0.168	0.300
differ	0.271	0.087	-0.110	-0.011	0.023	-0.173	-0.334	-0.493
achieve	-0.279	-0.298	0.035	0.282	0.183	-0.037	0.179	0.147
focuspresent	0.341	0.340	-0.120	-0.342*	0.327	0.010	0.018	0.145
emo_pos	-0.013	-0.225	-0.011	-0.111	-0.010	-0.059	0.221	0.430
motion	-0.255	-0.162	0.107	0.126	-0.010	-0.267	0.006	-0.026
cause	0.102	0.081	-0.067	-0.153	-0.087	-0.031	0.141	0.139
emo_anx	-0.274	NaN	0.090	-0.039	0.276	0.174	-0.126	-0.049