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# Personal resources *versus* risk factors:

# From academic achievement to anxiety forms

**Coordinator:** Prof. Giovanni Galfano

**Supervisor:** Prof. Irene C. Mammarella

**Co-Supervisor:** Prof. Lucia Mason

**PhD Student:** Enrica Donolato

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# ABSTRACT

Learning in the school context involves strong social and emotional components that have a role in academic achievement and children development (Zins, Weissberg, Wang, & Walberg, 2007). Among individual factors that prevent or promote school success and emotional well-being at school, different risk factors and personal resources have been considered in the literature.

The aim of the present dissertation is to consider the joint role of negative affect, anxiety forms and personal resources related to self-concept and resilience once the effect of cognitive abilities (i.e., working memory or intelligence) is taken into account. The relation among these different variables was addressed in three related studies that involved typically developing children. In the first Study, the interplay between general factors related to negative affect (i.e., general-anxiety and depressive symptoms), working memory and personal resources (i.e., competence and academic self-concept and ego-resilience) on mathematics and reading literacy was considered. In the second Study the relation among general and academic forms of anxiety (i.e., test-anxiety and mathematics-anxiety), and ego-resilience on mathematics and reading literacy was explored after controlling for fluid intelligence. In the third Study, the presence of different anxiety profiles and their relation with general (i.e., competence self-concept and ego-resiliency) or academic (i.e., academic self-concept and academic buoyancy) personal resources was considered. Each study will be presented starting from theoretical background and empirical evidence and then describing methodology, statistical analyses and results. General conclusions derived from the main findings of

the three studies as well as clinical and educational implications will be finally highlighted.

# ABSTRACT (Italian version)

L'apprendimento nel contesto scolastico è legato a forti componenti sociali ed emotive che hanno un ruolo nel rendimento accademico e nello sviluppo dei bambini (Zins, Weissberg, Wang e Walberg, 2007). Tra i fattori individuali che impediscono o promuovono il successo scolastico e il benessere emotivo a scuola, in letteratura sono stati identificati diversi fattori di rischio e risorse personali.

La presente tesi di Dottorato si propone di indagare il ruolo congiunto dell'ansia generale e dei sintomi depressivi, così come delle diverse forme di ansia e delle risorse personali legate all'autostima e all'ego-resilienza una volta considerato l'effetto delle abilità cognitive (es. memoria di lavoro o intelligenza). La relazione tra queste diverse variabili è stata affrontata in tre studi che hanno coinvolto bambini a sviluppo tipico. Nel primo studio è stata considerata la relazione tra fattori generali legati al *negative affect* (ansia generale e sintomi depressivi), alla memoria di lavoro e alle risorse personali (autostima di controllo sull'ambiente e autostima scolastica ed ego-resilienza) in relazione alle prestazioni scolastiche in matematica e italiano. Nel secondo studio è stata esplorata la relazione tra ansia generale e le forme d'ansia scolastica (ansia da valutazione e ansia per la matematica) e l'ego-resilienza in relazione a prove di matematica e italiano, dopo aver controllato per l'intelligenza fluida. Nel terzo studio, sono stati presi in considerazione diversi profili di ansia e la loro interazione con le risorse personali generali (autostima di controllo sull'ambiente e l'ego-resilienza) o accademiche (l'autostima scolastica e l'ottimismo scolastico). Ogni studio sarà presentato a partire dal contesto teorico e dalle evidenze empiriche, descrivendo successivamente la metodologia considerata, le analisi svolte e i risultati ottenuti.

Saranno infine evidenziate le conclusioni generali derivate dai risultati principali dei tre studi così come le implicazioni cliniche ed educative.

# CHAPTER 1

# EMOTIONAL ASPECTS AND PERSONAL RESOURCES INVOLVED IN CHILDREN EDUCATION

Learning at school is a key aspect in children life and development. Children are required to attend school in order to achieve goals that are of fundamental importance for their future working outcomes, income, employment, and health status in adult life (Fischbach, Keller, Preckel, & Brunner, 2013; Mirowsky & Ross, 2003; Roth, BeVier, Switzer, & Schippmann, 1996). Nevertheless, learning in the school has strong social and emotional components that are related to academic achievement and children development (Zins, Weissberg, Wang, & Walberg, 2004). This is clear considering that during the primary school, children receive several feedback about their performance, and they become more able to reflect on their results (Eccles, 1999). At the same time, children experience increasing pressure by teachers and parents about their performance, which is systematically evaluated in terms of grades and excellence standards (Killu, Marc, & Crundwell, 2016). This could lead to some emotional and achievement difficulties, which can negatively affect children development. In order to prevent these difficulties, it is of fundamental importance to examine those individual factors that prevent or promote school success and emotional well-being at school.

A great amount of literature has focused on different risk factors that are related to positive educational and developmental outcomes. Among these factors, negative affect, general and academic anxiety (i.e., test- and mathematics-anxiety) are considered

to have a negative impact on children academic achievement (Hembree, 1988, 1990; Ma, 1999; McDonald, 2001; Riglin, Petrides, Frederickson, & Rice, 2014; Segool, Carlson, Goforth, Von Der Embse, & Barterian, 2013; Seipp, 1991; Wu, Barth, Amin, Malcarne, & Menon, 2012). On the other hand, personal resources are aspects that help children to foster competence and promote successful development in individual, social and school areas of functioning (Dekovic, 1999). Among different personal resources, self-concept and resilience are associated with positive life outcomes including academic success (Eisenberg et al., 1997; Kuster, Orth, & Meier, 2013; Masten, 2001; Orth, Robins, & Widaman, 2012). A brief definition of each of these constructs will be given in the following sections, underlying their importance as related to children education.

## 1.1 Depressive symptoms and anxiety forms in children

Among factors that can have a detrimental effect on children development, anxiety and depressive symptoms (also called negative affect, see Owens, Stevenson, Hadwin, & Norgate, 2012) have frequently been investigated. General-anxiety (GA) is an aversive motivational state that occurs in those everyday life situations in which the level of perceived threat to the individual is high (Eysenck & Calvo, 1992). Depressive symptoms refer to the presence of low mood, intrusive ruminative thoughts and difficulties in concentration (e.g., Kovacs & Goldston, 1991; Nolen-Hoeksema, 2000). GA and depressive symptoms are common forms of psychological problems that are strongly related in children and adolescents (Higa-McMillan, Francis, & Chorpita, 2014; Rapee, Schniering, & Hudson, 2009; Seligman & Ollendick, 1998). Research shows that both GA and depressive symptoms have detrimental effects on different areas including the academic field (e.g., Fletcher, Lovatt, & Baldry, 1997; Fröjd et al.,

2008; Newbegin & Owens, 1996; Owens et al., 2012; Seipp, 1991). With regards to anxiety, the literature suggests to distinguish among different forms (i.e., test- and mathematics-anxiety), which can be differently related to academic achievement.

Test anxiety (TA) can be defined as a multidimensional construct involving cognitive, bodily-affective and behavioural responses associated to concerns about possible negative consequences of failure on evaluative situations (Zeidner, 1998). TA is related to school evaluations and to academic performance (Hembree, 1988; McDonald, 2001; Putwain, 2008). Another form of anxiety specifically related to academic achievement is mathematics-anxiety (MA), which can be defined as the presence of feelings of tension, worry and apprehension to current or prospective situation involving mathematics (Ashcraft & Moore, 2009; Richardson & Suinn, 1972; Wigfield & Meece, 1988). Since TA and MA occur in the primary school these aspects have been found to be associated with lower academic performance (e.g., Ashcraft & Moore, 2009; Hembree, 1988, 1990; Ma, 1999; McDonald, 2001; Segool et al., 2013; Wu et al., 2012). Beside these aspects (e.g., negative affect, TA and MA), which have a negative role in children everyday life and school performance, other studies examine the positive role of factors that support children academic success.

## 1.2 Self-concept and ego-resilience in children

Among individual factors that sustain children development and school functioning, self-concept and ego-resilience have been frequently considered.

Self-concept can be defined as a multidimensional and context-dependent construct that comprises the evaluation of the individual in several life domains (e.g., Bracken, 1996; Shavelson, Hubner, & Stanton, 1976). Self-concept is supposed to present a hierarchical structure, which includes different second order domains at the

bottom of the hierarchy (e.g., Bracken, 1996; Shavelson et al., 1976). Among several other domains, social, competence, affect, physical, academic, and family dimensions seem to constitute the principal aspects of self-concept (Bracken, 1996)[1]. Reflecting the hierarchical structure, these specific components of self-concept are considered as more differentiated and less highly correlated one to each other, so that much of the variance in domain-specific factors of self-concept could not be explained as higher-order factor. Results of several studies provide strong evidence that self-concept is predictive of positive individual outcomes in different life domains including work success, mental health and education (Kuster et al., 2013; Orth et al., 2012; Trzesniewski et al., 2006). Beside self-concept, resilience has also been associated with positive outcomes.

Resilience can be broadly defined as an adaptive response to adversities and stressful situations (e.g., Garmezy, 1991; Masten 2014; Windle, 2011). Two aspects seem to characterize resilience, i.e. adversity and positive adaptation (see Fletcher & Sarkar, 2013). With the term "adversity" some researchers refer to the notion of "risk", while others consider it more broadly as any hardship and suffering linked to trauma or difficulties (e.g., Jackson, Firtko, & Edenborough, 2007; Sameroff & Rosenblum, 2006). In a similar vein, "positive adaptation" is defined in different ways, such as in relation to developmental tasks or well-being (Luthar & Cicchetti, 2000; Masten & Obradovic´, 2006). Along with the definition of resilience, different conceptualizations of this construct have emerged in the literature.

Resilience as a personality trait is often referred as ego-resiliency or ego-resilience (Block & Block, 1980; Luthar et al., 2000). Ego-resilience is characterized by a pattern of individual features, such as general resourcefulness, strength of character,

[1] In the context of the multidimensional, hierarchical model of self-concept, self-esteem is considered the global construct at the apex of the hierarchy, while self-concept refers to specific components within this model (e.g., academic self-concept, social self-concept). For this reason, we treat the terms global self-concept and self-esteem as synonymous.

and flexibility of functioning that allow individuals in adapting to external and internal stressors. One common aspect of ego-resilience is the ability to adapt one's level of impulse expression to changing circumstances and to one's environment, recovering quickly from difficulties and day-to-day challenges (Block & Block, 1980). The role of children's ego-resilience has been examined in relation to social and academic outcomes suggesting that it allows to better manage different challenges leading to good development (e.g., Eisenberg et al., 1997).

## 1.3 Aim and structure of the present dissertation

The main aim of the present dissertation is to examine the relation between different individual factors that prevent or promote children academic success and emotional well-being. We decided to focus on negative affect (i.e., anxiety and depressive symptoms), anxiety forms (i.e., GA, TA and MA) and personal resources (i.e., self-concept or ego-resilience) considering their relation once the role of cognitive abilities (i.e., working memory or intelligence) was considered. The relation between these different variables was addressed in three related studies that involved typically developing children. In the first Study, we focused on the interplay between negative affect (i.e., GA and depressive symptoms), working memory and personal resources (i.e., competence and academic self-concept and ego-resilience) on mathematics and reading literacy. Then, a second Study was addressed in order to examine the relation between general and academic forms of anxiety (i.e., GA, TA and MA), and ego-resilience on mathematics and reading literacy after controlling for fluid intelligence. While the first Study focused on middle school students, the second Study considered both primary and middle school scholars. Finally, a third Study was carried out to examine the presence of different anxiety profiles in order to understand whether MA

and TA are a manifestation of a general form of anxiety or the expression of specific forms of anxiety in primary school children. Moreover, the relation between these anxiety profiles and general (i.e., competence self-concept and ego-resiliency) or academic (i.e., academic self-concept and academic buoyancy) personal resources was examined.

In these three studies, different statistical approaches were used. In the first two studies, structural equation models (SEM) were performed in order to test our hypotheses in terms of latent variables (i.e., at construct level) and to have better estimations of the relations between the considered variables on academic achievement (i.e., mathematics and reading literacy). In the first two studies, we decided to consider the performance on different academic domains such as mathematics and reading literacy. The vast majority of research has focused on a single measure of academic achievement (i.e., school grades) or only on mathematics achievement (Devine, Fawcett, Szűcs, & Dowker, 2012; Hill et al., 2016). For example, measures of reading literacy are often neglected and this might present with some limitations, e.g., research has shown that anxiety may affect reading proficiency and is not only affecting mathematics (e.g., Ackerman, Izard, Kobak, Brown, & Smith, 2007; Carroll & Iles, 2006; Mammarella et al., 2016; Rajchert, Żułtak, & Smulczyk, 2014). Including different measures of the academic performance (e.g., mathematics and reading literacy) together with anxiety forms (e.g., GA, TA and MA) is very uncommon, while this seems to be fundamental in order to have a better understating of the relations between these factors (see Carey, Devine, Hill, & Szűcs, 2017; Hill et al., 2016). In order to have reliable indexes of mathematics and reading literacy performance we decided to use objective measures of academic achievement. This decision was based on the observation that evaluations provided by the teachers, e.g. GPA, or grade point average, tend to be less reliable compared to academic achievement tests (Giofrè, Borella, &

Mammarella, 2017). Differently, in the third Study, measures of academic achievement were not considered. In fact, we aimed to examine whether different anxiety profiles can be distinguished in primary school children and to analyse the relation between latent profiles and general (i.e., competence self-concept and ego-resiliency) or academic personal resources (i.e., academic self-concept and academic buoyancy).

## 1.4 Chapters' overview

As previously mentioned, the main aim of the present PhD dissertation is to examine factors that can prevent or promote academic success and emotional well-being in school-aged children. Table 1.1 summarizes the main characteristics and the number of children involved in the three studies as well as the main aims and the hypotheses of each research that will be presented in details in the next chapters.

***Table 1.1*** Summary of the essential information concerning each study: number of participants (N), constructs tested, aims and hypothesis.

| Study | N | Constructs | Aims | Hypotheses |
|---|---|---|---|---|
| I | N=143 children<br><br>Grades 6 and 8 | **General-anxiety**<br>**Depressive symptoms**<br><br>**Self-concept (competence and academic)**<br>**Ego-resiliency**<br><br>**Working memory**<br><br>**Mathematics and reading literacy** | • General aim: examining the relation among negative affect (i.e., general-anxiety and depressive symptoms), personal resources (i.e., academic and competence self-concept and ego-resilience) and WM on mathematics and reading literacy.<br>• Specific aims:<br>  • testing the effect of negative affect on mathematics and reading literacy when WM is considered;<br>  • testing the effect of personal resources on mathematics and reading literacy when WM is considered. | • It was expected that negative affect would have an effect on mathematics and reading literacy when WM abilities are considered (Eysenck & Calvo, 1992; Eysenck, Derakshan, Santos, & Calvo, 2007; Ellis & Moore, 1999; Owens et al., 2012).<br>• Personal resources were supposed to have a positive effect on both mathematics and reading literacy once WM was considered (Giofrè, Borella, & Mammarella, 2017; Kwok, Hughes, & Luo, 2007; Swanson, Valiente, Lemery-Chalfant, & Caitlin O'Brien, 2011). |
| II | N=269 children<br><br>Grades 5, 6 and 8 | **General-anxiety**<br>**Test-anxiety**<br>**Mathematics-anxiety**<br><br>**Ego-resiliency**<br><br>**Intelligence**<br><br>**Mathematics and reading literacy** | • General aim: studying the relation among anxiety forms (i.e., GA, TA and MA) and ego-resilience on mathematics and reading literacy once fluid intelligence was taken into account.<br>• Specific aims:<br>  • testing the effect of GA, TA and MA on mathematics and reading literacy;<br>  • testing the contribution of ego-resilience on mathematics and reading literacy once GA, TA and MA are considered. | • We hypothesized that MA would have a specific effect on mathematics achievement, while TA might have role on reading literacy (Ackerman et al., 2007; Carroll & Iles, 2006; Hembree, 1988, 1990; Mammarella et al., 2016; Richardson & Suinn, 1972; Wu et al., 2012). Moreover, it was expected that GA could have an effect on mathematics and reading literacy throughout MA and TA respectively (Carey et al., 2017; Hill et al., 2016).<br>• Ego-resilience was supposed to have a positive effect on mathematics and reading literacy (Chuang, Lamb, & Hwang, 2006; Kwok et al., 2007; Swanson et al., 2011) even when GA, TA and MA are considered. |
| III | N=664 children<br><br>Grades 3, 4, 5 and 6 | **General-anxiety**<br>**Test-anxiety**<br>**Mathematics-anxiety**<br><br>**Self-concept (competence and academic)**<br><br>**Ego-resiliency and academic buoyancy** | • Aim 1: testing the presence of different anxiety profiles based on measures of GA, TA, and MA;<br>• Aim 2: testing the relation between different anxiety profiles and general (i.e., competence and academic self-concept) or academic (e.g., ego-resilience or academic buoyancy) personal resources. | • It was expected to find different profiles of anxiety derived by the combination of GA, TA and MA, which showed moderate correlations (Hembree, 1988, 1990; Ma, 1999; see also Carey et al., 2017).<br>• We expected that general and academic personal resources had a different role on latent profiles of anxiety (e.g., Benetti & Kambouropoulos, 2006; Bong & Skaalvik, 2003; Putwain, Daly, Chamberlain, & Sadreddini, 2015; Sowislo & Orth, 2013). |

*Note.* GA = general-anxiety; TA=test-anxiety; MA=Mathematics-anxiety; WM: working memory.

In the next chapter (**Chapter 2)** a brief review of the literature about the relation between negative affect (i.e., GA and depressive symptoms), personal resources (i.e., competence and academic self-concept and ego-resilience), mathematics and reading literacy will be present. Previous studies on the relation between negative affect and working memory will also be described. In the second part of this chapter, the first Study will be present, which aims to examine the role of negative affect, working memory, and personal resources on mathematics and reading literacy.

**Chapter 3** will provide definition of academic anxiety forms (e.g., MA and TA) and evidence about the relation with academic performance. Evidence about the role of resilience in academic achievement and its relation to TA will also be presented. This Study will focus on the relation among general and academic forms of anxiety (i.e., GA, TA and MA), ego-resilience on mathematics and reading literacy, after the role of fluid intelligence was taken into account.

While the first two studies are focused on the relation between negative affect or anxiety forms (i.e., GA, TA and MA) and personal resources (i.e., self-concept or ego-resilience) on mathematics and reading literacy, the last Study of the present dissertation will examine in depth on the relation between anxiety forms and personal resources, without considering academic achievement.

Hence, **Chapter 4** will summarize the literature about the relation between anxiety forms (i.e., GA, TA and MA). Indeed, the association between GA, TA and MA and general or academic personal resources (i.e., competence and academic self-concept, ego-resilience or academic buoyancy) will be described. The third Study of this dissertation, which aimed to examine the presence of different risk anxiety profiles in children and their relation with general (i.e., competence self-concept and

ego-resiliency) or academic (i.e., academic self-concept and academic buoyancy) personal resources will be then presented.

Finally, **Chapter 5** will summarize the main findings from each study. Strengths and limits of the conducted studies will be further examined together with suggestions for further research. Finally, educational and clinical implications of current studies will be discussed.

# CHAPTER 2

# THE RELATION AMONG NEGATIVE AFFECT, PERSONAL RESOURCES AND WORKING MEMORY ON MATHEMATICS AND READING LITERACY

## 2.1 Introduction

A large body of research has examined the role of cognitive abilities (i.e., working memory) on academic achievement (e.g., Rohde & Thompson, 2007). Research points out that working memory (WM) is one of the most important factors in academic performance (e.g., Gathercole, Pickering, Knight, & Stegmann, 2004; St Clair-Thompson & Gathercole, 2006). Alongside WM, previous studies have examined the interplay between emotions and academic achievement (e.g., Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017). Among these factors, general anxiety and depressive symptoms (hereafter called negative affect) have been showed to be associated with lower academic achievement (Fletcher, Lovatt, & Baldry, 1997; Fröjd et al., 2008; Seipp, 1991). On the other hand, self-concept and ego-resilience (hereafter called personal resources) are aspects that support children in the academic field (Kwok, Hughes, & Luo, 2007; Liew, Cao, Hughes, & Deutz, 2018; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005; Valentine, DuBois, & Cooper, 2004). However, limited evidence on the relation among negative affect, WM and personal resources on

academic achievement is available.

The present chapter will first outline how negative affect (i.e., general-anxiety and depressive symptoms) and personal resources (i.e., competence and academic self-concept and ego-resilience) are related to academic performance. Theoretical models and evidence about the relation between negative affect and WM will also be present. Thereafter, the first Study of the present dissertation, which examined the relation among negative affect, WM and personal resources on mathematics and reading literacy will be described. Children in grades 6 and 8 were involved. We decided to consider this particular age range as it is important transitional period when pre-adolescents are more likely to face emotional difficulties and decreasing in self-concept (e.g., Eccles, 1999; Steinberg & Morris, 2001). Participants were tested with self-report measuring general-anxiety and depressive symptoms, WM experimental tasks and national tests for assessing mathematics and reading literacy. Structural equational models were used to examine the relation among these variables on mathematics and reading literacy. Results will be discussed in relation to the extant literature.

## 2.2 Negative affect, personal resources and academic performance

In recent studies, negative affect has been used to refer to anxiety and depressive symptoms (see Owens et al., 2012). As mentioned in the previous chapter, general-anxiety (GA) refers to the individual's tendency to feel anxious about everyday situations, involving physiological anxiety, worry and social anxiety (Reynolds & Richmond, 2012). Depressive symptoms are described as the presence of low mood, intrusive ruminative thoughts, loss of interest as well as social withdrawal (Beck, 1967; Kirkcaldy & Siefen, 1998; Nolen-Hoeksema, 2000). As regard the relation between GA and depressive symptoms, it is widely recognized that these two aspects frequently co-

occur in children (Seligman & Ollendick, 1998) and that they are both associated with poor academic attainment (e.g., Fletcher et al., 1997; Fröjd et al., 2008; Owens et al., 2012; Seipp, 1991).

Extensive research points out that individuals suffering from GA and depressive symptoms could experience academic difficulties such as lower grades, scores on standardized tests and graduation rates (e.g., Ansary, McMahon, & Luthar, 2012; Fröjd et al., 2008). A recent meta-analysis provides stronger evidence about the negative association between GA and depressive symptoms and school attainment (Riglin, Petrides, Frederickson, & Rice, 2014). It should be noted that most of the previous research examined the relation among GA, depressive symptoms and academic achievement focused on clinical samples, while studies on typical developing students are scarce and produced inconsistent findings (e.g., Bernstein & Borchardt, 1991; Cole, Martin, Powers, & Truglio, 1996; Kovacs & Devlin, 1998). Although negative affect has a detrimental effect on academic achievement, there are several other factors, such as personal resources, that should be considered.

Among personal resources, self-concept and ego-resilience are important aspects for the academic success (e.g., Kwok et al., 2007; Liew et al., 2018; Swanson, Valiente, Lemery-Chalfant, & Caitlin O'Brien, 2011; Valentine et al., 2004). Self-concept can be defined as the individual and subjective evaluation of the person in different life contexts based on personal evaluations of their own past behaviours and experiences (Bracken, 1996). Whereas, ego-resilience is considered as a set of personal characteristics that help the individual to adapt to changing environment, recovering quickly from difficulties (Block & Block, 1980). Both ego-resilience and self-concept are positively associated with academic achievement.

A recent meta-analysis shows a significant, although small in terms of the

magnitude, positive association of self-concept on academic achievement even when controlling for initial level of achievement (Valentine et al., 2004). Intriguingly, the effect of self-concept seems to be significant even after controlling for WM (Giofrè et al., 2017). Similarly to self-concept, ego-resilience is positively linked to academic performance (e.g., Swanson et al., 2011). This result holds true also for reading and mathematics achievement and even when the effect of general cognitive ability and family economic adversity are considered (Kwok et al., 2007). However, more research is needed in order to examine the interplay among all these aspects and other cognitive factors (i.e., WM) in the academic field.

## 2.3 The relation between negative affect and working memory: theoretical models and available evidence

Research has started to link anxiety and depressive symptoms to cognitive abilities such as working memory considering their effect on performance and school achievement.

Working memory (WM) is a limited-capacity system that enables information to be temporarily stored and manipulated (Baddeley, 1986; Baddeley, 2000). In the literature, different models have been proposed. The most classical theorization is the tripartite model by Baddeley and Hitch (1974) that proposes the existence of a *central executive system* responsible for controlling the resources and monitoring information-processing across informational domains, using two domain-specific modalities (i.e., the *phonological loop* and the *visuospatial sketchpad*) for either verbal or visuospatial information. Even if this model has met a broad consensus (Baddeley, 2012), other research has suggested a modality-independent model, according to which WM is

supposed to be a domain-general factor (Kane et al., 2004), without distinguishing between verbal and visuospatial components. A great amount of research points out that WM is an important factor of academic performance (e.g., St Clair-Thompson & Gathercole, 2006) in key academic domains such as reading comprehension (Borella, Carretti, & Pelegrina, 2010; Borella & de Ribaupierre, 2014) and mathematics achievement (Mammarella, Caviola, Giofrè, & Szucs, 2018; Passolunghi, Mammarella, & Altoè, 2008; Friso-van den Bos, van der Ven, Kroesbergen, & van Luit, 2013; Peng, Namkung, Barnes, & Sun, 2016). While there is a wide consensus about the positive association between WM and academic achievement, research about the interplay between these aspects and negative affect is limited.

The Processing Efficiency Theory (PET) and the Attentional Control Theory (ACT) theories suppose that anxiety interfere with WM reducing the performance on cognitive tasks. According to the PET theory, the worrying component of anxiety gives rise to task-irrelevant cognitions that require WM abilities, reducing the available resources for the completion of a given task (Derakshan & Eysenck, 2009; Eysenck & Calvo, 1992; Eysenck & Derakshan, 2011; Owens, Stevenson, Norgate, & Hadwin, 2008). The ACT theory suggests that anxiety could impair the efficiency of the goal-directed attentional system by reducing the attentional control resources available in WM (Eysenck et al., 2007; Eysenck, Payne, & Derakshan, 2005; Walkenhorst & Crowe, 2009). A recent meta-analysis provides evidence about this relation pointing out the presence of moderate negative association between anxiety and WM (Moran, 2016). In a similar vein, depressive symptoms are supposed to be related to lower cognitive abilities. The Resource Allocation Model (RAM; Ellis & Moore, 1999) suggests that intrusive ruminative thoughts related to depressive symptoms interfere with cognitive processes in terms of reducing the ability to allocate attentional resources to complex

cognitive tasks (see also Christopher & MacDonald, 2005). Interestingly, the relation among negative affect and WM is examined also in relation to academic performance (e.g., Owens et al., 2012) but evidence about this point is still scarce.

## 2.4 Overview of the present study[2]

The present study aims to investigate the relation among negative affect (i.e., GA and depressive symptoms), WM and personal resources (i.e., academic and competence self-concept and ego-resilience) on mathematics and reading literacy in middle-school students.

The first aim of the present study is to examine the role of negative affect on mathematics and reading literacy when WM is also considered. Literature suggested that negative affect is related to performance and academic achievement when WM is also taken into account (Owens et al., 2012; see also Eysenck & Calvo, 1992; Eysenck et al., 2007; Ellis & Moore, 1999). For this reason, negative affect was expected to have an effect on mathematics and reading literacy. Little evidence is present about the interplay between anxiety, depressive symptoms and WM abilities in academic achievement, thus our findings could better clarify the role of these aspects on the two considered academic domains.

The second aim of the present study is to examine the effect of personal resources on mathematics and reading literacy when WM abilities are taken into account. A great amount of research examined the relation among personal resources (i.e., self-concept and ego-resilience) and negative affect (Alessandri, Vecchione,

[2] The present study has been submitted for publication: Donolato, E., Giofrè, D., & Mammarella, I. C. (Under review). Working memory, negative affect and personal resources: Which relation to mathematics and reading literacy?

Caprara, & Letzring, 2012; Block & Gjerde, 1990; Chuang, Lamb, & Hwang, 2006; Orth, Robins, Trzesniewski, Maes, & Schmitt, 2009; Sowislo & Orth, 2013; Vecchione, Alessandri, Barbaranelli, & Gerbino, 2010), but these aspects are rarely studied when cognitive abilities are also assessed (i.e., Giofrè et al., 2017; Kwok et al., 2007; Liew et al., 2018). Based on the results of these studies, we expected that personal resources would have a positive effect on both mathematics and reading literacy even when WM was assessed. Findings could give more support to the extant literature about the role of such personal resources once the effect of WM is assessed. Finally, WM ability was supposed to be a strong predictor of both mathematics and reading literacy (see Borella et al., 2010; Borella & de Ribaupierre, 2014; Friso-van den Bos et al., 2013; Giofrè et al., 2017; Mammarella et al., 2018; Passolunghi et al., 2008; Peng et al., 2016).

## 2.5 Method

### 2.5.1 Participants

For the present study, 144 (49% girls, $M_{age}$=12.06 years, *SD*= 1.11; range= 10.00 – 15.00 years) schoolchildren in grades 6 to 8 were involved. All students were recruited at public schools placed in urban areas of the north-east Italy and came from middle-class families. Participants were typically-developing children with no special educational needs, intellectual disabilities, or neurological and genetic disorders. One participant was found to be a multivariate outlier using Mahalanobis distance (D>50) and was excluded from the analyses. Thus, the final sample included 143 children (50% girls) in grade 6 (N=65, 54% girls) and 8 (N=78, 46% girls).

The study was approved by the Ethical Committee at the University of Padova (Italy). After obtaining the school's approval, informed consent was obtained from the

parents by providing them with a written account of the study's purposes and a permission form in their native language that was returned to the student's school prior to the test.

### 2.5.2 Materials

**Negative affect**

The *Revised Children's Manifest Anxiety Scale: Second Edition* (RCMAS-2; Reynolds & Richmond, 2012) is a self-report tool for measuring general anxiety in children and adolescents. The questionnaire consists of 49 item requiring a yes or no answer, thus higher scores indicate higher general anxiety. The self-report provides the scores on worries (e.g., *"I am worried that my classmates could make fun of me"*), physiological anxiety (e.g., *"I often have stomachache"*) and social anxiety (e.g., *"I feel nervous when things don't go as I want"*). For the present study the Italian validated version of the tool was used. As reported in the manual, the RCMAS-2 shows good internal consistency for worries (Cronbach's α = .86), physiological (Cronbach's α = .75) and social (Cronbach's α = .80) anxiety subscales. In the present sample adequate internal consistency was also found for all the subscales, including the worries (Cronbach's α = .76), physiological (Cronbach's α = .62) and social (Cronbach's α = .76) anxiety scores.

The *Children's Depression Inventory* (CDI; Kovacs, 1988) is a questionnaire for identifying symptoms of depression in children and adolescents. The self-report consists of a 27-item composed by three different statements (e.g., "*Sometimes I am sad" – "I am often sad" – "I am always sad"*). For each item respondents are asked to mark the sentence that best describes how they have been feeling and thinking during the preceding 2 weeks, choosing one of the three alternatives. Each item is associated with a

score based on their severity, thus higher scores indicate higher depressive symptoms. The Italian validated version of the questionnaire was used. As reported in the manual, the CDI shows good internal consistency for school-aged children (Cronbach's α = .87). In the sample of the present study a good internal consistency was also found (Cronbach's α = .87).

The *Questionnaire for the Assessment of Psychopathology in Adolescence* (*Q-PAD;* Sica, Chiri, Favilli & Marchetti, 2011) is a self-report tool that measures different aspects of psychopathology in adolescents. For the present study, the *depression* scale was used in order to identify sadness, boredom and melancholy linked to depression but not necessarily of clinical relevance (e.g., *"Recently I feel sad or melancholy most of the time"*). The scale comprises 8 item scored on a 4-point Likert scale between 1 "not describing my situation at all" and 4 "absolutely describing my situation", thus higher scores indicate higher depressive symptoms. The internal consistency of the scale as reported in the manual (Cronbach's α = .78) and found in the present sample (Cronbach's α = .86) was good.

**Personal resources**

The *Ego-Resiliency Scale* (ER; Block & Kremen, 1996) is an inventory for detecting resilience as a personality trait linked to general resourcefulness, strength of character, and flexibility of functioning (e.g., "*I quickly get over and recover from being startled*"). The questionnaire is composed by 14 statements scored on a 4-point Likert scale, from 1 "does not apply at all" to 4 "applies very strongly", thus higher scores suggest higher ego-resiliency. The scale was used with adults and adolescents (see Caprara, Steca & De Leo, 2003), showing good psychometric properties (Cronbach's α = .87). For the present study, an adaptation of the tool was used choosing

comprehensible and suitable words for children. The internal consistency of the questionnaire was found to be adequate in the sample of the current study (Cronbach's α = .69).

The *Multidimensional Self-Concept Scale* (MSC; Bracken, 2003) is a self-report tool to assess self-concept in children and adolescents. For the present study, the *Academic* (SC-A) and the *Competence* (SC-C) subscales were used to assess participants' perceptions about themselves at school (i.e., *"Studying is difficult for me"*), and their ability of influencing their environment, solving problems or achieving their goals (i.e., *"I trust on myself"*), respectively. Each subscale consisted of 25 statements scored on a 4-point Likert scale, from "absolutely true" to "absolutely false", thus higher scores indicates more positive self-concept perception in the relative subscales. The tool presents good internal consistency for both *Academic* and *Competence* subscales (Cronbach's α =.91 and α =.87 respectively) as reported in the manual. In the present study good psychometric properties were also found for both the subscales (Cronbach's α =.86 and α =.79).

**Working memory**

**Verbal WM**

*Verbal dual tasks* (DT-V; De Beni, Palladino, Pazzaglia, & Cornoldi, 1998). The DT-V consisted of orally-presented word lists composed by four words of high-medium frequency. The word lists were organized into sets containing word lists of different length (i.e., from 2 to 6 words to recall). The first set contained 2 lists of words (with two words to recall) and an increasing number of lists were presented in later sets. Children were asked to press the space bar whenever they heard an animal noun and, after completing each set, they had to recall the last word on each list, in the same order

that the lists were originally presented in. The score corresponded to the proportion of words accurately recalled (Cronbach's α = .69).

*Listening span test* (LST; Daneman & Carpenter, 1980; Palladino, 2005). The LST consists of orally-presented sentences arranged into sets containing a different number of sentences (i.e., from 2 two 5). The first set contained 2 sentences and an increasing number of sentences were presented in later sets. After hearing each sentence, children were asked whether the sentence was true or false. After completing each set, the children had to recall the last word in each sentence, in their order of presentation. The score corresponded to the number of words accurately recalled (Cronbach's α = .83).

**Visuospatial WM**

*Visuospatial dual tasks* (Mammarella & Cornoldi, 2005). In the DT-VS, a series of two-dimensional 4 × 4 grids, each comprising 16 empty cells, was shown on the screen. Seven of the sixteen cells (i.e, a row and a column) were always coloured in grey while the others were white. The task was administered in sets of three grids, in which a black dot appeared in one of the cells, and then disappeared. The children were asked to press the spacebar if the dot appeared in a grey cell, and also to remember the last position of the dot (in the third grid in each set). The grids were arranged into 5 sets composed by 2 series of grids each. Moreover, each series included from 2 to 6 dots stimuli to be remembered, with 2 stimuli in the first sets and increasing number in later sets. The score corresponded to the proportion of dot positions accurately recalled in the right order (Cronbach's α = .82).

*Dot matrix task* (DOT, derived from Miyake, Friedman, Rettinger, Shah, & Hegarty, 2001). In this task, children were shown a matrix equation that they were

asked to verify, then a dot appeared in a 5 × 5 grid and they had to remember its position. The matrix equation involved adding or subtracting simple line drawings. After a given series of pairs of equations and grids, the positions of the dots in the various grids had to be recalled by clicking with the mouse on an empty grid. The matrixes were presented into 4 series increased in length so that from 2 to 5 dot positions had to be remembered, with 2 dots in the first set. The score corresponded to the proportion of dot positions correctly recalled (Cronbach's α =.74).

**Mathematics and reading literacy**

The *INVALSI* (Italian Institute for the Assessment of the Instruction System, 2011) are tests that are widely used in Italy as national assessment of academic achievement in *mathematics* and *reading literacy*. For each grade, the appropriate version of the INVALSI test was proposed. As regard *mathematics,* the INVALSI tests provided scores about four areas: *space and figures* (MATH-SF) related to geometry problems; *numbers* (MATH-N) consists number fractions and other mathematics elements; *relations and functions* (MATH-RF) including problems with equivalences or algebraic expressions; and *data and prediction* (MATH-DP) consists in probability and statistical problems. The task showed good psychometric properties in the present sample (Cronbach's α = .85 in grade 6 and .88 in grade 8). As regard *reading literacy,* the INVALSI provided scores related to reading comprehension and grammar. For reading comprehension (READ-RC), students were shown some passages and they had to answer several multiple-choice or short open-ended questions. For grammar (READ-G), respondents were asked to answer questions on Italian language spelling, morphology and lexicon. The task showed good psychometric properties in the present sample (Cronbach's α = .89 in grade 6 and .82 in grade 8).

### 2.5.3 Procedure

Participants were tested in different stages: a) a collective session lasting approximately 1 hour, when the self-report measures were administered; b) an individual session lasting approximately 30 minutes, when WM tasks were presented; and c) two collective sessions lasting 75 minutes each, when achievement tests were proposed. The first session was conducted on November-December, the individual testing was proposed between February and March, while the last sessions were proposed on May of the same school year. The collective sessions were administrated in students' classrooms, while the individual sessions were conducted individually in a quiet room. In all sessions, the tests were administered by a trained assistant researcher using a standardized procedure, and in the presence of a teacher. Tasks in the different sessions were administrated in fixed order following the procedure of other studies (e.g., Giofrè et al., 2017; Hill et al., 2016). In the first session students completed the SC-Academic scale (Bracken, 2003), the SC-Competence scale (Bracken, 2003), the CDI (Kovacs, 1988), the ER-89 (Block & Kremen, 1996), the Q-PAD (Sica, Chiri, Favilli & Marchetti, 2011) and the RCMAS-2 (Reynolds & Richmond, 2012). At the individual session, the WM tasks were administered as follows: (1) DT-V; (2) DOT; (3) LST; (4) DT-VS. In the last two sessions the INVALSI for mathematics and reading literacy were presented respectively. As regard WM, all tasks were programmed using the E-prime 2 software and presented on a 15-inch touchscreen laptop. Each task considers two practice trials that were followed to the complete task that began on the easiest level and gradually became more difficult, with two trials before switching to each higher level of complexity. The partial credit scoring method was used for scoring (Conway, et al. 2005; Giofrè & Mammarella, 2014).

### 2.5.4 Data analysis

Analyses were performed using R statistical software (R Development Core team, 2016). A latent modelling approach was used to test our research questions considering this approach allows to control for measurement error (Kline, 2016). A two-step modelling approach was used, i.e. the models obtained by confirmatory factor analyses (CFAs) were tested before those obtained by SEMs (Kline, 2016). This means that CFAs models aimed to clarifying which factors could be merged together, or maintained separately. Then, SEMs were performed in order to test how well hypothesized models fitted the data and if comparable nested models differed significantly from each other. For this purpose, analyses were performed using the *lavaan* package (Rosseel, 2012). The maximum-likelihood-based estimation method was used (Muthén & Muthén, 2007). Model fit was assessed using different indexes according to the criteria suggested by Hu and Bentler (1999). The chi-square ($\chi^2$), the comparative fit index (CFI), the non-normed fit index (NNFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) were considered. The chi-square difference ($\Delta\chi^2$), and the Akaike information criterion (AIC) were also used to compare the fit of alternative models (Kline, 2016). We initially evaluated a first model based on theoretical reasons, then paths were removed based on magnitude and statistical-significance starting from smallest coefficients. Because different grades were considered, we decided to residualize row data for the effect of this variable. Indeed, considering the presence of different item in the INVALSI tasks for grades 6 and 8, IRT scaling was used to make the results comparable (Cook & Eignor, 1991).

## 2.6 Results

Descriptive statistics (mean, standard deviation, range, skewness and kurtosis) for each measure are reported in Table 2.1. For most measures, skewness and kurtosis did not exceed a critical value of 1, suggesting that no strong violation of normality distribution was apparent (Tabachnik & Fidell, 2001). Correlations between all measures are reported in Table 2.2.

***Table 2.1*** Means, Standard Deviations, Range, Skewness and Kurtosis for all considered variables before residualizing by grade.

| | M (*SD*) | Range | Skewness | Kurtosis |
|---|---|---|---|---|
| **General Anxiety** | | | | |
| RCMAS-2 PA | 3.26 (2.69) | 0-12 | .96 | .45 |
| RCMAS-2 WO | 6.08 (3.67) | 0-16 | .24 | -.67 |
| RCMAS-2 SO | 4.08 (2.65) | 0-12 | .45 | -.28 |
| **Depressive symptoms** | | | | |
| CDI | 8.79 (6.86) | 0-32 | 1.32 | 1.42 |
| Q-PAD | 14.45 (5.21) | 7-32 | .95 | .65 |
| **Self-concept** | | | | |
| SC-C | 75.78 (7.56) | 59-92 | .01 | -.69 |
| SC-A | 71.15 (8.29) | 42-92 | -.38 | .65 |
| **Resilience** | | | | |
| ER | 44.11 (4.48) | 26-54 | -.48 | 1.07 |
| **Working Memory** | | | | |
| DT-VS | 22.72 (7.35) | 4-39 | -.22 | -.58 |
| DOT | 15.28 (5.16) | 5-27 | .14 | -.64 |
| DT-V | 17.27 (6.64) | 2-35 | .05 | -.14 |
| LST | 13.94 (5.51) | 3-28 | .24 | -.77 |
| **Mathematics** | | | | |
| MATH-N | 41.97 (19.67) | 0-90 | .31 | -.70 |
| MATH-SF | 41.85 (17.42) | 0-86 | .15 | -.30 |
| MATH-DP | 47.59 (23.20) | 0-100 | .17 | -.86 |
| MATH-RF | 42.57 (21.51) | 0-100 | .22 | -.24 |
| **Reading literacy** | | | | |
| READ-RC | 63.44 (16.70) | 16-92 | -.64 | -.14 |
| READ-G | 69.76 (20.15) | 0-100 | -1.31 | -1.70 |

*Note*. Please note that means and standard deviations for MATH and READ were calculated on raw data, before the IRT scaling was applied. For the INVALSI tasks the proportion of correct answers are reported. RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; CDI = Children's Depression Inventory; Q-PAD = Questionnaire for the Assessment of Psychopathology in Adolescence; SC = Self-concept scale; -C = Competence subscale; -A = Academic subscale; ER = Ego-Resiliency scale; DT-VS = Visuospatial dual tasks; DOT = Dot matrix task; DT-V = Verbal dual tasks; LST = Listening span test; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar.

***Table 2.2*** Correlations between all considered measures after residualizing by grade.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. RCMAS-2 PA | 1 | | | | | | | | | | | | | | | | | |
| 2. RCMAS-2 WO | .471 | 1 | | | | | | | | | | | | | | | | |
| 3. RCMAS-2 SO | .533 | .685 | 1 | | | | | | | | | | | | | | | |
| 4. CDI | .693 | .507 | .641 | 1 | | | | | | | | | | | | | | |
| 5. Q-PAD | .601 | .516 | .565 | .747 | 1 | | | | | | | | | | | | | |
| 6. SC-C | -.438 | -.299 | -.387 | -.523 | -.496 | 1 | | | | | | | | | | | | |
| 7. SC-A | -.401 | -.110 | -.366 | -.505 | -.442 | .673 | 1 | | | | | | | | | | | |
| 8. ER | -.226 | -.133 | -.297 | -.368 | -.204 | .429 | .426 | 1 | | | | | | | | | | |
| 9. DT-VS | -.083 | -.089 | -.078 | -.074 | -.089 | -.038 | .061 | -.010 | 1 | | | | | | | | | |
| 10. DOT | -.069 | -.120 | -.124 | -.108 | -.046 | -.068 | -.017 | -.067 | .608 | 1 | | | | | | | | |
| 11. DT-V | -.192 | -.133 | -.209 | -.191 | -.146 | .027 | .252 | .043 | .528 | .438 | 1 | | | | | | | |
| 12. LST | -.120 | .008 | -.074 | -.071 | -.066 | -.031 | .140 | -.001 | .422 | .318 | .673 | 1 | | | | | | |
| 13. MATH-N | -.286 | -.215 | -.360 | -.248 | -.228 | .192 | .337 | .079 | .321 | .252 | .321 | .151 | 1 | | | | | |
| 14. MATH-SF | -.198 | -.082 | -.181 | -.177 | -.159 | .127 | .214 | .049 | .228 | .231 | .247 | .187 | .392 | 1 | | | | |
| 15. MATH-DP | -.174 | -.118 | -.161 | -.150 | -.207 | .207 | .279 | .112 | .320 | .282 | .331 | .136 | .516 | .366 | 1 | | | |
| 16. MATH-RF | -.110 | -.097 | -.169 | -.131 | -.139 | .041 | .174 | .077 | .339 | .352 | .381 | .310 | .517 | .422 | .449 | 1 | | |
| 17. READ-RC | -.161 | -.211 | -.268 | -.168 | -.270 | .190 | .343 | .129 | .210 | .298 | .361 | .305 | .458 | .297 | .501 | .514 | 1 | |
| 18. READ-G | -.251 | -.125 | -.214 | -.241 | -.242 | .043 | .259 | .201 | .210 | .223 | .279 | .207 | .408 | .368 | .506 | .464 | .580 | 1 |

*Note*. All coefficients ≥ .165 are significant at .05 level. RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; CDI = Children's Depression Inventory; Q-PAD = Questionnaire for the Assessment of Psychopathology in Adolescence; SC = Self-concept scale; -C = Competence subscale; -A = Academic subscale; ER = Ego-Resiliency scale; DT-VS = Visuospatial dual tasks; DOT = Dot matrix task; DT-V = Verbal dual tasks; LST = Listening span test; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar.

### 2.6.1 CFAs models

CFAs were used to examine the measurement model that reflects the structure of our variables (Kline, 2016). First, a seven-factor CFA model (CFA-01) was estimated. In this model, the Verbal dual tasks (DT-V) and the Listening span test (LST) reflected a WM verbal (WM-V) factor, while the Visuospatial dual tasks (DT-VS) and the Dot matrix task (DOT) reflected the WM visuospatial (WM-VS) factor. Indeed, the CDI and the Q-PAD scores were supposed to reveal a depressive symptoms (DEP), while the RCMAS-2 physiological (PA), worries (WO) and the social anxiety (SO) scores reflected a general-anxiety (GA). The ER, Self-concept Academic and Competence scores were considered as personal resources (PER) factor. Finally, space and figures (SF), numbers (N), relations and functions (RF) and data and prediction (DP) scores were considered as reflected mathematics (MATH), while reading comprehension (RC) and grammar (G) were supposed to reflect a reading literacy (READ) factor. The fit of the model was adequate, $\chi^2(114)=177.57$, $p=.001$, $RMSEA=.062$, $SRMR=.054$, $CFI=.943$, $NNFI=.924$, $AIC=11451$. Factor loadings and inter-factor correlations for the first measurement model (CFA-01) are reported in Table 2.3.

***Table 2.3*** Factor loadings and inter-factor correlations for the first measurement model (CFA-01).

| | GA | DEP | PER | WM-VS | WM-V | MATH | READ |
|---|---|---|---|---|---|---|---|
| 1. RCMAS-2 PA | .75 | | | | | | |
| 2. RCMAS-2 WO | .70 | | | | | | |
| 3. RCMAS-2 SO | .80 | | | | | | |
| 4. CDI | | .91 | | | | | |
| 5. Q-PAD | | .82 | | | | | |
| 6. SC-C | | | .80 | | | | |
| 7. SC-A | | | .84 | | | | |
| 8. ER | | | .52 | | | | |
| 9. DT-VS | | | | .83 | | | |
| 10. DOT | | | | .73 | | | |
| 11. DT-V | | | | | .96 | | |
| 12. LST | | | | | .70 | | |
| 13. MATH-N | | | | | | .71 | |
| 14. MATH-SF | | | | | | .53 | |
| 15. MATH-DP | | | | | | .71 | |
| 16. MATH-RF | | | | | | .71 | |
| 17. READ-RC | | | | | | | .79 |
| 18. READ-G | | | | | | | .74 |
| Inter-factor correlation matrix | | | | | | | |
| GA | 1 | | | | | | |
| DEP | .900** | 1 | | | | | |
| PER | -.550** | -.686** | 1 | | | | |
| WM-VS | -.150 | -.117 | -.011 | 1 | | | |
| WM-V | -.242* | -.201* | .178 | .654** | 1 | | |
| MATH | -.367** | -.298* | .357** | .557** | .497** | 1 | |
| READ | -.365** | -.322* | .363** | .378** | .448** | .870** | 1 |

*Note*. All factor loadings are significant ($p < .01$). Inter-factor correlations, * $p<.05$, ** $p<.01$.

RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; CDI = Children's Depression Inventory; Q-PAD = Questionnaire for the Assessment of Psychopathology in Adolescence; SC = Self-concept scale; -C = Competence subscale; -A = Academic subscale; ER = Ego-Resiliency scale; DT-VS = Visuospatial dual tasks; DOT = Dot matrix task; DT-V = Verbal dual tasks; LST = Listening span test; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar; GA = general-anxiety; DEP = depressive symptoms; PER = Personal resources; WM-VS = Working Memory Visuospatial; WM-V = Working Memory Verbal.

A second model (CFA-02) was estimated in which the GA and DEP factors were considered as a unique latent variable referred to negative affect (NEG). This was supported by the presence of high correlations ($r$=.90) between these two factors and is in line with the previous literature, suggesting that these aspects are strongly related one to each other in children (Seligman & Ollendick, 1998). It has been argued that tools commonly used to measure depressive symptoms and anxiety could simultaneously capture anxiety and depressive symptoms (see Seligman and Ollendick, 1998; Seligman, Ollendick, Langley, & Baldacci, 2004). The model fit was adequate $\chi^2(120)=190.21$, $p$=.001, *RMSEA*=.064, *SRMR* =.055, *CFI*=.937, *NNFI*=.920, *AIC*=11452. The model was more parsimonious compared to the previous one and thus it was retained for the subsequent analyses. Factor loadings and inter-factor correlations for the final measurement model (CFA-02) are reported in Table 2.4.

***Table 2.4*** Factor loadings and inter-factor correlations for the final measurement model (CFA-02).

| | INT | PER | WM-VS | WM-V | MATH | READ |
|---|---|---|---|---|---|---|
| 1. RCMAS-2 PA | .76 | | | | | |
| 2. RCMAS-2 WO | .62 | | | | | |
| 3. RCMAS-2 SO | .74 | | | | | |
| 4. CDI | .90 | | | | | |
| 5. Q-PAD | .82 | | | | | |
| 6. SC-C | | .82 | | | | |
| 7. SC-A | | .82 | | | | |
| 8. ER | | .52 | | | | |
| 9. DT-VS | | | .83 | | | |
| 10. DOT | | | .73 | | | |
| 11. DT-V | | | | .95 | | |
| 12. LST | | | | .71 | | |
| 13. MATH-N | | | | | .70 | |
| 14. MATH-SF | | | | | .54 | |
| 15. MATH-DP | | | | | .71 | |
| 16. MATH-RF | | | | | .71 | |
| 17. READ-RC | | | | | | .79 |
| 18. READ-G | | | | | | .74 |
| Inter-factor correlation matrix | | | | | | |
| INT | .1 | | | | | |
| PER | -.665** | 1 | | | | |
| WM-VS | -.131 | -.017 | 1 | | | |
| WM-V | -.221* | .163 | .656** | 1 | | |
| MATH | -.331** | .346** | .557** | .499** | 1 | |
| READ | -.349** | .349** | .377** | .449** | .872** | 1 |

*Note*. All factor loadings are significant ($p < .01$). Inter-factor correlations, * $p<.05$, ** $p<.01$.

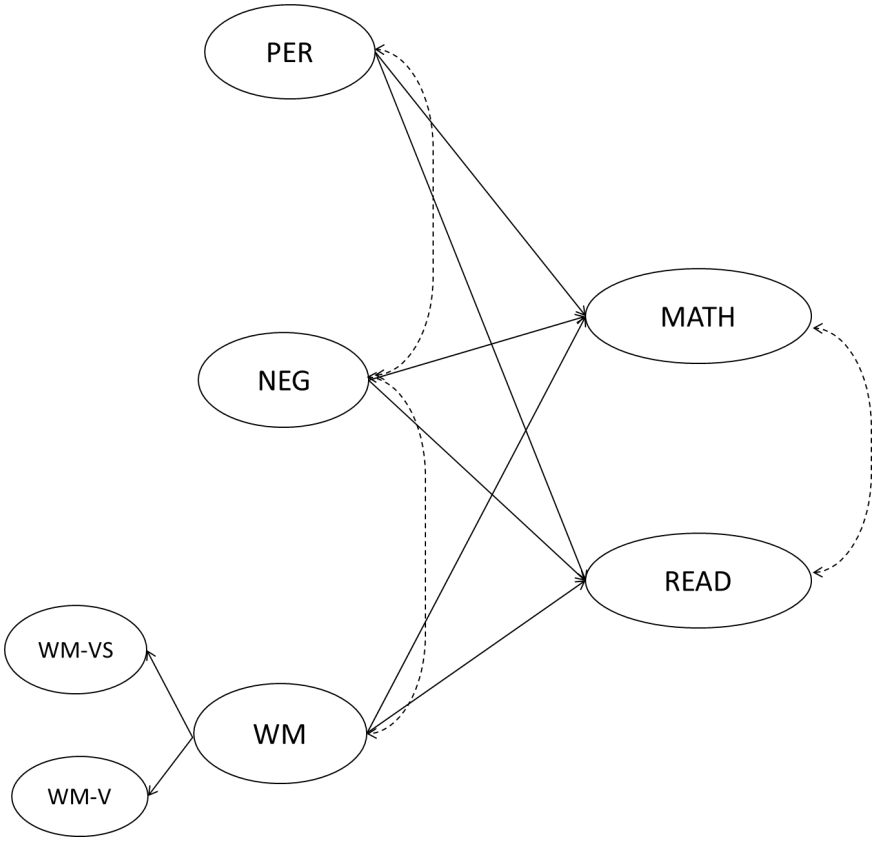
RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; CDI = Children's Depression Inventory; Q-PAD = Questionnaire for the Assessment of Psychopathology in Adolescence; SC = Self-concept scale; -C = Competence subscale; -A = Academic subscale; ER = Ego-Resiliency scale; DT-VS = Visuospatial dual tasks; DOT = Dot matrix task; DT-V = Verbal dual tasks; LST = Listening span test; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar; NEG = negative affect; PER = Personal resources; WM-VS = Working Memory Visuospatial; WM-V = Working Memory Verbal.

### 2.6.2 SEM models

Different models were estimated to assess the relation among the considered variables on mathematics (MATH) and reading literacy (READ).

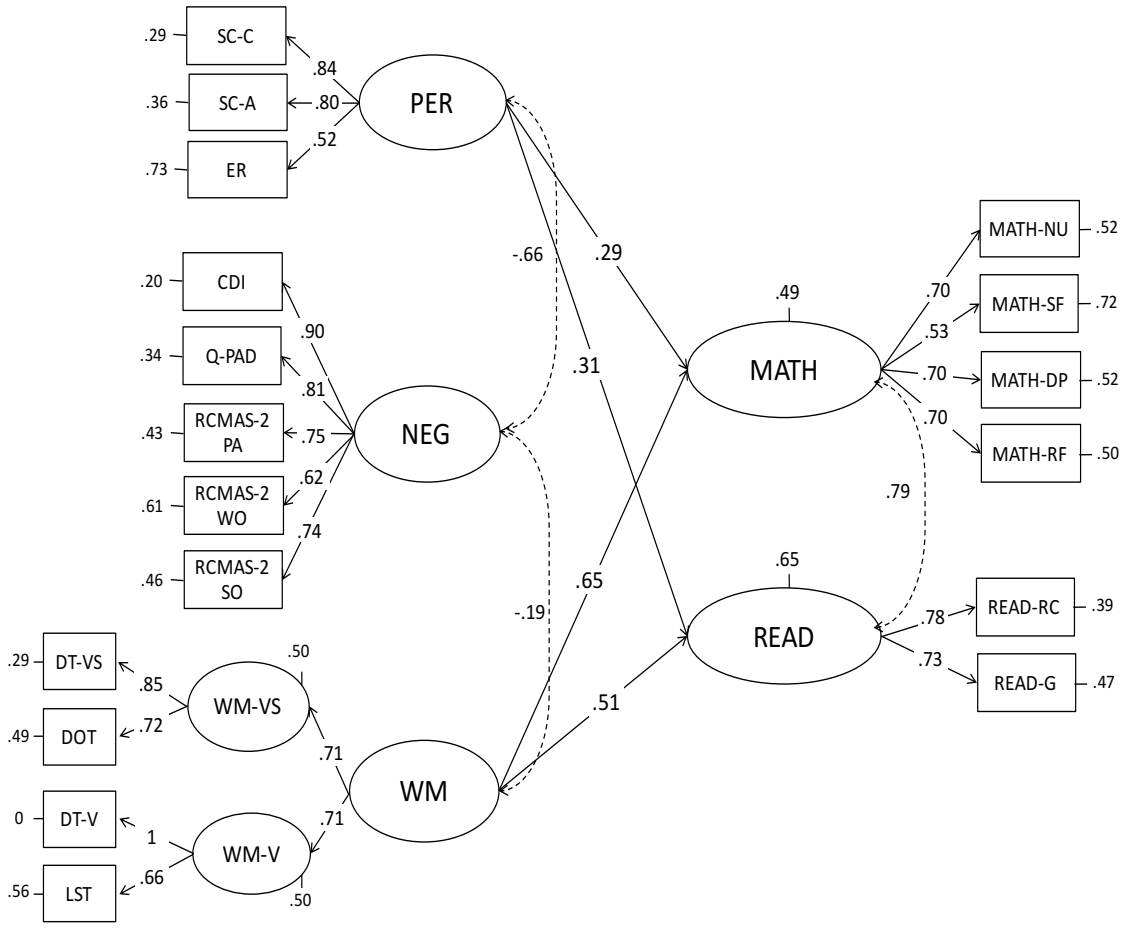
In the first model (SEM-01; Figure 2.1) a second-order WM factor with loading to the merge the WM-V and WM-VS factors was assessed. In fact, the correlation between these two factors was moderately high but overall only the 46% of the variance was shared, confirming that these two constructs are probably distinguishable. This was in line with previous studies that support the presence of two-factor model distinguishing between visuospatial and verbal components (e.g., Alloway, Gathercole, & Pickering, 2006) that however share a considerable amount of variance (Kane et al., 2004; Miyake et al., 2001). Then, we considered a model in which NEG, PER and WM were exogenous and correlated with each other, while MATH and READ were endogenous. The fit of the model was adequate, $\chi^2(127)=201.04$, $p=.001$, $RMSEA=.064$, $SRMR=.066$, $CFI=.934$, $NNFI=.920$, $AIC=11449$. In this model some coefficients were quite small and non-statistically-significant thus they were dropped starting from the smallest one. The final model (SEM-02) is shown in Figure 2.2. It had an adequate fit, $\chi^2(129)=201.54$, $p=.001$, $RMSEA=.063$, $SRMR=.066$, $CFI=.935$, $NNFI=.923$, $AIC=11445$ and it was more parsimonious compared to the previous one ($\Delta\chi^2(2)=0.506$, $p=.777$). It is important to note that standard coefficients of the variables in the final model were very similar, in terms of magnitude, to the ones of the initial model. All paths in SEM-02 were statistically significant thus it was retained as final model.

***Figure 2.1*** Initial tested model.




*Note*. PER = Personal resources; NEG = negative affect; WM-VS = Working Memory Visuospatial; WM-V = Working Memory Verbal; WM= working memory; MATH = Mathematics literacy; READ = Reading literacy.

***Figure 2.2*** Final model with standardized coefficients.




*Note*. Final SEM Model (SEM-02). All reported paths are statistically significant ($p < .05$).
RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; CDI = Children's Depression Inventory; Q-PAD = Questionnaire for the Assessment of Psychopathology in Adolescence; SC = Self-concept scale; -C = Competence subscale; -A = Academic subscale; ER = Ego-Resiliency scale; DT-VS = Visuospatial dual tasks; DOT = Dot matrix task; DT-V = Verbal dual tasks; LST = Listening span test; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar; NEG = negative affect; PER = Personal resources; WM-VS = Working Memory Visuospatial; WM-V = Working Memory Verbal; WM = Working Memory.

## 2.7 Discussions

The main aim of this study was to investigate the relation among negative affect (i.e., GA and depressive symptoms), WM and personal resources (i.e., academic and competence self-concept and ego-resilience) on mathematics and reading literacy in a sample of middle-school students. It was expected that negative affect would have an effect on mathematics and reading literacy also when WM abilities were assessed (see Eysenck & Calvo, 1992; Eysenck et al., 2007; Ellis & Moore, 1999; Owens et al.,

2012). Positive effects of personal resources on mathematics and reading literacy were expected on both academic domains also when WM was considered (Chuang et al., 2006; Giofrè et al., 2017; Kwok et al., 2007; Liew et al., 2018; Swanson et al., 2011; Valentine et al., 2004; Vecchione et al., 2010). Finally, WM abilities were supposed to be strongly related to both mathematics and reading literacy as reported by previous literature (see Borella et al., 2010; Borella & de Ribaupierre, 2014; Friso-van den Bos et al., 2013; Giofrè et al., 2017; Mammarella et al., 2018; Passolunghi et al., 2008; Peng et al., 2016).

Our results revealed that personal resources and WM maintain an effect on mathematics and reading literacy once negative affect was assessed. Our results about personal resources are in line with previous research suggesting their key contribution in different areas of academic achievement even when cognitive abilities are considered (Chuang et al., 2006; Giofrè et al., 2017; Kwok et al., 2007; Liew et al., 2018; Swanson et al., 2011; Valentine et al., 2004; Vecchione et al., 2010). Personal resources may be an index of, for example, a child's effort or persistence in studying and mastering school work, thus having a specific contribution in sustaining children's achievement. Contrary to our expectations and previous studies (e.g., Owens et al., 2012), we found that negative affect lack to have an effect on mathematics and reading literacy when personal resources and WM are taken into account. According to previous research (see Eysenck & Calvo, 1992; Eysenck et al., 2007; Ellis & Moore, 1999), negative affect may operate by consuming WM resources necessary for math computations and reading comprehension, decreasing the performance in these two domains by compromising WM. Anxiety and depressive symptoms may particularly harm school performance in several ways: both such symptoms have been found to be associated with negative or ruminative thoughts (Michl, McLaughlin, Shepherd, & Nolen-Hoeksema, 2013), which

can interfere with academic achievement (Owens et al., 2012; see also Eysenck & Calvo, 1992; Eysenck et al., 2007; Ellis & Moore, 1999); they can also generate cognitive interference due to emotional distraction (Borkovec & Roemer, 1995; Putwain, Connors, & Symes, 2010). Although previous studies suggest that negative affect is negatively associated with academic achievement, our results point out that this relation is more complex than typically assumed reflecting an underlying mechanism linked to personal resources and WM. It is worth noting that no previous research had considered all these variable in a single study. As for WM, our findings pointed out that this is a strong predictor of good performance in mathematics and reading literacy as reported by previous studies (e.g., Borella et al., 2010; Borella & de Ribaupierre, 2014; Friso-van den Bos et al., 2013; Giofrè et al., 2017; Mammarella et al., 2018; Passolunghi et al., 2008; Peng et al., 2016).

Although our study provides important contributions, there are some limitations to be considered for further research. First, the sample size in the present study is not particularly large, suggesting that future studies should replicate our results in a larger sample. Second, we involved only a limited sample of 11- and 13-year-old students, so our findings could only be applied to this particular population. To fully elucidate the reciprocal influence of WM, negative affect, personal resources and academic achievement, future studies should focus on younger children too. Finally, more research is needed to clarify the joint role of academic anxiety (e.g., test- and mathematics-anxiety) on academic achievement. As suggested by Carey and co-authors (2017) anxiety forms could co-occur pointing out the importance of considering all these aspects in order to investigate their specific effects on academic performance. The vast majority of research about anxiety has been focused on mathematics-anxiety and the mathematics domain, without considering the role of general and academic anxiety

and personal resources on different academic domains (see Carey et al., 2017; Hill et al., 2016). For this reason, it would be interestingly to assess the role of these factors on both mathematics and reading literacy.

Our findings also have educational and clinical implications. For example, intervention programs for reducing GA and depressive symptoms should be considered for children with social, emotional and behavioural difficulties. Cognitive-behavioural treatment protocols have been demonstrated to be effective in reducing anxiety symptoms helping the individual to be more aware about bodily arousal to physical signs of anxiety and to manage them by replacing worries and concerns, using relaxation techniques or facing challenges by applying problem solving skills (see Barrett, 1998; Flannery-Schroeder & Kendall, 2000; Silverman, Pina, & Viswesvaran, 2008). At the same time, it is important to promote prevention and intervention programs focusing on self-concept and ego-resilience, which might be particularly useful in supporting children in academic success. For a start, it could be important: a) reducing links students make between their achievement and their worth as a person; b) shifting students' focus away from those elements that are more threatening to their self-worth; and c) promoting a constructive view of poor performance in terms of personal progress (Martin & Marsh, 2003). Moreover, students benefit from explicit instruction in decision making and self-management skills about managing emotions, setting goals, and coping with frustration or set-backs (Morrison & Allen, 2007). This is particular important considering that students with high levels of self-concept and resilience are able to take on challenging tasks, persist when faced with difficulties, and believe in their ability to do well (Niemiec & Ryan, 2009).

To sum up, school children academic achievement seems to be related by several factors, including personal resources (e.g., ego-resilience or self-concept) and WM. The

effect of negative affect seems to be more complex than expected when WM and personal resources are taken into account. Our results underline the importance of promoting personal resources in order to sustain children academic success.

# CHAPTER 3

# THE RELATION AMONG GENERAL-, TEST- AND MATHEMATICS- ANXIETY AND EGO-RESILIENCE ON MATHEMATICS AND READING LITERACY

## 3.1 Introduction

Children's anxiety about their academic performance have important implications in terms of educational outcomes. As regard the school context, research distinguishes between general and academic anxiety, i.e., test- and mathematics-anxiety (Hembree, 1988, 1990; Ma, 1999). Several studies show a negative association between test- and mathematics-anxiety and academic performance (Hembree, 1988, 1990; Hill et al., 2016; Putwain, 2008; Wu et al., 2012; Zeidner, 1998). Other studies consider the positive interplay between academic emotions, resilience or coping with academic stress and achievement (Pekrun et al., 2017; Putwain & Daly, 2013; Struthers, Perry, & Menec, 2000). However, only few studies have considered the role of different domain general (e.g., general-anxiety and ego-resilience) and academic forms of anxiety (i.e., test- and mathematics-anxiety) on different academic domains (i.e., mathematics and reading literacy).

In this chapter, we will initially present the extant literature on the relation between different academic forms of anxiety (e.g., test- and mathematics-anxiety) and

academic performance. The role of resilience on academic achievement and recent evidence about the relation between these variables and test-anxiety will also be described. Afterward, the second Study of this dissertation will be present, which aims to examine the relation among general and academic forms of anxiety (i.e., general-, test- and mathematics-anxiety), ego-resilience and fluid intelligence on mathematics and reading literacy. In this study, children attending grades 5, 6 and 8 were involved. The focus on this age range is based on the consideration that both test- and mathematics-anxiety seem to have a detrimental role on school performance after grade 4; therefore, testing younger children might have produced unreliable estimates (e.g., Ergene, 2003). We decided to exclude measures of depressive symptoms from Study 2 based on the results of the Study 1 (Chapter 2), which showed that general-anxiety and depressive symptoms measures tend to be highly correlated and indistinguishable from a statistical point of view. Considering that the focus of the second Study was on the relation among general and academic forms of anxiety (i.e., test-anxiety and mathematics-anxiety) as well as ego-resilience on mathematics and reading literacy, we also decided not to include measures about working memory. Our first study already showed the crucial role of working memory on mathematics and reading literacy also when negative affect and personal resources are considered. In addition, a huge number of studies examined the relation between working memory to both test- and mathematics anxiety (Ashcraft & Krause, 2007; Ashkenazi & Danan, 2017; Korhonen, Nyroos, Jonsson, & Eklöf, 2018; Lee, 1999; Ng & Lee, 2015; Ng & Lee, 2016; Mammarella, Hill, Devine, Caviola, & Szűcs, 2015; Passolunghi, Caviola, De Agostini, Perin, & Mammarella, 2016; Ramirez, Gunderson, Levine, & Beilock, 2013) as well as to both mathematics and reading literacy (e.g., Borella et al., 2010; Borella & de Ribaupierre, 2014; Friso-van den Bos et al., 2013; Giofrè et al., 2017; Mammarella et al., 2018; Passolunghi et

al., 2008; Peng et al., 2016). However, we included a measure of fluid intelligence as a control variable, which is based upon evidence indicating that this variable is a strong predictor of academic achievement (Gottfredson, 2002a, 2002b; Kuncel, Hezlett, & Ones, 2004; Rohde & Thompson, 2007). For these reasons, participants were tested with self-report measuring anxiety forms (i.e., general-, test- and mathematics-anxiety), ego-resilience and a pen and pencil test about fluid intelligence. Achievement was measured using national tests on mathematics and reading literacy. Structural equational models were performed to evaluate the contribution of each of these factors on mathematics and reading literacy. As a result, the specific effects of test- and mathematics-anxiety on these two different academic domains (i.e., mathematics and reading literacy) were examined. Findings of the present study will be finally presented and discussed in light of the current literature.

## 3.2 The relation among anxiety forms, resilience and academic performance

Students' performance related to anxiety can have a negative role on their performance and general wellbeing. As previously reported, the literature suggests the presence of general as well as specific forms of anxiety, e.g. TA and MA, which tend to be related to the academic performance (Ashcraft & Moore, 2009; Hembree, 1988, 1990; Ma, 1999; McDonald, 2001; Segool et al., 2013; Wu et al., 2012).

Test-anxiety (TA) can be considered one common form of anxiety in educational settings encompassing affective, cognitive, expressive, and peripheral physiological processes (Lohbeck, Nitkowski, & Petermann, 2016). Recent studies on children suggests that TA can be operationalised in terms of: a) a cognitive component linked to

worry and task-irrelevant thoughts; b) behavioural responses such as nervous habits linked to avoidance and c) social concerns about failing (see Benson, Moulin-Julian, Schwarzer, Seipp, & El-Zahhar, 1992; Lowe et al., 2008; Wren & Benson, 2004; Zeidner, 2007). In the literature, the effect of TA has been examined in relation to academic achievement.

Several studies show that high levels of TA have a detrimental role on academic performance (see Hembree, 1988; McDonald, 2001; Zeidner, 1998), and lead to poorer grades (Segool et al., 2013; Sena, Lowe, & Lee, 2007) in school-aged children (Putwain, 2008; McDonald, 2001; Segool et al., 2013). The relation between TA and academic achievement could be understood considering that whether before, during or after an evaluation, students feel unsure of their ability or not performed to their best, they may experience feelings of apprehension and distress (McDonald, 2001; Zeidner, 2007). However, other factors such as intelligence (Hembree, 1988), social–emotional functioning (e.g., Beidel & Turner, 1988), and academic abilities (e.g., Sub & Prabha, 2003) may play a role in the perception of school evaluation as a threat and the level of TA (Hancock, 2001). Another form of anxiety that can be present at school is mathematics-anxiety.

Mathematics-anxiety (MA) refers to tension and worry experienced in anticipation or during mathematical activities and evaluations that interfere with mathematics performance in daily life and school settings (e.g., Ashcraft & Moore, 2009; Richardson & Suinn, 1972; Wigfield & Meece, 1988). MA can be operationally defined as a form of anxiety for numbers (e.g., anxiety for mathematics in the ordinary academic situations) and for evaluation in mathematics (e.g., being called on during math class or performed a mathematics tests) (Vukovic, Kieffer, Bailey, & Harari, 2013). MA is negatively related to mathematics achievement in both adults and children

(Ashcraft & Moore, 2009; Hembree, 1990; Hill et al., 2016; Ma, 1999; Wu et al., 2012). One possible explanation of the debilitating effect of MA on mathematics is that high levels of anticipatory anxiety can lead to avoidance of mathematics (Lyons & Beilock, 2012; Maloney & Beilock, 2012) or influence affective climate surrounding mathematics (Ho et al., 2000; Wigfield & Meece, 1988).

TA and MA are shown to be associated, with studies reporting moderate correlations between these two constructs. Meta-analyses involving studies carried-out on high school and college students showed higher correlation between TA and MA ($r$=.52) and moderate correlation between GA and MA ($r$=.35) (Hembree, 1988, 1990). These results suggested that TA and MA share higher variance respect to GA but that at the same time these factors present unique variance that is specific for each construct. Research pointed out that GA, TA and MA are distinguishable but related constructs but only few studies have examined their combined effect on different academic domains. For example, research showed that partialling out the effect of GA significantly reduced the relation between MA and mathematics achievement (Hill et al., 2016).

Resilience could be broadly defined as an adaptive response to adversity or stressful situations (e.g., Garmezy, 1991; Masten 2014; Windle, 2011). Resilience helps children to cope with anxious situations also in the school context (Smith & Carlson, 1997; Putwain, Nicholson, Connors, & Woods, 2013). In a similar vein, ego-resilience, which is a pattern of personal characteristics that individuals may have when faced with potential difficulties (Block & Block, 1980), is positively related to the academic performance (Kwok et al., 2007; Liew et al., 2018; Swanson et al., 2011). This result holds true even when the effect of intelligence is taken into account (Kwok et al., 2007). Resilient children perform better on evaluative conditions compared to students with similar abilities thank to the ability of maintaining effort and persistence on the task

(Martin & Marsh, 2006). Resilience is also negative associated with TA, which might in turn supports the academic performance (e.g., Putwain et al., 2013).

## 3.3 Overview of the present study

The present study aims to examine the relation among anxiety forms (i.e., GA, TA and MA) and ego-resilience on mathematics and reading literacy in school-aged children. As reported above, we were interested in evaluating these relations once the effect of fluid intelligence, which tends to be consistently related to the academic performance (Gottfredson, 2002a, 2002b; Kuncel et al., 2004; Rohde & Thompson, 2007), was taken into account.

The first aim of the present study is to examine the role of GA, TA and MA on mathematics and reading literacy. Recent evidence suggests that MA affects mathematics achievement but that also anxiety may have a detrimental role on reading proficiency (Ackerman et al., 2007; Carroll & Iles, 2006; Hembree, 1988, 1990; Mammarella et al., 2016; Richardson & Suinn, 1972; Wu et al., 2012). Based on these findings, we hypothesize that when TA and MA are assessed together along with mathematics and reading literacy, specific effects should appear. In particular, MA, which seems to be highly related to mathematics performance, was supposed to have a specific effect on mathematics achievement, whereas TA, which seems to be implied in different academic domains, was expected to have a role on reading achievement. Recent evidence also suggest that GA could be involved in the development of MA or in mathematics achievement (Hill et al., 2016; Wu et al., 2012). It has been suggested that students who show a predisposition towards different anxiety forms, including GA, are more at risk to develop MA regardless their mathematics experiences and

performance (Carey et al., 2017). Based on these considerations, we supposed that GA could only have an effect on mathematics and reading literacy throughout MA and TA respectively.

The second aim of the present study is to examine the contribution of ego-resilience on mathematics and reading literacy once GA, TA and MA are considered. Children's resilience tends to affect levels of TA and seems to be indirectly related to academic achievement (e.g., Putwain et al., 2013). In a similar vein, ego-resilience supports academic achievement (e.g., Swanson et al., 2011) and performance in specific academic domains including mathematics and reading literacy (Kwok et al., 2007; Liew et al., 2018). Notably, ego-resilience is negatively related to anxiety and internalizing problems in nonclinical samples (Alessandri, Vecchione, Caprara, & Letzring, 2012; Block & Gjerde, 1990; Chuang et al., 2006; Vecchione et al., 2010). However, this evidence is still scarce with no previous studies aimed to examine the contribution of ego-resilience in supporting mathematics and reading literacy when GA, TA and MA are considered. Based on available research we expected to find a positive contribution of ego-resilience on mathematics and reading literacy (Kwok et al., 2007; Liew et al., 2018) even when other forms of anxiety (i.e., GA, TA and GA) are considered.

## 3.4 Method

### 3.4.1 Participants

In the present study 269 (47% girls, $M_{age}$ = 11.28 years, *SD*= 1.31; range= 9.00 – 15.00 years) children in grades 5 to 8. Students were recruited from public schools placed in urban areas of the north-east Italy and came from middle-class families. Participants were typically-developing children. Three children were found to be a

multivariate outliers using Mahalanobis distance (D>36.5) and were excluded from the analyses. Thus the final sample included 265 children in grades 5 (N=87, 54% girls), the 6 (N=89, 34% girls) and 8 (N=9. 54% girls).

The study was approved by the Ethics Committee on Psychology Research at the University of Padova (Italy). After school's approval, written informed parental consent was obtained prior to the test.

### 3.4.2 Materials

**General anxiety**

The *Revised Children's Manifest Anxiety Scale: Second Edition* (RCMAS-2; Reynolds & Richmond, 2012) is a self-report questionnaire for detecting general anxiety in children and adolescents. It comprises 49 item with a yes/no response format, thus higher scores indicated higher anxiety. The questionnaire provides scores on different subscales concerning worries (e.g., *"I am worried that my classmates could make fun of me"*), physiological (e.g., *"I often have stomachache"*), and social anxiety (e.g., *"I feel nervous when things don't go as I want"*). The RCMAS-2 shows good internal consistency for worries (Cronbach's α = .86), physiological (Cronbach's α = .75) and social anxiety (Cronbach's α = .80) subscales as reported in the manual. In the present sample adequate internal consistency was found for the worries (Cronbach's α = .74), physiological (Cronbach's α = .63) and social (Cronbach's α = .77) anxiety scores.

**Test anxiety**

The *Test Anxiety Questionnaire for Children* (TAQ-C; Donolato, Marci, Altoè, & Mammarella, under review) is a self-report tool for assessing TA in primary and middle school children. Children were asked to read 24 item and to rate each item using

a 4-point Likert scale from 1= "never" to 4= "always", so higher scores indicated higher levels of TA. The questionnaire provides scores on four different subscales about thoughts (e.g., *"I think I'm going to get a bad grade"*), off-task behaviours (e.g., *"I play with my pencil"*), autonomic reactions (e.g., *"My heart beats fast"*) and social concerns about failing a test (e.g., *"I am worried that all my friends will get high scores in the test and only I will get low ones"*). Good internal consistency was found in the Italian sample considered for the assessment of the psychometric properties of the tool (see Donolato et al., under review). In the present sample good internal consistency was also found for the thoughts (Cronbach's $\alpha = .83$), off-task behaviours (Cronbach's $\alpha = .76$), autonomic reactions (Cronbach's $\alpha = .79$) and social (Cronbach's $\alpha = .82$) scores.

**Math anxiety**

The *Abbreviated Math Anxiety Scale* (AMAS; Hopko, Mahadevan, Bare, & Hunt, 2003) is a brief self-report tool for measuring MA in children. The questionnaire is composed by 9 item with a 5-point Likert scale from 1 "strongly agree" to 5 "strongly disagree", thus higher scores indicated higher MA. Children were asked to evaluate each statement about different situations involving math school activities in terms of how anxious they would be (i.e., *"Thinking about the upcoming written math test you have tomorrow"*). For the present study the Italian translation of the questionnaire (Caviola, Primi, Chiesi, & Mammarella, 2017) was used. Good internal consistency (Cronbach's $\alpha = .77$) was found in the Italian sample (see Caviola et al., 2017) and in the present study (Cronbach's $\alpha = .84$).

**Ego-resiliency**

The *Ego-Resiliency Scale* (ER; Block & Kremen, 1996) is a questionnaire for assessing resiliency as general resourcefulness, strength of character, and flexibility of functioning that allow to adapt more quickly to changing circumstances. The questionnaire comprises 14 statements (e.g., "*I quickly get over and recover from being startled*") scored on a 4-point Likert scale, from 1 "does not apply at all" to 4 "applies very strongly". The scale was used with adults and with adolescents, showing good psychometric properties (Cronbach's α = .87) (see Caprara, Steca & De Leo, 2003). An adequate internal consistency of the scale was also observed in the present sample (Cronbach's α = .75).

**Intelligence**

The *Cattell Culture Fair Intelligence Test* (CFIT; Cattell & Cattell, 1981) is a pen and pencil test for measuring general cognitive abilities linked with fluid intelligence. It consists of 46 multiple-choice item divided into four timed subtests (series completion, odd-one-out, matrices and topology) covering judgments and reasoning composed by item with increasing difficulties within each subtest. The CFIT has good internal consistency (Cronbach's α = .76) as reported in the manual.

**Mathematics and reading literacy**

The *INVALSI* (Italian Institute for the Assessment of the Instruction System, 2011) were used to assess academic achievement related to *mathematics* and *reading literacy*. For each grade the appropriate version of the INVALSI test was proposed. As regard *mathematics,* the INVALSI tests provided scores about four areas: *space and figures* (MATH-SF) related to geometry problems; *numbers* (MATH-N) consists

number fractions and other mathematical calculations; *relations and functions* (MATH-RF) including problems with equivalences or algebraic expressions; and *data and prediction* (MATH-DP) consists in probability and statistical problems. The task showed good psychometric internal consistency in the present sample (Cronbach's α = .88 in grade 5, .90 in grade 6, and .84 in grade 8). As regard *reading literacy,* the INVALSI provided scores about reading comprehension and grammar. For reading comprehension (READ-RC), students were shown some passages and they had to answer several multiple-choice or short open-ended questions. For grammar (READ-G), students were asked to answer questions on Italian language spelling, morphology and lexicon. Also the reading literacy showed good psychometric properties in the present sample (Cronbach's α = .92 in grade 5, .91 in grade 6, and .84 in grade 8).

### 3.4.3 Procedure

Participants were tested in different steps: a) a collective session lasting approximately 45 minutes, when questionnaires and cognitive measure about intelligence were proposed; b) two collective sessions lasting 75 minutes each, when achievement tests were administrated. The first session was conducted on November-December, while the last two sessions were proposed on April-May of the same school year. All tasks were administrated in students' classrooms by a trained assistant researcher using a standardized procedure, and in the presence of a teacher. Also for this study, all tasks were administrated in fixed order as also reported by other studies (e.g., Giofrè et al., 2017; Hill et al., 2016). In the first session students were presented the CFIT (Cattell & Cattell, 1981), the RCMAS-2 (Reynolds & Richmond, 2012), the ER (Block & Kremen, 1996), the TAQ-C (Donolato et al., under review) and the AMAS

(Hopko et al., 2003; Caviola et al., 2017). In the last two collective sessions the reading literacy and mathematics INVALSI test (2011) were presented.

### 3.4.4 Data analysis

Analyses were performed using R statistical software (R Development Core team, 2016). In the present study, a latent variable approach was used considering that it has several advantages, including adjusting for the measurement error (Kline, 2016). A two-step modelling approach considering confirmatory factor analyses (CFAs) and structural equational models (SEMs) was performed. For this purpose the *lavaan* package (Rosseel, 2012) was used. The maximum-likelihood-based estimation method was considered (Muthén & Muthén, 2007). The model goodness-of-fit was evaluated considering several indexes (Hu & Bentler, 1999). In particular, the chi-square ($\chi^2$), the comparative fit index (CFI), the non-normed fit index (NNFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) were considered. The chi-square difference ($\Delta\chi^2$), and the Akaike information criterion (AIC) were also used to compare the fit of alternative models (Kline, 2016). We initially evaluated a first model based on theoretical reasons. Thereafter, we removed paths based on magnitude and statistical-significance starting from smallest coefficients. Because different grades were considered, we decided to residualize row data for the effect of this variable. IRT scaling was also used to make the results comparable for the INVALSI task considering that different versions were used for each grade (Cook & Eignor, 1991).

## 3.5 Results

Descriptive statistics (mean, standard deviation, range, skewness and kurtosis) for each measure are shown in Table 3.1. As reported, skewness and kurtosis were very reasonably small, suggesting the presence of no strong violation of normality distribution (Tabachnik & Fidell, 2001). Correlations among all measures are reported in Table 3.2.

***Table 3.1*** Means, Standard Deviations, Range, Skewness and Kurtosis for all considered variables before residualizing by grade.

| | M (*SD*) | Range | Skewness | Kurtosis |
|---|---|---|---|---|
| **General Anxiety** | | | | |
| RCMAS-2 PA | 3.75 (2.40) | 0-10 | .46 | -.42 |
| RCMAS-2 WO | 6.88 (3.42) | 0-16 | .06 | -.55 |
| RCMAS-2 SO | 4.40 (2.83) | 0-12 | .28 | -.62 |
| **Test-anxiety** | | | | |
| TAQ-C PA | 11.25 (3.79) | 6-24 | .78 | .12 |
| TAQ-C THO | 13.65 (4.03) | 6-24 | .55 | -.22 |
| TAQ-C OFF | 12.43 (4.11) | 6-24 | .59 | -.31 |
| TAQ-C SO | 11.28 (4.24) | 6-24 | .95 | .30 |
| **Math anxiety** | | | | |
| AMAS | 22.84 (7.73) | 9-43 | .20 | -.59 |
| **Resilience** | | | | |
| ER | 41.27 (5.58) | 26-56 | -.28 | -.40 |
| **Intelligence** | | | | |
| Cattell 1 | 8.52 (1.64) | 2-12 | -.65 | .95 |
| Cattell 2 | 7.30 (1.76) | 3-12 | .14 | -.23 |
| Cattell 3 | 8.42 (2.30) | 0-12 | -.64 | .08 |
| Cattell 4 | 4.69 (1.81) | 0-8 | -.15 | -.65 |
| **Mathematics** | | | | |
| MATH- N | 41.94 (21.14) | 0-93 | .10 | -.75 |
| MATH-SF | 40.28 (20.60) | 0-100 | .37 | -.33 |
| MATH-DP | 47.62 (23.22) | 0-100 | .19 | -.63 |
| MATH-RF | 39.38 (22.04) | 0-90 | .19 | -.90 |
| **Reading** | | | | |
| READ-RC | 64.25 (18.59) | 10-98 | -.77 | .20 |
| READ-G | 71.51 (18.71) | 0-100 | -.77 | -.04 |

*Note*. Please note that means and standard deviations for MATH and READ were calculated on raw data, before the IRT scaling was applied.
RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; TAQ-C = test-anxiety scale; -PA = physiological subscale; -THO = thoughts subscale; -OFF= off-task behaviour; -SO = social subscale; AMAS = mathematics anxiety scale; ER = resiliency scale; Cattell = intelligence scale; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar.

***Table 3.2*** Correlations among all considered measures after residualizing by grade.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. RCMAS-2 PA | 1 | | | | | | | | | | | | | | | | | | |
| 2. RCMAS-2 WO | .526 | 1 | | | | | | | | | | | | | | | | | |
| 3. RCMAS-2 SO | .468 | .681 | 1 | | | | | | | | | | | | | | | | |
| 4. TAQ-C PA | .345 | .417 | .431 | 1 | | | | | | | | | | | | | | | |
| 5. TAQ-C THO | .280 | .336 | .420 | .577 | 1 | | | | | | | | | | | | | | |
| 6. TAQ-C OFF | .406 | .256 | .252 | .378 | .377 | 1 | | | | | | | | | | | | | |
| 7. TAQ-C SO | .296 | .398 | .525 | .547 | .728 | .269 | 1 | | | | | | | | | | | | |
| 8. AMAS | .199 | .290 | .326 | .321 | .356 | .194 | .372 | 1 | | | | | | | | | | | |
| 9. ER | -.133 | -.149 | -.272 | .012 | -.052 | -.113 | -.087 | -.023 | 1 | | | | | | | | | | |
| 10. Cattell 1 | .060 | .021 | .001 | -.040 | -.046 | .071 | -.096 | -.085 | .111 | 1 | | | | | | | | | |
| 11. Cattell 2 | -.047 | -.022 | -.032 | -.023 | -.083 | .009 | -.103 | -.161 | -.033 | .273 | 1 | | | | | | | | |
| 12. Cattell 3 | -.035 | .043 | -.098 | -.104 | -.084 | -.073 | -.165 | -.224 | -.005 | .303 | .374 | 1 | | | | | | | |
| 13. Cattell 4 | .074 | .015 | -.014 | .089 | .051 | .077 | -.037 | -.120 | -.002 | .160 | .261 | .27 | 1 | | | | | | |
| 14. MATH-N | -.100 | -.132 | -.204 | -.117 | -.194 | -.090 | -.207 | -.366 | .085 | .234 | .308 | .395 | .287 | 1 | | | | | |
| 15. MATH-SF | -.051 | -.020 | -.106 | .015 | -.092 | -.043 | -.105 | -.165 | .105 | .250 | .227 | .250 | .225 | .537 | 1 | | | | |
| 16. MATH-DP | -.091 | -.047 | -.167 | -.038 | -.126 | -.009 | -.180 | -.278 | .120 | .176 | .309 | .288 | .266 | .561 | .501 | 1 | | | |
| 16. MATH- RF | -.076 | -.108 | -.160 | -.073 | -.118 | .036 | -.171 | -.231 | .115 | .229 | .313 | .389 | .193 | .489 | .412 | .487 | 1 | | |
| 18. READ-RC | -.075 | -.022 | -.186 | -.061 | -.141 | -.079 | -.203 | -.289 | .140 | .219 | .273 | .33 | .163 | .451 | .282 | .422 | .307 | 1 | |
| 19. READ-G | -.100 | -.040 | -.187 | -.094 | -.146 | -.091 | -.218 | -.259 | .048 | .217 | .253 | .355 | .163 | .461 | .343 | .480 | .321 | .667 | 1 |

*Note*. All coefficients ≥ .121 are significant at .05 level.
RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; TAQ-C = test-anxiety scale; -PA = physiological subscale; -THO = thoughts subscale; -OFF= off-task behaviour; -SO = social subscale; AMAS = mathematics anxiety scale; ER = resiliency scale; Cattell = intelligence scale; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar.

### 3.5.1 CFAs models

In the measurement model (CFA-01), we estimated seven latent variables. In this model, RCMAS-2 physiological (PA), worries (WO) and the social anxiety (SO) scales were supposed to reflect a general anxiety factor (GA), while the TAQ-C physiological (PA), thought (THO), off-task (OFF) and social anxiety (SO) scores were reflecting a test-anxiety factor (TA) and finally the AMAS was considered to reveal a mathematics-anxiety factor (MA). The ER score was also considered to reveal ego-resilience (RES), while the Cattell subscales (Cattell 1, 2, 3, and 4) were supposed to reflect a fluid intelligence factor (*g*). As regard achievement, the space and figures (SF), numbers (N), relations and functions (RF) and data and prediction (DP) scores were considered as reflected mathematics achievement (MATH), while reading comprehension (RC) and grammar (G) were considered part of reading literacy (READ) factors. RES and MA errors were fixed using the reliability of the scale (see Kline, 2016 for more details). This model showed an adequate fit, $\chi^2(133)=199.52$, $p=.001$, $RMSEA=.043$, $SRMR=.047$, $CFI=.960$, $NNFI=.948$, $AIC=18060$ and was therefore retained for subsequent analyses. Factor loadings and inter-factor correlations for this model are reported in Table 3.3.

***Table 3.3*** Factor loadings and inter-factor correlations for the measurement model.

| | GA | TA | MA | RES | *g* | MATH | READ |
|---|---|---|---|---|---|---|---|
| 1. RCMAS-2 PA | .59 | | | | | | |
| 2. RCMAS-2 WO | .79 | | | | | | |
| 3. RCMAS-2 SO | .86 | | | | | | |
| 4. TAQ-C PA | | .69 | | | | | |
| 5. TAQ-C THO | | .84 | | | | | |
| 6. TAQ-C OFF | | .42 | | | | | |
| 7. TAQ-C SO | | .84 | | | | | |
| 8. AMAS | | | .87 | | | | |
| 9. ER | | | | .75 | | | |
| 10. Cattell 1 | | | | | .44 | | |
| 11. Cattell 2 | | | | | .55 | | |
| 12. Cattell 3 | | | | | .70 | | |
| 13. Cattell 4 | | | | | .41 | | |
| 14. MATH-N | | | | | | .81 | |
| 15. MATH-SF | | | | | | .63 | |
| 16. MATH-DP | | | | | | .70 | |
| 17. MATH-RF | | | | | | .69 | |
| 18. READ-RC | | | | | | | .81 |
| 19. READ-G | | | | | | | .82 |
| Inter-factor correlation matrix | | | | | | | |
| GA | 1 | | | | | | |
| TA | .640** | 1 | | | | | |
| MA | .426** | .505** | 1 | | | | |
| RES | -.352** | -.098 | -.035 | 1 | | | |
| *g* | -.047 | -.164* | -.340** | .019 | 1 | | |
| MATH | -.239* | -.241* | -.423** | .210* | .710** | 1 | |
| READ | -.181* | -.248** | -.349** | .171 | .675** | .712** | 1 |

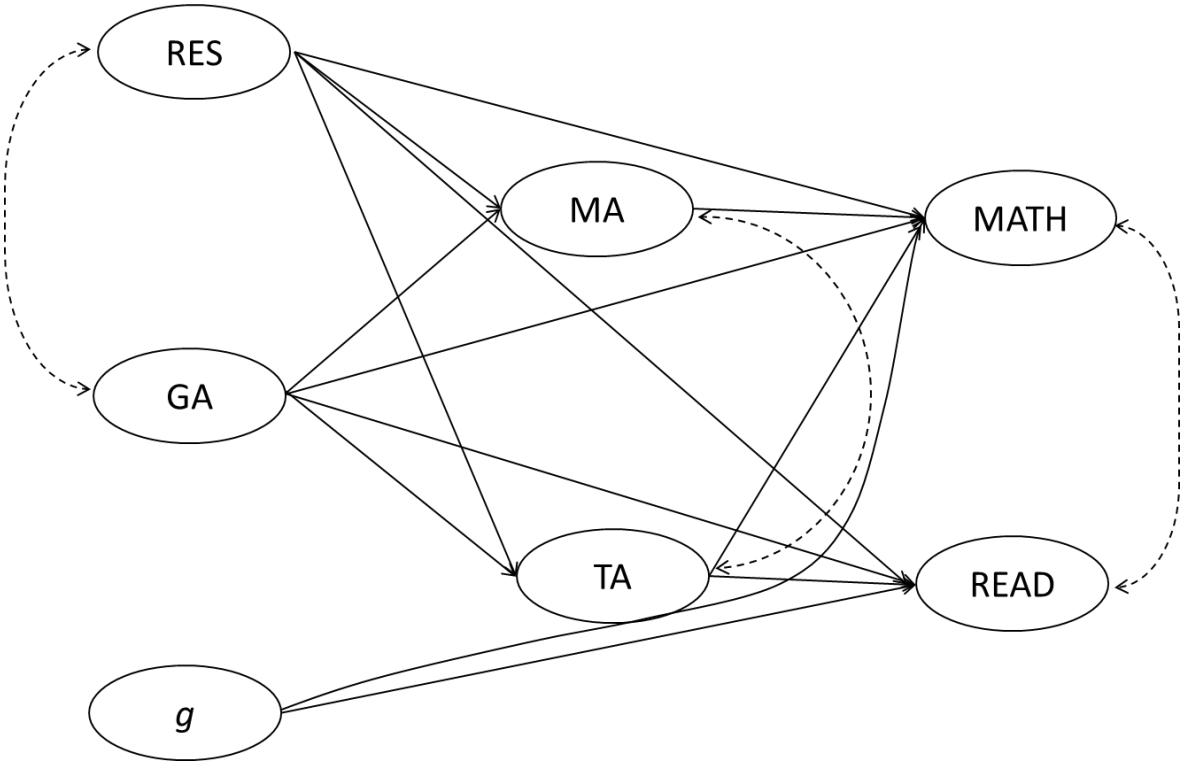
*Note*. All factor loadings are significant ($p < .01$). Inter-factor correlations, * $p<.05$, ** $p<.01$.
RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; TAQ-C = test-anxiety scale; -PA = physiological subscale; -THO = thoughts subscale; -OFF= off-task behaviour; -SO = social subscale; AMAS = mathematics anxiety scale; ER = resiliency scale; Cattell = intelligence scale; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar; GA = general-anxiety; TA=test-anxiety; MA=Mathematics-anxiety; RES = Ego-resilience; *g* = fluid intelligence.

### 3.5.2 SEM models

Different models were estimated to assess the relation and the relation among anxiety forms on mathematics (MATH) and reading literacy (READ). In all models, the effect of fluid intelligence (*g*) was considered on both considered outcomes.

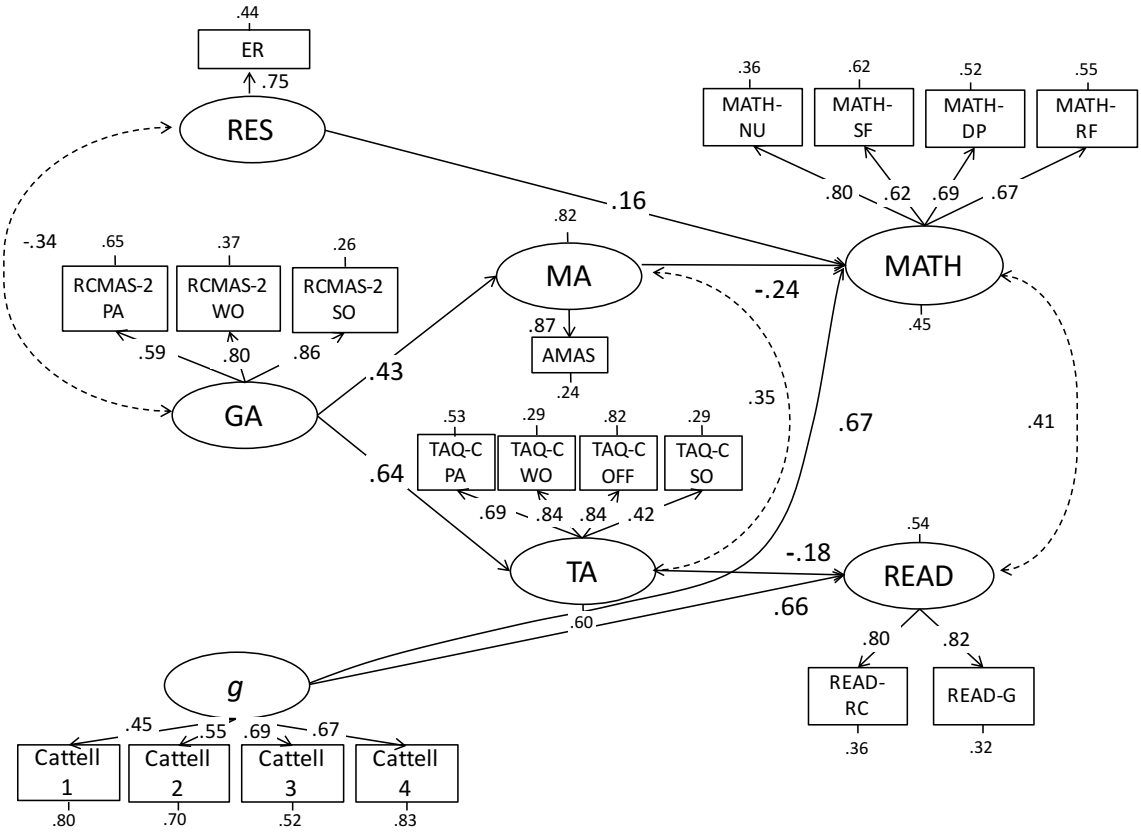
We started from a model (SEM-01; Figure 3.1) in which TA and MA mediate the relation between GA and RES and both MATH and READ. We considered a model in which: i) MA was supposed to have a specific effect on MATH; ii) TA was considered to have an effect on READ; iii) GA and RES were supposed to have an effect on both MATH and READ. The fit of the model was adequate, $\chi^2(138)=220.44$, $p=.001$, *RMSEA*=.048, *SRMR*=.061, *CFI*=.950, *NNFI*=.938, *AIC*=18071. However, some coefficients were quite small and non-statistically-significant. Therefore, we decided to drop these coefficients starting from the smallest one. We evaluated the paths from the exogenous variables to the endogenous one. Notably, exactly the same findings were obtained when we started from removing paths from endogenous rather than exogenous factors. The final model (SEM-02) is shown in Figure 3. It had an adequate fit, $\chi^2(144)=228.67$, $p=.001$, *RMSEA*=.047, *SRMR*=.064, *CFI*=.948, *NNFI*=.939 *AIC*=18067, and it was more parsimonious compared to the previous one, $\Delta\chi^2(6)=8.24$, $p=.221$. It is important to note that standard coefficients of the variables in the final model were very similar, in terms of magnitude, to the ones of the initial model. All paths were statistically significant thus SEM-02 was retained as final model. It is noteworthy that whether the standard coefficient of RES on READ was considered, the magnitude ($\beta$ = .149, *SE* =.117) was similar to the one on MATH ($\beta$ = .208, *SE* =.124).

***Figure 3.1*** Initial tested model.




*Note*. RES = Ego-resilience; GA = general-anxiety; TA=test-anxiety; MA=Mathematics-anxiety; *g* = fluid intelligence; MATH = Mathematics literacy; READ = Reading literacy.

***Figure 3.2*** Final model with standardized coefficients.




*Note*. Final SEM Model (SEM-02). All reported paths are statistically significant ($p < .05$).
RCMAS-2 = general anxiety scale; -PA = physiological subscale; -WO = worries subscale; -SO = social subscale; TAQ-C = test-anxiety scale; -PA = physiological subscale; -THO = thoughts subscale; -OFF= off-task behaviour; -SO = social subscale; AMAS = mathematics anxiety scale; ER = resiliency scale; Cattell = intelligence scale; MATH = Mathematics literacy; -N = numbers; -SF = space and figures; -DP = data and prediction; -RF = relations and functions; READ = Reading literacy; -RC = reading comprehension; -G = grammar; GA = general-anxiety; TA=test-anxiety; MA=Mathematics-anxiety; RES = Ego-resilience; *g* = fluid intelligence.

## 3.6 Discussions

The second study of this dissertation aimed to assess the relation among GA, TA, MA and ego-resilience on mathematics and reading literacy in school-aged children. As previously mentioned, MA was hypothesized to have a specific effect on mathematics performance, while TA was supposed to play a role on reading literacy (Ackerman et al., 2007; Carroll & Iles, 2006; Hembree, 1988, 1990; Mammarella et al., 2016; Richardson & Suinn, 1972; Wu et al., 2012). GA was expected to have an effect on mathematics and reading literacy throughout MA and TA respectively (Hill, et al. 2016; Carey, et al. 2017). As for ego-resilience, this factor was hypothesized to have an

effect on mathematics and reading literacy even when other forms of anxiety are considered (Kwok et al., 2007; Liew et al., 2018; Putwain et al., 2013; Swanson et al., 2011).

As regard the relation between different anxiety forms (e.g., GA, TA and MA) on mathematics and reading literacy, our findings revealed that MA had a specific effect on mathematics performance and that TA had an effect on reading literacy. These results provide more evidence that MA is specifically involved in mathematics even when other forms of anxiety (e.g., GA and TA) are considered (see Hembree, 1988, 1990; Hill et al., 2016; Wu et al., 2012). Indeed, our results suggest that reading literacy is negatively associated with academic stress and anxiety (Ackerman et al., 2007; Carroll & Iles, 2006; Mammarella et al., 2016; Rajchert et al., 2014). Notably, our findings point out that MA had a higher impact on mathematics rather than the effect of TA on reading literacy, suggesting that mathematics is a field in which children could experience more difficulties in terms of emotional distress and anxiety respect to reading literacy. The effect of GA on mathematics and reading literacy was found to be related to TA and MA. In agreement with other studies (Carey et al., 2017; Hill et al., 2016), our results pointed out that GA still has a role on mathematics achievement and reading literacy. This seems to be consistent with the hypothesis that GA could be a risk factor for the development of MA (see Carey et al., 2017). Although a mediational model was tested, it is important to note that this statistical analysis is not adequate for interpreting our results in terms of causal relations.

The present study also shows that ego-resilience had a positive contribution on mathematics achievement. This is in line with previous findings that suggest the role of ego-resilience on academic achievement (Chuang et al., 2006; Kwok et al, 2007; Liew et al., 2018; Swanson et al., 2011; Vecchione et al., 2010). Contrary to our expectations,

the effect of ego-resilience was specific for the mathematics domain. However, this result seems to be linked to non-statistical-significant effect because the effect of ego-resilience on reading literacy was very similar, in terms of magnitude, to the one on mathematics. This suggests that the effect of ego-resilience on mathematics and reading literacy could be comparable in these two academic domains. Interestingly, our results point out that ego-resilience is related to GA rather than to TA and MA. This is in line with previous research that pointed out that ego-resilience is negatively related to internalizing problems, including anxiety, in nonclinical samples (e.g., Chuang, Lamb, & Hwang, 2006). More importantly our results extend previous findings about the relation among resilience and other specific forms of anxiety (see Putwain et al., 2013), suggesting that when both general and academic forms of anxiety (i.e., TA and MA) are assessed, ego-resilience seems to be related to the former rather than the latter in supporting students' academic achievement. All the effects are estimated once fluid intelligence was taken into account considering it is a strong predictor of mathematics and reading literacy (Gottfredson, 2002a, 2002b; Kuncel et al., 2004; Rohde & Thompson, 2007).

Although the present study gives important contributions, some limitations should be addressed in future studies. First, our results should be replicated considering younger but also older students such as adolescents in order to better clarify the role of the considered variables in different age ranges. The present study involved Italian students, while it would be particular interestingly to test our model also in samples from other countries in order to examine possible cultural differences. Finally, we did not consider the role of contextual features that might be of interest in relation to children anxiety. For instance, teachers and parents' expectations on their children's attitudes and achievement may influence students' anxiety, so it would be particularly

interesting to include such effects in future models (e.g., Christenson, Rounds, & Gorney, 1992). Some studies have considered the role of these aspects in relation to MA (Chang & Beilock, 2016; Gunderson, Ramirez, Levine, & Beilock, 2012; Fennema, Peterson, Carpenter, & Lubinski, 1990), while research on TA is scare (see Campbell & Mandel, 1990; Putwain et al., 2010).

Both educational and clinical implications can be drawn from our findings. For example, prevention programs should involve screening about different anxiety forms (i.e., GA, TA and MA) considering that children experience these emotional difficulties since the primary school (Ergene, 2003). At the same time, more information about general and academic anxiety should be given to parents and teachers in order to prevent the development of such problems. Specific interventions programs involving the management of academic anxiety should be proposed to children who show these emotional difficulties (see Weems et al., 2010). Also in this case, empirical evidence about the effectiveness of several practices based on behavioural theory, cognitive theory, cognitive–behavioural theory, and in the area of academic skill-building was found (Von Der Embse, Barterian, & Segool, 2013; Gregor, 2005; Lang & Lang, 2010; Larson et al., 2010). Such programs should be proposed to the classrooms or groups of students with high levels of TA or to children with learning difficulties that are more likely to display emotional difficulties (see Nelson & Harwood, 2011; Mammarella, et al. 2016; Mugnaini, Lassi, La Malfa, & Albertini, 2009). At the same time, personal resources such as resilience should be promoted. For example, it is important to sustain and enhance student's personal qualities promoting a sense of responsibility or becoming more engaged and invested in their learning, developing autonomy and independence (Morrison & Allen, 2007).

To sum up the present study suggests that MA and TA had specific effects on mathematics and reading literacy, while GA had effects on these two academic domains throughout MA and TA. Ego-resilience was shown to sustain academic achievement. All these effects were presence once the role of fluid intelligence was assessed. This suggests to consider the role of anxiety forms and ego-resilience on mathematics and reading literacy in order to better clarifying how these aspects are related in school-aged children academic success.

# CHAPTER 4

# ANXIETY PROFILES AND PERSONAL RESOURCES: A LATENT PROFILE ANALYSIS IN CHILDREN

## 4.1 Introduction

Anxiety forms related to general-, test- and mathematics-anxiety (GA, TA and MA respectively) have been often separately investigated in the academic field (Devine et al., 2012; Hill et al., 2016; Roick & Ringeisen, 2017; Putwain, Daly, Chamberlain, & Sadreddini, 2015). As previously reported, GA, TA and MA are considered as distinct but related constructs (Hembree, 1988, 1990; Ma, 1999). TA and MA are found to be highly related, while GA has a small but consistent relation with both MA and TA (Hembree, 1988, 1990). In a recent study Wang et al. (2014) carried out one of the first research that investigated the genetics contribute to MA and its association with GA. Their results revealed that genetic factors accounted for around 40% of the variation in MA, with the remaining being accounted for by child-specific environmental factors. In addition, data showed that 9% of the total variance in MA was associated with genetic influences in common with GA and 4% of the total variance was associated with non-shared environmental influences in common with GA. On the other hand, the presence of a high correlation between TA and MA is supposed to be linked to environmental factors (e.g., negative experiences in class or teacher characteristics) and personality variables (e.g., generally anxious personality, or presence of academic difficulties) (see

Carey et al., 2017 on this point). The evidence about the relation among these factors provides a strong rationale to assess GA, TA and MA together. However, anxiety forms are rarely investigated together as part of the same study or considered in relation with personal resources.

The present chapter will focus on the available literature about the relation between anxiety forms (i.e., GA, TA and MA) and general or academic personal resources (i.e., competence and academic self-concept, ego-resilience or academic buoyancy). Afterward, the third Study of the present dissertation will be present, which aimed to examine the presence of different risk anxiety profiles in primary school children as well as their relation with general (i.e., competence self-concept and ego-resiliency) or academic (i.e., academic self-concept and academic buoyancy) personal resources. A large sample of participants was tested with self-report measuring GA, TA and MA as well as with self-report about general personal resources (i.e., general self-concept and ego-resilience) and academic personal resources (i.e., academic self-concept and academic buoyancy). Latent profile analysis was performed in order to identify possible cluster on GA, TA and MA. Thereafter MANOVAs considering school grade (grades 3 to 6) and latent profiles as fixed factors and general or academic personal resources as dependent variables were performed. Our findings will be present followed by a discussion based on the extant literature.

## 4.2 The relation between general-, mathematics-, or test-anxiety and personal resources

Several studies examine the relation between different anxiety forms and personal resources related to general (i.e., competence and academic self-concept) or academic (i.e., ego-resilience or academic buoyancy) personal resources.

Among anxiety forms, GA has been extensively studied in relation to self-concept. Previous research reveals an association between GA and lower levels of self-esteem or self-concept (e.g., Sowislo & Orth, 2013; see also Lowe, Papanastasiou, Deruyck, & Reynolds, 2005; Lowe, Peyton, & Reynolds, 2007). Notably, the correlation between GA and self-concept is moderate and negative. Benetti and Kambouropoulos (2006), using path analyses, examine the relation between GA and self-concept also including resilience. Their findings indicated that the effect of resilience and GA on self-concept was mediated by positive and negative affect, respectively with any significant direct effects between GA, resilience and self-concept.

Some studies also examine the relation between TA or MA and academic self-concept. The extant literature provides evidence that academic self-concept has a strong impact on students' TA (Bandalos, Yates, & Thorndike-Christ, 1995; Bong & Skaalvik, 2003; Goetz, Preckel, Zeidner, & Schleyer, 2008; Putwain & Daniels, 2010; Zeidner & Schleyer, 1999). Bandalos and collegues (1995) found that academic self-concept was negatively related to TA, and mediated the link between prior experience and anxiety. In a similar vein, MA and self-concept are found to be associated. For example, research suggests that MA is an antecedent of self-concept and self-esteem (Ahmed, Minnaert, Kuyper & van der Werf, 2012), supporting the hypothesis that MA can promote negative academic self-concepts regarding math abilities (Ma & Kishor, 1997; Shen & Pedulla, 2000).

As for the relation between anxiety forms (i.e., GA, TA and MA) and resilience there are not many published studies. GA and resilience have been found to be negatively related showing similar results when ego-resiliency is considered (i.e., Chuang et al., 2006; Vecchione et al., 2010). The relation between TA and resilience has been examined too, suggesting also in this case a negative association between these two constructs (e.g., Putwain et al., 2013). However, little is known about the relation between MA and resilience.

A relatively new psychological construct related to personal resources in the school is academic buoyancy. Academic buoyancy is defined as an adaptive student's response to typical academic challenges, and stress such as competing deadlines, examination pressure or periods of underperformance (Martin & Marsh, 2008a, 2008b; 2009). According to Zeidner and Matthews' (2005) self-referral model of TA, academic buoyancy could influence the appraisal of performance situations leading to lower TA. This hypothesis is supported by some studies that point out that academic buoyancy is related to lower academic anxiety (Martin & Marsh, 2008a; Martin, Colmar, Davey, & Marsh, 2010; Martin, 2013) and TA (Putwain et al., 2015; Putwain, Symes, Connors, & Douglas-Osborn, 2012). Also longitudinal designs provide evidence about the presence of negative correlations between academic buoyancy and academic anxiety even when prior academic buoyancy is considered (Martin & Marsh, 2008a; Martin et al., 2010). Putwain et al. (2012) also found that academic buoyancy explained a significant portion of the variance in all components of TA (ranging from $R^2$=.13 to $R^2$=.23), and was inversely related thereto. However, little is known about the relation between academic buoyancy and other forms of academic anxiety (i.e., MA), suggesting that more research about this point is needed.

## 4.3 Overview of the present study[3]

Previous research tends to study the effect of GA, TA, or MA in isolation, with scarce consideration for the effect of personal resources such as self-concept and resilience. Carey and colleagues (2017) recently assess different forms of anxiety by conducting a latent profile analysis on students in grade 4, or in grades 7 and 8 identifying different group solutions. Studying such latent profiles is interesting to see how distinct but related forms of anxiety appear within a population because, unlike simple correlations, latent profiles help to identify heterogeneous subgroups that express certain patterns. In the study by Carey and colleagues (2017) four anxiety profiles in grade 4, ranging from low to high anxiety were identified. This four-group solution also emerged on students in grades 7 and 8, but the profiles appeared more specific in this case, and were described as low anxiety, general anxiety, academic anxiety (i.e., MA and TA), and high anxiety. However, little is known about latent anxiety profiles on younger children. Based on these premises, our first aim was to test whether specific latent profiles of anxiety emerged between grades 3 and 6 in order to better understand whether on this particular age range MA and TA are a manifestation of a general form of anxiety, or the expression of specific forms of anxiety. We expected to find different profiles of anxiety in primary school students, derived by the combination of GA, TA and MA. This hypothesis is supported by results of meta-analytical studies, which showed moderate correlations among these variables (Hembree, 1988, 1990; Ma, 1999), and by the study of Carey and colleagues (2017) previously cited.

Another aim of our study was to test differences in latent anxiety profiles on general (i.e., competence and academic self-concept) or academic (e.g., ego-resilience

[3] The present study has been published: Mammarella, I. C., Donolato, E., Caviola, S., & Giofrè, D. (2018). Anxiety profiles and protective factors: A latent profile analysis in children. *Personality and Individual Differences, 124*, 201-208. doi:10.1016/j.paid.2017.12.017.

or academic buoyancy) personal resources. As previously mentioned, self-concept, resilience, or academic buoyancy are negatively related to different anxiety forms (e.g., Benetti & Kambouropoulos, 2006; Bong & Skaalvik, 2003; Putwain et al., 2013; Putwain et al., 2015; Sowislo & Orth, 2013). While previous studies mainly investigated the relation between academic self-concept or academic buoyancy and anxiety (TA in particular), here we distinguished between general (i.e., competence self-concept and ego-resiliency) and academic personal resources (i.e., academic self-concept and academic buoyancy). This is because we assumed that, just as it seems important to distinguish between general and academic forms of anxiety, so too a distinction between general and academic personal resources can help to clarify their potential relation with latent anxiety profiles. As a result, we expected that the identified anxiety profiles would present different scores on general and academic personal resources scores, in agreement with previous studies showing a negative relation between different anxiety forms and these personal resources (e.g., Benetti & Kambouropoulos, 2006; Bong & Skaalvik, 2003; Putwain et al., 2013; Putwain et al., 2015; Sowislo & Orth, 2013).

## 4.4 Method

### 4.4.1 Participants

The present study included 664 children (47% girls, $M_{age}$ = 9.20 years, *SD* = 1.13; range 10.00 – 14.00 years) from grades 3 to 6. Specifically, children were in grades 3 (N=184), 4 (N=206), 5 (N=166) and 6 (N=108). Students were recruited from public schools placed in urban areas in the north-east Italy and came from middle-class

families. Participants were typically-developing children with no special educational needs, intellectual disabilities, or neurological and genetic disorders.

The study was approved by the Ethics Committee on Psychology Research at the University of Padova, Italy. After obtaining the school's approval of carrying out the research, written informed parental consent was obtained prior to the test.

### 4.4.2 Materials

#### General anxiety

The *Revised Children's Manifest Anxiety Scale: Second Edition* (RCMAS-2; Reynolds & Richmond, 2012) is a self-report tool for measuring of general anxiety in children and adolescents thank to 49 item with yes or no answer. The questionnaire provides scores on worries (e.g., *"I am worried that my classmates could make fun of me"*), physiological anxiety (e.g., *"I often have stomachache"*) and social anxiety (e.g., *"I feel nervous when things don't go as I want"*). For the present study the total score was used (Cronbach's $\alpha = .92$). Good internal consistency was also found in the sample of the present study (Cronbach $\alpha = .89$).

#### Academic anxiety

The *Test Anxiety Questionnaire for Children* (TAQ-C; Donolato et al., under review) is a questionnaire for measuring TA in children. The tool comprises 24 item with 4 point Likert scale from 1= "never" to 4= "always". The self-report provides scores about thoughts (e.g., *"I think I'm going to get a bad grade"*), off-task behaviours (e.g., *"I play with my pencil"*), autonomic reactions (e.g., *"My heart beats fast"*) and social concerns about failing a test (e.g., *"I am worried that all my friends will get high scores in the test and only I will get low ones"*). Also in this case the total score

provided by the four subscales was considered. Good fit indexes were found in the Italian sample considered for the assessment of the psychometric properties of the tool (see Donolato et al., under review). Good internal consistency for the total score was also found in the present sample (Cronbach's α = .84).

The *Abbreviated Math Anxiety Scale* (AMAS; Hopko et al., 2003) is a brief questionnaire for assessing MA in children. The tool is composed by 9 item on a 5-point Likert from 1 "strongly agree" to 5 "strongly disagree". Children were asked to read each statement about different situations involving mathematics school activities and to evaluate them in terms of how anxious they would be (i.e., *"Thinking about the upcoming written math test you have tomorrow"*). Good internal consistency (Cronbach's α = .77) was found in the study about the Italian validation of the self-report (see Caviola et al., 2017) and in the present study (Cronbach's α = .83).

**General personal resources**

The *Multidimensional Self-Concept Scale* (MSC; Bracken, 2003) is a questionnaire for the assessment of self-concept in children and adolescents. In order to evaluate participants' perceptions about their ability of influencing their environment, solving problems or achieving their goals, the *Competence* subscale (e.g., *"I trust in myself"*) was used. The subscale is composed by 25 item scored on 4-point Likert scale from "absolutely true" to "absolutely false". The total score was calculated as recommended in the manual (Bracken, 2003), so higher scores corresponded to a more positive competence self-concept. The internal consistency of the *Competence* scale as reported in the manual (Cronbach's α = .87) and in the present sample (Cronbach's α = .85) were good.

The *Ego-Resiliency scale* (ER; Block & Kremen, 1996) is a questionnaire for assessing resilience as a personality trait (e.g., *"I enjoy dealing with new and unusual situations"*). The questionnaire comprises 14 item scored on a 4-point scale from 1 "does not apply at all" to 4 "applies very strongly". The scale showed good psychometric properties (Cronbach's α = .87) in an Italian sample of adolescents (see Caprara, Steca & De Leo, 2003) as well as in the sample of the present study (Cronbach's α = .72).

**Academic personal resources**

The *Multidimensional Self-Concept Scale* (MSC; Bracken, 2003) is a questionnaire for the evaluation of self-concept in children and adolescents. In order to assess participants' academic self-concept, the *Academic scale* (i.e., *"Studying is difficult for me"*) was used. The subscale is composed by 25 item scored on 4-point Likert scale from "absolutely true" to "absolutely false". The total score was calculated, so higher scores corresponded to higher levels of academic self-concept. The internal consistency of the *Academic* scale as reported in the manual (Cronbach's $\alpha$ = .91) and assessed in the present sample (Cronbach's $\alpha$ = .87) were good.

The *Academic Buoyancy Scale* (ABS; Martin & Marsh, 2008a, 2008b) is a brief inventory for assessing the ability to deal with academic difficulties and challenges linked to school life (e.g., poor grades, competing deadlines, exam pressure, difficult schoolwork). The questionnaire comprises 4 item (e.g. *"I'm good at dealing with setbacks at school"*) scored on 7-point Likert scale from 1 "strongly disagree" to 7 "strongly agree". For the present study an Italian translation and adaptation of the tool was used. The scale showed good internal consistency (Cronbach's α=.82) as reported by the authors (see Martin & Marsh, 2008a). Adequate internal consistency was found

in the sample of the present study (Cronbach's α=.60).

### 4.4.3 Procedure

Participants were tested in a collective session lasting approximately 1 hour when all the questionnaires were administrated. The session was conducted from November to January when all questionnaires were administrated in students' classrooms by a trained assistant researcher and in the presence of a teacher. Similarly to the other two studies, all tasks were presented using a fixed pseudorandomized order (see Giofrè et al., 2017; Hill et al., 2016). Specifically, the SC-Competence scale (Bracken, 2003), the SC-Academic scale (Bracken, 2003), the RCMAS-2 (Reynolds & Richmond, 2012), the AMAS (Hopko et al., 2003), the ER (Block & Kremen, 1996), the TAQ-C (Donolato et al., under review) and the ABS (Martin & Marsh, 2008a, 2008b) were proposed.

### 4.4.4 Data analysis

Analyses were performed using R (R Development Core team, 2017). Cluster analyses were run using the mclust package (Fraley, Raftery, Murphy, & Scrucca, 2012), while ggplot2 package was used for graphs and bootstraps, which is calculating 95% CI (Wickham, 2009). A model-based clustering analysis approach was used, where modelling clusters were considered as a finite mixture of Gaussian distribution fitted via the EM algorithm (Fraley & Raftery, 2002). This approach was used considering that, unlike other standard clustering procedures (e.g., Ward and variable-centred correlations), it allows for a better partitioning of the data while retaining as much as possible from the data variability (Scrucca, Fop, Murphy, & Raftery, 2016). This method enabled us to assess different clustering solutions in terms of the model

parameters. Only the data matrix was provided, and the number of mixing components and the covariance parameterisation were selected using the Bayesian Information Criterion (BIC). Several clustering models were considered in terms of their evidence measured against the BIC index and the number of underlying components (from 1 to 9). In the package mclust, the BIC index is used by default for model selection and computed with an alternative formulation, so that the best model is the one with the highest score (e.g., in case of two models with scores -80 and -10, then the highest score associated to the best model is -10). After latent profiles were identified, a mixed ANOVA including the number of profiles and anxiety measures were considered in order to examine whether the profiles were flat or not on GA, TA and MA measures. MANOVAs using school grades and latent profiles as fixed factors with general personal resources (SC-Competence scale and ER scale) or academic personal resources (SC–Academic scale and Academic Buoyancy Scale) as dependent variables were performed. In reported analyses, both the statistical significance and the magnitude of the difference in terms of the effect size were considered.

## 4.5 Results

Descriptive statistics (mean and standard deviation) and correlations between all measures are presented in Table 4.1.

***Table 4.1*** Means, Standard Deviations, and correlations for all considered variables.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Age | 1 | | | | | | | |
| 2. RCMAS-2 | .031 | 1 | | | | | | |
| 3. TAQ-C | .068 | .596* | 1 | | | | | |
| 4. AMAS | .056 | .413* | .337* | 1 | | | | |
| 5. SC-C | -.083* | -.444* | -.427* | -.282* | 1 | | | |
| 6. ER | .018 | -.177* | -.075 | -.123* | .354* | 1 | | |
| 7. SC-A | -.152* | -.418* | -.404* | -.325* | .668* | .365* | 1 | |
| 8. ABS | .026 | -.122* | -.151* | -.157* | .248* | .237* | .250* | 1 |
| M | 9.20 | 15.39 | 54.46 | 22.66 | 74.54 | 4.62 | 72.29 | 19.83 |
| SD | 1.13 | 7.58 | 14.90 | 7.80 | 1.00 | 6.22 | 9.38 | 5.87 |

*Note.* * $p < .05$

RCMAS-2 = general anxiety scale; TAQ-C = test-anxiety scale; AMAS = mathematics anxiety scale; SC-C = Self-concept competence scale; ER= Ego-resiliency scale; SC-A = Self-concept academic scale; ABS = Academic buoyancy scale.

Interestingly, negative moderate correlations were found between the two SC scores (i.e., Academic and Competence subscales) and all anxiety measures (i.e., GA, TA and MA). Small negative correlations between ER scores and both GA and MA were observed. Small negative correlations between the ABS scale and all anxiety measures (i.e., GA, TA and MA scales) were also found.

### 4.5.1 Cluster analysis

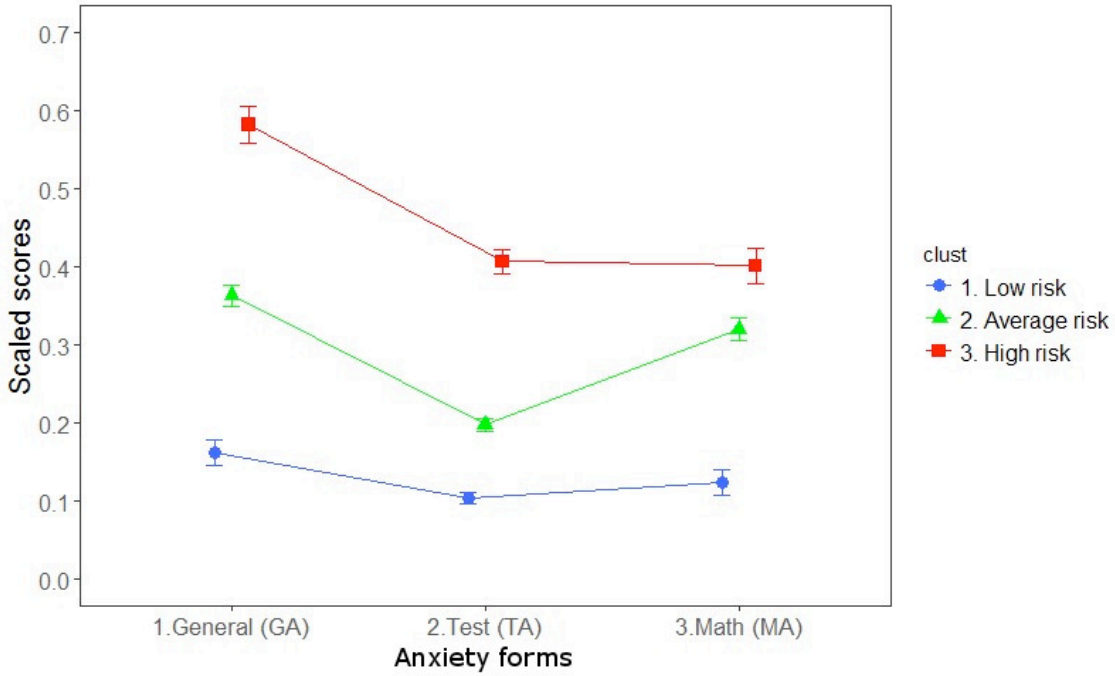
Model-based clustering of the GA, MA, and TA scores yielded different profiles. The model with 3 risk profiles proved to be superior (i.e., it had a lower BIC; see Table 4.2), thus this solution was retained for subsequent analyses (see Figure 4.1).

***Table 4.2*** BIC for clustering models as function of the number of components. The higher the BIC values, the better the model.

| Number of components | BIC values | |
|---|---|---|
| | VEE | VVE |
| 1 | 1754.48 | 1754.48 |
| 2 | 1812.02 | 1807.15 |
| **3** | **1822.06** | **1812.57** |
| 4 | 1787.66 | 1761.06 |
| 5 | 1769.45 | 1743.65 |
| 6 | 1764.25 | 1724.45 |
| 7 | 1766.50 | 1701.52 |
| 8 | 1736.84 | 1668.23 |
| 9 | 1721.15 | 1641.95 |

*Note*. VEE = Ellipsoidal, equal shape and orientation; VVE = Ellipsoidal, equal orientation. Lower BIC values correspond to a better fit. For further information, see Scrucca, Fop, Murphy, and Raftery (2016).

***Figure 4.1***. The profile of the three clusters - low-, average- and high-risk - on general anxiety (GA), test-anxiety (TA) and mathematics-anxiety (MA). Error bars represent 95% bootstrapped confidence intervals of the interaction.



Profile 1 (N = 79, 11.72%) was characterized by the presence of low scores on all anxiety measures so it was labelled as "low-risk". Profile 2 (N = 454, 66.22%) was called "average-risk". Finally, Profile 3 (N = 131, 22.06%) reported high levels of anxiety, particularly for GA scores, so it was labelled as "high-risk". Interestingly, scores on GA, MA, and TA in these three profiles were not homogenous.

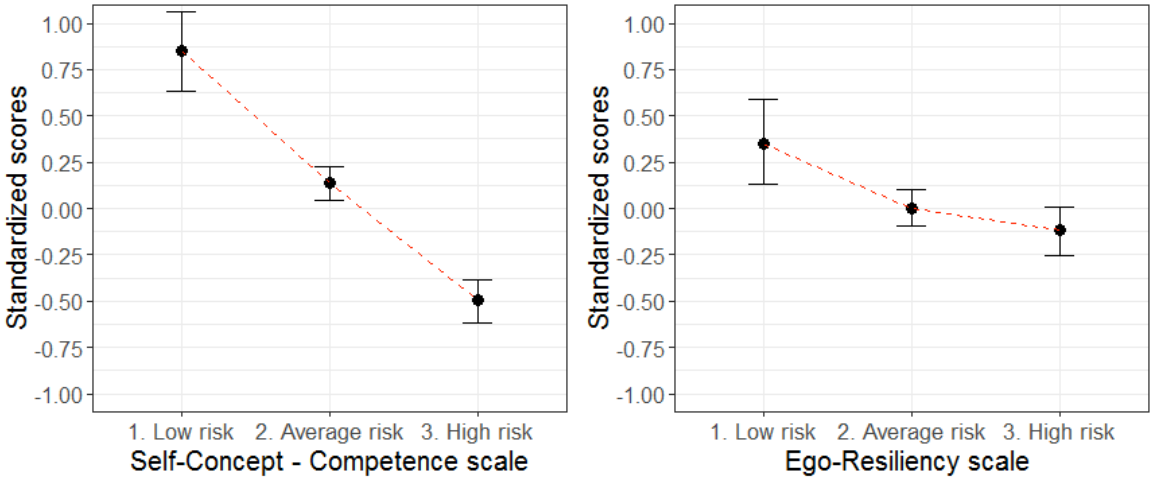
A 3 risk profile [low, moderate and high] × 3 form of anxiety [GA, MA and TA] mixed ANOVA was performed. The main effect of risk profile, $F(2, 661) = 391.77$, $p < .001$, $\eta^2_p = .351$ and the main effect of form of anxiety, $F(2, 1322) = 113.18$, $p < .001$, $\eta^2_p = .085$ were statistically significant as well as the interaction effect, $F(4, 1322) = 33.93$, $p < .001$, $\eta^2_p = .053$. All the post-hoc tests, with Bonferroni's corrections, were statistically significant ($p < .05$) except for the difference between MA and GA or TA in the low-risk group ($p > .05$). The presence of a statistically significant interaction demonstrated that the profiles in the three groups were not flat. To further elucidate this finding we calculated the standardized difference between the three profiles across the three forms of anxiety (GA, MA, and TA). The results revealed extremely large effect sizes (*Cohen's d* > 1.13) in all cases except for the difference in MA between the moderate- and high-risk groups, which was small in terms of effect size (*Cohen's d* = .46), although statistically significant. Based on these findings, we surmise that the high-risk profile was characterized by higher levels of GA and TA, and lower levels of MA, while the moderate-risk profile featured moderate levels of GA and MA, and lower levels of TA.

### 4.5.2 Differences between profiles on personal resources

A first MANOVA with school grade (grades 3 to 6) and risk profile (low, average and high risk) as fixed factors and academic personal resources (SC–Academic

scale and Academic Buoyancy Scale) as dependent variables was performed. There was a statistically significant effect of the risk profile, $F(4, 1302) = 29.26$, $p < .001$; Wilk's $\Lambda = 0.842$, $\eta^2_p = .082$ but not of school grade, $F(6, 1302) = 0.891$, $p = .501$, Wilk's $\Lambda = 0.992$, $\eta^2_p = .004$, or the interaction between school grade and risk profile, $F(12, 1302) = 1.49$, $p$=.121, Wilk's $\Lambda = 0.973$, $\eta^2_p = .014$. Post-hoc ANOVAs confirmed a statistically significant effect of the risk profile on both SC–Competence score, $F(2, 652) = 57.93$, $p < .001$, $\eta^2_p = .151$, and ER scale $F(2, 652) = 3.51$, $p = .031$, $\eta^2_p = .011$ (Figure 4.2).

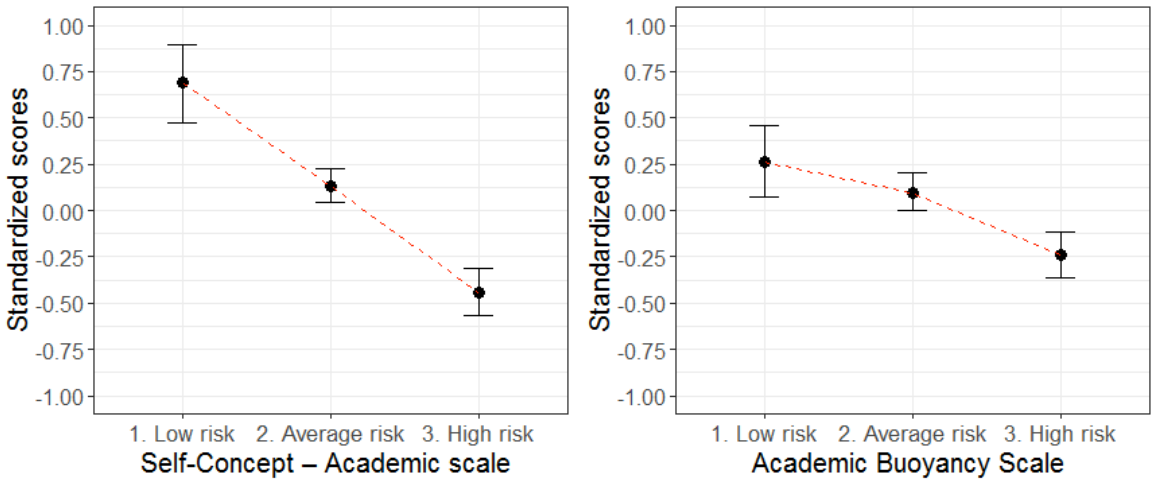
***Figure 4.2*** Performance of the three anxiety profiles (low-, average- and high-risk) on general personal resources. Higher scores represent better self-concept and higher resilience. Standard errors represent bootstrapped 95% Confidence Intervals.




In the second MANOVA school grade (grades 3 to 6) and risk profile (low, average and high risk) were considered as fixed factors while academic personal resources (SC–Academic scale and Academic Buoyancy Scale) as dependent variables. In this case there was a statistically significant effect of the risk profile, $F(4, 1302) = 22.50$, $p < .001$; Wilk's $\Lambda = 0.875$, $\eta^2_p = .082$, and school grade $F(6, 1302) = 2.89$, $p =$

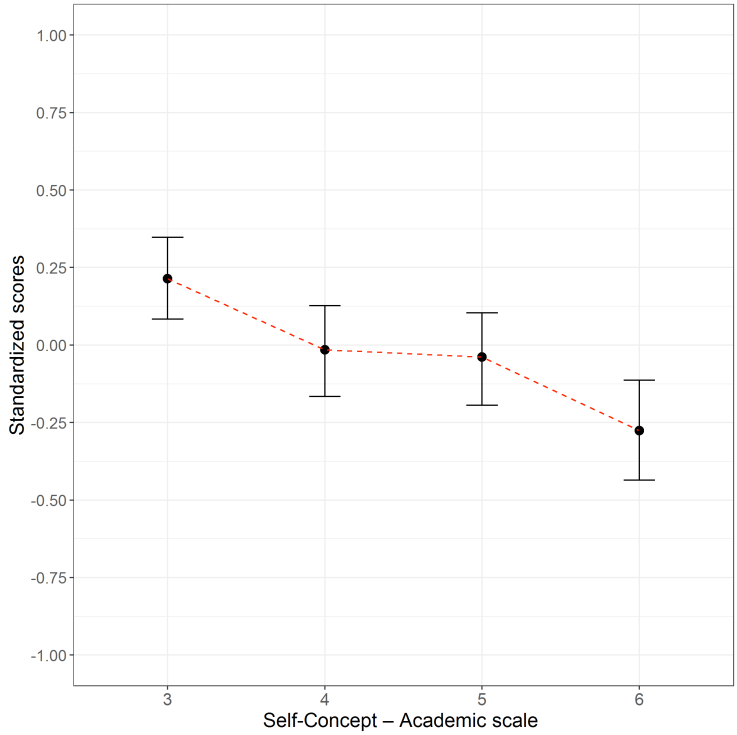
.008, Wilk's $\Lambda = 0.974$, $\eta^2_p = .013$, while the interaction between school grade and risk profile, $F(12, 1302) = 0.71$, $p = .744$, Wilk's $\Lambda = 0.987$, $\eta^2_p = .006$ was not. Post-hoc ANOVAs confirmed a significant effect of the risk profile on both the SC–Academic scale, $F(2, 652) = 44.02$, $p < .001$, $\eta^2_p = .119$, and the Academic Buoyancy Scale, $F(2, 652) = 9.33$, $p < .001$, $\eta^2_p = .028$ (Figure 4.3).

***Figure 4.3*** Performance of the three anxiety profiles (low-, average- and high-risk) on academic personal resources. Higher scores represent better self-concept and higher academic buoyancy. Standard errors represent bootstrapped 95% Confidence Intervals.




The effect of school grade was statistically significant for the SC–Academic scale, $F(2, 652) = 3.18$, $p < .024$, $\eta^2_p = .014$, but not for the Academic Buoyancy Scale, $F(2, 652) = 1.79$, $p = .147$, $\eta^2_p = .008$ (Figure 4.4).

***Figure 4.4*** Effects of school grade (grades 3, 4, 5 and 6) on SC-Academic scale. Error bars represent bootstrapped confidence intervals.




A series of post-hoc analyses (using Bonferroni's correction) was also performed on the effects found statistically significant. In terms of the effect of risk profile, the three profiles differed from each other on the SC-Competence ($p < .05$) and SC-Academic scales ($p < .05$). The low- and average-risk profiles were statistically different on the ER scale ($p < .05$), while the low- and high-risk profiles differed statistically on the Academic Buoyancy Scale ($p < .05$). As for the effect of school grade, children in grades 3 and 6 were statistically different on the SC–Academic scale ($p < .05$).

## 4.6 Discussion

The main aim of this study was to identify latent profiles related to GA, TA, and MA measures in a sample of primary school children and to assess their relation to general (i.e., competence and academic self-concept) and academic (i.e., ego-resilience or academic buoyancy) personal resources. As regard latent anxiety profiles, it was expected to identify different patterns derived by the combination of GA, TA and MA considering that these aspects are moderately correlated (Hembree, 1988, 1990; Ma, 1999; see also Carey et al., 2017). It was also expected that latent anxiety profiles presented different scores on general and academic personal resources scores as suggested by studies that examined the relation among these constructs (e.g., Benetti & Kambouropoulos, 2006; Bong & Skaalvik, 2003; Putwain et al., 2013; Putwain et al., 2015; Sowislo & Orth, 2013).

Concerning our first aim, we found a three-profile solution: a small proportion of children (around 12%) in our sample expressed a low risk of exhibiting GA, TA and MA; a large proportion (around 66%) showed an average risk; and the remaining 22% revealed a high risk of experiencing different anxiety forms related to GA, TA and MA. The profiles in these three groups were not flat, however: no differences emerged in the low-risk group, in which all children showed low anxiety levels of GA, TA, and MA; the average-risk profile was characterized by higher levels of GA and MA respect to TA, but in all cases the scores ranged around the average; and the high-risk profile featured higher levels of GA and TA respect to MA, although all scores ranged in high levels of anxiety. Our latent profile analysis revealed different anxiety profiles in children. Our data seem to support the hypothesis that MA in school-aged children could be driven primarily by a general tendency to be anxious, since our average-risk profile was characterized by higher levels of GA and MA than of TA. This is coherent

with the idea that MA can develop not only showing repeatedly poor performance in mathematics but also as a predisposition to anxiety in general (Carey et al., 2017; see also Hill et al., 2016). Our results do not exactly replicate those of Carey and colleagues (2017), maybe because they tested students in grades 4 or 7-8, while we focused on children from grades 3 to 6. In fact, the effect of age was not statically significant in our sample, so we found neither a simple distinction between different (i.e., low, moderate, high) degrees of risk to develop anxiety, nor any clear difference between general and academic forms of anxiety (which only becomes apparent in older students; see Campbell & Rapee, 1996 on this point). Nevertheless, our results provide more evidence about the relation between anxiety forms in younger children. Testing children along a continuum, from grades 3 to 6, enabled us to identify an intermediate stage of anxiety development, at which point our high-risk profile coincided with more GA and TA than MA, while our average-risk profile showed more GA and MA than TA. Judging from our data, the hypothesis advanced by Carey and colleagues (2017) for the development of MA may therefore extend to TA as well. In other words, GA seems to act as a risk factor for the onset of other, more or less other specific forms of anxiety (MA and TA).

The second goal of our study was to test differences in latent anxiety profiles on both personal general and academic personal resources. We found that distinguishing between general and academic personal resources did not produce different results by risk profile among children: the three profiles showed different scores on competence and academic self-concept with more clear trends respect to the results with ego-resiliency or academic buoyancy. As reported, children with a low-risk profile reported higher scores on competence or academic self-concept than children with average- or high-risk profiles.

Interestingly, an effect on the Self-Concept–Academic scale was present, indicating significantly higher scores for children in grade 3 than for grade 6. The existing literature suggests that academic self-concept tended to decline as the children grew up (e.g., Eccles, 1999; Marsh, 1989). Moreover, ample evidence of high levels of academic self-concept predicting low levels of TA (Bong & Skaalvik, 2002; Putwain & Daniels, 2010), and showing that MA promotes negative academic self-concepts regarding math abilities (Ma & Kishor, 1997; Shen & Pedulla, 2000) is present. These results might support the hypothesis that an older age (and possibly more negative academic experiences) is associated to a higher risk of anxiety, and to a worsening specific academic self-concept, even if longitudinal studies should be addressed about this point.

As for the effect of resilience, we found that school children with a low anxiety risk profile scored higher than those at higher risk on both measures of resilience and academic buoyancy. Children at moderate risk of anxiety did not differ from those with a high-risk profile (or from the low-risk group when it came to academic buoyancy). As a result, it could be argued that resilient students can maintain or regain prior levels of functioning, unlike those students who respond badly to adversity, and consequently risk developing higher levels of anxiety related to GA, TA and MA.

Although it contains interesting findings this study also has some limitations. First, our agreement with the schools did not include testing neither of students in grades 1 and 2 nor of students older than grade 6, hence further studies should also consider younger children or older students in order to better understand how anxiety forms could characterize other ages. Actually, these aspects change in relation with age, suggesting that understanding the interplay between these variables is crucial in terms of preventions and interventions. Indeed, the present study included several self-reported

measures, which can be somewhat affected by common-method bias (Williams & Brown, 1994). Children could actually show the tendency to present a favourable image of themselves in responding on questionnaires as result of social desirability. Although youth have been consistently found to be valid and reliable reporters of their own internalizing distress (see, e.g., Weems, Zakem, Costa, Cannon, & Watts, 2005), future research should also take into account parents evaluations and other family risk factors such as the presence of anxiety problems in children parents and relatives.

It is worth noting that our findings also have some clinical and educational implications: for a start, a better understanding of how different forms of anxiety develop is crucial to the design of programs to reduce students' anxiety; and fostering resilience can prevent academic anxiety. Our findings can be used to underpin the preparation and testing of interventions (Rose, Miller, & Martinez, 2009). In particular, interventions should be focused in promoting academic self-concept and resilience offering continuous feedback, suitable tasks based on children's different competence levels, and promoting collaborative learning (see Hagenauer & Hascher 2014). In addition, school-based interventions using cognitive and behavioural emotion regulation strategies for different forms of anxiety in primary school children would be effective in reducing the onset of anxiety symptoms (e.g., Weems et al., 2015). Students with high levels of self-concept and resilience are able to take on challenging tasks, persist when faced with difficulties, and believe in their ability to do well (Niemiec & Ryan, 2009).

To conclude, our study suggests that different combinations of anxiety are present in primary school. Although no clear distinction between general and academic anxiety emerged in this age bracket, GA seemed to act as a risk factor for the onset of more specific forms of anxiety. Concerning the role of personal resources different effects emerged for self-concept and resilience (both general and academic): self-

concept was lower the higher the anxiety risk profile (from low to average and high); and academic self-concept also decreased with age, while resilience only decreased in association with the high anxiety risk profile.

# CHAPTER 5

# GENERAL DISCUSSION

Middle childhood is characterized by several types of advances in learning and development. During this period, children are required to achieve school goals that are considered fundamental for their future (Fischbach et al., 2013; Roth et al. 1996). Attending school, children improve their abilities, discover new practices and strategies that allow them to improve their learning, evaluating their progress and modifying their behaviours based on their reflections (Eccles, 1999). Throughout the entire school period, children receive increasing feedback by teachers and parents about their performance facing more pressure to achieve good standards (Killu et al., 2016). As a result, some children can experience anxiety that sometimes prevent academic success. As children progress from primary to middle school, anxiety can increase while self-concepts tend to decline together with persistence on tasks that are considered too difficult leading to poor academic performance and low well-being (Blum & Libbey, 2004; Eccles, 1999). For these reasons, it is of fundamental importance to study those individual characteristics that support and promote academic success and well-being in school-aged children.

The main aim of the present dissertation was to examine how different individual factors prevent or promote academic success and well-being in children. We decided to focus on negative affect (i.e., general-anxiety and depressive symptoms), anxiety forms (i.e., general-, test- and mathematics- anxiety) and personal resources

(i.e., self-concept or ego-resilience) considering their role once the effect of cognitive abilities (i.e., working memory or intelligence) were taken into account. The relation between these different variables was addressed in three studies on typically developing children. In the first Study, the role of negative affect (i.e., general-anxiety and depressive symptoms), working memory and personal resources (i.e., academic and competence self-concept and ego-resilience) on mathematics and reading literacy was considered (Chapter 2). The second Study focused on the relation between general and academic forms of anxiety (i.e., general-, test- and mathematics- anxiety) and ego-resilience on mathematics and reading literacy once the fluid intelligence was taken into account (Chapter 3). A third Study was conducted in order to test the latent profiles of different forms of anxiety (i.e., general-, test- and mathematics- anxiety) as well as their relation with general (i.e., competence self-concept and ego-resiliency) or academic (i.e., academic self-concept and academic buoyancy) personal resources.

The main findings of each study are summarized in the following sections. The strengths and limitations of the studies are also mentioned, together with suggestions for further research. Finally, both clinical and educational implications of the study findings are discussed.

## 5.1 Research findings overview

Findings from Study 1 pointed out that when negative affect, personal resources and working memory are simultaneously assessed, only mathematics and reading literacy maintain an effect on the two considered academic domains. Our findings suggested that personal resources have a positive effect in supporting students in both mathematics and reading literacy (Chuang et al., 2006; Kwok et al., 2007; Liew et al., 2018; Sowislo & Orth, 2013; Swanson et al., 2011; Valentine et al., 2004; Vecchione et

al., 2010), even when general cognitive factors (i.e., working memory abilities) are considered. This is particularly important considering that we involved students attending grades 6 and 8. This is actually an important transitional period when pre-adolescents are more likely to face emotional difficulties and decreasing in self-concept (e.g., Eccles, 1999; Steinberg & Morris, 2001). Contrary to our expectations, the present Study pointed out that negative affect lack to maintain an effect on mathematics and reading literacy when personal resources and WM are considered. One possible explanation is that negative affect may operate by consuming WM resources necessary for math computations and reading comprehension, decreasing the performance in these two domains by compromising WM (see Eysenck & Calvo, 1992; Eysenck et al., 2007; Ellis & Moore, 1999). However, this process could also involve personal resources underlying that taking into account multiple variables allow to a better comprehension of the complex relations among them. As regard general cognitive ability, in our Study working memory was found to be strongly associated with better performance in mathematics and reading literacy as indicated by other studies (Borella et al., 2010; Borella & de Ribaupierre, 2014; Friso-van den Bos et al., 2013; Mammarella et al., 2018; Peng et al., 2016).

The results of Study 2 underlined that general and academic forms of anxiety had different roles in academic achievement. Specifically, mathematics- anxiety (MA) had a specific effect on mathematics performance, while test-anxiety (TA) was found to have an effect on reading literacy. These findings gave more evidence about the specific role of MA on mathematics even when other forms of anxiety are considered (Hembree, 1988, 1990; Hill et al., 2016; Wu et al., 2012). TA was also found to have an effect on reading literacy suggesting that academic anxiety can be negatively associated with the performance in this field (Ackerman et al., 2007; Carroll & Iles, 2006; Mammarella et

al., 2016; Rajchert et al., 2014). Indeed, GA was found to have an effect on mathematics and reading literacy throughout MA and TA respectively. This is consistent with other studies that pointed out that GA has a role on academic achievement (see Hill et al., 2016). Finally, ego-resilience was found to have a positive effect on academic achievement (see Kwok et al, 2007; Liew et al., 2018). Once again, these effects were present when fluid intelligence was assessed and found to be a strong predictor of mathematics and reading literacy (Gottfredson, 2002a, 2002b; Kuncel et al., 2004; Rohde & Thompson, 2007).

In the third Study, low-, moderate- and high-risk profiles of anxiety, related to GA, TA and MA were found. The low-risk group showed that children had low anxiety in all anxiety forms, the average-risk profile was characterized by higher GA and MA respect to TA, although scores were around average, while the high-risk profile showed higher levels of GA and TA compared to MA. These profiles provide evidence of the relation between different anxiety forms in primary school children, suggesting that GA could be considered a risk factor for the onset of academic forms of anxiety (MA and TA). As for the relation between anxiety profiles and general and academic personal resources, similar results emerged for general and academic personal resources. As regard self-concept, children belonging to the low-risk anxiety profile reported higher scores on these measures than children with average- or high-risk anxiety profiles. Results suggest the hypothesis that older children (and possibly with more negative academic experiences) are more likely to show higher risk of anxiety, and lower scores on specific academic self-concept. In a similar vein, children with a low anxiety risk profile showed higher scores than those at higher risk on resilience and academic buoyancy measures. Children with moderate risk of anxiety did not differ from those with a high-risk profile (or from the low-risk group when academic buoyancy was

considered), suggesting that resilience and academic buoyancy could be considered crucial personal resources in protecting against different forms of anxiety. Actually, resilient students can maintain or regain prior levels of functioning, while those who respond badly to adversity could show higher risk of developing higher levels of GA, TA and MA.

Table 5.1 summarizes the main findings of the four studies carried out for the present PhD dissertation.

***Table 5.1*** Summary of the essential information concerning each study: number of participants (N), constructs tested, aims and findings.

| Study | N | Constructs | Aims | Results |
|---|---|---|---|---|
| I | N=143 children<br><br>Grades 6 and 8 | **General-anxiety**<br>**Depressive symptoms**<br><br>**Self-concept (competence and academic)**<br>**Ego-resiliency**<br><br>**Working memory**<br><br>**Mathematics and reading literacy** | • General aim: examining the relation among negative affect (i.e., general-anxiety and depressive symptoms), personal resources (i.e., academic and competence self-concept and ego-resilience) and WM on mathematics and reading literacy.<br>• Specific aims:<br>  • testing the effect of negative affect on mathematics and reading literacy when WM is considered;<br>  • testing the effect of personal resources on mathematics and reading literacy when WM is considered. | • Negative affect lacked to maintain an effect on mathematics and reading literacy when personal resources and WM were assessed.<br>• Personal resources had positive effects on both mathematics and reading literacy, even when WM abilities were considered.<br>• WM was found to be strongly associated with better performance in mathematics and reading literacy. |
| II | N=269 children<br><br>Grades 5, 6 and 8 | **General-anxiety**<br>**Test-anxiety**<br>**Mathematics-anxiety**<br><br>**Ego-resiliency**<br><br>**Intelligence**<br><br>**Mathematics and reading literacy** | • General aim: studying the relation among anxiety forms (i.e., GA, TA and MA) and ego-resilience on mathematics and reading literacy once fluid intelligence was taken into account.<br>• Specific aims:<br>  • testing the effect of GA, TA and MA on mathematics and reading literacy;<br>  • testing the contribution of ego-resilience on mathematics and reading literacy once GA, TA and MA are considered. | • MA and TA were found to have a specific effect on mathematics and reading literacy respectively.<br>• GA was found to have an effect on mathematics and reading literacy throughout the MA and TA.<br>• Ego-resilience was found to have very similar effect in terms of magnitude on mathematics and reading literacy.<br>• Fluid intelligence showed a strong effect on both mathematics and reading literacy. |
| III | N=664 children<br><br>Grades 3, 4, 5 and 6 | **General-anxiety**<br>**Test-anxiety**<br>**Mathematics-anxiety**<br><br>**Self-concept (competence and academic)**<br><br>**Ego-resiliency and academic buoyancy** | • Aim 1: testing the presence of different anxiety profiles based on measures of GA, TA, and MA;<br>• Aim 2: testing the relation between different anxiety profiles and general (i.e., competence and academic self-concept) or academic (e.g., ego-resilience or academic buoyancy) personal resources. | • Low-, average- and high- risk latent profiles related to GA, TA and MA were found, suggesting that GA seems to be a risk factor for the onset of academic forms of anxiety (MA and TA).<br>• Children belonging to the low-risk profile reported higher self-concept, than children with average- or high-risk profiles.<br>• Children with a low-risk profile showed higher scores than those at higher risk on resilience and academic buoyancy measures. |

*Note.* GA = general-anxiety; TA=test-anxiety; MA=Mathematics-anxiety; WM: working memory.

Interestingly, some key considerations can be drawn from our studies.

The first Study pointed out that general emotional factors (i.e., negative affect and general anxiety) have a limit role on academic performance mathematics and reading literacy. Actually, in the first Study the role of negative affect on academic achievement seemed to be complex than expected, involving the contribution of both personal resources and working memory. These results are confirmed and expanded by the second Study that pointed out that GA had an effect on mathematics and reading literacy throughout TA and MA. This seems in line with previous literature that underlined the risk role of GA in developing academic anxiety but also the protective role of ego-resilience as a general factor that can sustain academic success. The second Study also provided evidence that, when assessed together, academic forms of anxiety such as MA and TA have a specific role on mathematics and reading literacy respectively. It could be argued that the presence of high levels of negative affect or anxiety can have a negative role on academic performance as these aspects can adversely influence concentration, memory, organization of work, and performance on evaluative tasks. The higher is negative affect or anxiety level, the lower is the probability to obtain good results in academic tests. As suggest by our findings, academic anxiety has stronger effects on academic performance compared to worries and tension linked to general anxiety. It is important to consider general forms of anxiety in the academic context as an additional risk factor for the development of more specific forms of anxiety, such as TA and MA, as highlighted in our third Study.

Taken together, our findings also underline the importance of considering individual factors that sustain and promote children functioning. The first and the second Study of the present dissertation suggested that personal resources linked to self-concept or ego-resilience are key factors in supporting children achievement related to

mathematics and reading literacy. Importantly, this was confirmed considering children at different ages (i.e., middle and primary school-aged children) as well as different personal resources (i.e., self-concept or ego-resilience). It can be argued that aspects related to positive self-concept and resilience have a protective role in children development and school performance. When children with good personal resources experience academic failures can show more persistence and effort in their learning with lower probability of giving up or withdrawal from tasks that are considered difficult. It is important to note that negative affect, anxiety forms and personal resources have an effect once the role of different cognitive factors (i.e., working memory and fluid intelligence) was considered. This is of particular importance considering that these cognitive variables are strong and reliable predictors of academic achievement. Finally, Study 3 showed that personal resources have an important role also in relation to different anxiety profiles related to GA, TA and MA, suggesting that examining the association between anxiety, self-concept and resilience is helpful for promoting well-being and preventive strategies in children education and development.

## 5.2 Study limitations and future directions

Although the present dissertation gives important contributions to the extant literature, there are some limitations to be considered together with some aspects that might be addressed in future research. While some of these issues were presented in the Discussion sections of the single studies, the focus here is on more general aspects.

As regard academic achievement, the INVALSI tasks were used considering that these are national curriculum tests that show extremely good psychometrics properties. However, these tasks are only available for grades 5, 6 and 8, thus results of Study 1 and 2 should be replicated using adjacent age groups. Indeed, the INVALSI tasks for the

assessment of reading literacy skills provide a score that referred to children abilities and competences in both reading comprehension and grammar. As a result, this measure provides an index that is not a pure measure of reading literacy. For this reason, results of Study 1 and 2 should be replicated by using other measures of reading literacy. It is also important to mention that we decided to focus on self-concept instead of self-efficacy. Self-efficacy can be defined as individual judgment of his or her ability to organize and execute behaviours required to perform well a task (Bandura, 1986). Self-efficacy represents individuals' expectations and convictions about what their skills and abilities are and what they can accomplish in given situations. On the other hand, self-concept is one's perceptions and subjective evaluation of the person in given domains of functioning (Bracken, 1996). As a result, these two constructs are closely related. In the present dissertation, we decided to focus on self-concept instead of self-efficacy in order to examine the individual evaluation about the self and its relation to academic achievement and anxiety rather than the ability perception in different tasks. However, further studies should analyse the joint role of self-concept and self-efficacy in fostering the academic success. As regard resilience, we decided to consider this construct in terms of personality trait in order to assess children capacities related to adaptation to their environment or resiliency. This choice was based on the decision to focus on typically developing children rather than in sample of children in significant adverse conditions (i.e., mental illness). However, future research should be addressed considering specific risk populations such as children with a diagnosis of emotional problems (i.e., anxiety disorders or depression) or Specific Learning Disorders, in order to assess the role of resilience in protecting against risks factors.

As regard individual factors, the role of other aspects such as motivation should be considered in future research. This aspect has been considered in relation to

mathematics (Middleton, & Spanias, 1999; Singh, Granville, & Dika, 2002; Wigfield & Meece, 1988) or reading comprehension (Anmarkrud, & Bråten, 2009; Bråten, Ferguson, Anmarkrud, & Strømsø, 2013; Unrau & Schlackman, 2006; see overview by Schiefele, Schaffner, Möller, & Wigfield, 2012), while less research about its relation with anxiety and resilience is available. Environmental factors related to peers, teachers and family also have an important role in children learning and development. Although the present dissertation was specifically aimed at examining individual variables, it is fully recognized that peer-, school- and family- factors are relevant to children academic achievement and development. For example, classroom environment (i.e., student-teacher relationship) as well as parental involvement should be considered in future research, considering their role in the academic performance and well-being (see Baker, 2006; Furrer & Skinner, 2003; Karbach, Gottschling, Spengler, Hegewald, & Spinath, 2013; Longobardi, Prino, Marengo, & Settanni, 2016; Wang, 2009) but also their interplay with TA and resilience (see Putwain et al., 2010; Shadach & Ganor-Miller, 2013; see also Lowe et al., 2008). In the field of MA, the role of teachers and parents' MA has been extensively considered (Beilock, Gunderson, Ramirez, & Levine, 2010; Vukovic, Roberts, & Green Wright, 2013) but further evidence is needed by including teachers' and parents' GA and TA in future models.

Finally, future studies should also investigate how negative affect or anxiety forms, personal resources and academic achievement might be mutually influenced over time. Longitudinal design should be particularly important in order to better clarifying whether the forms of anxiety seen in younger children are precursors of those identified in older students, and how personal resources influence children development.

## 5.3 Clinical and educational implications

Our findings also have clinical and educational implications that should be considered. First, prevention programs should be proposed in order to prevent the development of anxiety problems. The school system has been identified as an ideal avenue for promotion and prevention programs such as early intervention for anxiety (Masia-Warner, Nangle, & Hansen, 2006). Schools provide an opportunity to reach children and adolescents and to plan screening programs in order to identify children who present high anxiety risk factors linked to GA, TA and MA. School-based programs can also be proposed as part of the formal school curriculum or after school activities. Such programs have several advantages such as reducing common barriers to treatment related to time, location, stigmatization, transportation and cost, by offering convenient, low- cost and non-threatening alternatives (Barrett & Pahl, 2006; Masia-Warner et al., 2006). Additionally, the school environment is likely to facilitate the acquisition of skills, as it is viewed as a place of learning (Rambaldo, Wilding, Goldman, McClure, & Friedberg, 2001). For example, the FRIENDS for life (Barrett & Ryan, 2004) is a program based on cognitive-behavioural activities conducted by the teachers as facilitators to run group sessions as a routine component of the class activity (Fisak, Richard, & Mann, 2011; Lowry-Webster, Barrett, & Dadd, 2001; Stallard, Simpson, Anderson, Hibbert, & Osborn, 2014). Individual and group intervention programs based on behavioural and cognitive principles and focused on TA should also be proposed to students who suffer from greater TA when other efforts fail (Lang & Lang, 2010; Larson, Ramahi, Conn, Este, & Ghibellini, 2010; Von Der Embse et al., 2013). Several studies point out the effectiveness of interventions reducing academic anxiety, reducing fear of failure and developing more adaptive locus of control in

attributions (Covington, 1998; Craven, Marsh, & Debus, 1991; Martin, 2008a; McInerney, McInerney, & Marsh, 1997).

Prevention and intervention programs considering personal resources should be proposed in order to help children develop new skills and support them in achieving academic success. For example, social and emotional learning (SEL) programs have been found to foster the development of several cognitive, affective, and behavioural competencies, such as self- and social-awareness, relationship skills, and responsible decision making. These competencies facilitate academic performance as reflected in more positive social behaviours, less emotional distress, and improved test scores and grades (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Greenberg et al., 2003). As specifically regard the school context, other facets could be targeted in order to deal with challenge and pressures related to the academic setting. For example, individualized tasks should be proposed where possible (Schunk & Miller, 2002), addressing and enhancing students' negative beliefs about themselves in the academic contexts (Bandura, 1997), and developing skills in effective goal setting (Locke & Latham, 2002). Teachers and parents can work to decrease external incentives (i.e., concrete rewards or a point system) and punishments (i.e., withdrawal of privileges) related to academic performance. It is also important to help children in reworking their interpretation about their successes in relation to their efforts and strategies and academic outcomes, suggesting that possible failures do not imply a lack of ability (Covington & Omelich, 1979). Finally, activities for promoting self-management skills (i.e., setting goals and coping with frustration or set-backs) should be proposed in order to promote personal progress and improvement (Covington, 1992). All these aspects are particularly important to help children to face difficulties and supporting academic success and well-being since the primary school.

To conclude it is important to consider the combined role of risk factors and personal resources in children academic achievement and well-being in order to promote positive outcomes in their development and future life. The present dissertation was an effort to raise and clarify the relation these factors but many points remain open and require further studies.

# REFERENCES


Ackerman, B. P., Izard, C. E., Kobak, R., Brown, E. D., & Smith, C. (2007). Relation between reading problems and internalizing behavior in school for preadolescent children from economically disadvantaged families. *Child Development*, *78*(2), 581–596. doi:10.1111/j.1467-8624.2007.01015.x

Ahmed, W., Minnaert, A., Kuyper, H., & van der Werf, G. (2012). Reciprocal relationships between math self-concept and math anxiety. *Learning and individual differences*, *22*(3), 385-389. doi:10.1016/j.lindif.2011.12.004

Alessandri, G., Vecchione, M., Caprara, G., & Letzring, T. D. (2012). The ego resiliency scale revised: a crosscultural study in italy, spain, and the united states. *European Journal of Psychological Assessment*, *28*(2), 139–146. doi:10.1027/1015-5759/a000102

Alloway, T. P., Gathercole, S. E., & Pickering, S. J. (2006). Verbal and visuospatial short-term and working memory in children: are they separable? *Child Development*, *77*(6), 1698–1716. doi:10.1111/j.1467-8624.2006.00968.x

Anmarkrud, Ø., & Bråten, I. (2009). Motivation for reading comprehension. *Learning and Individual Differences*, *19*(2), 252-256. doi:10.1016/j.lindif.2008.09.002

Ansary, N. S., McMahon, T. J., & Luthar, S. S. (2012). Socioeconomic context and emotional- behavioral achievement links: Concurrent and prospective associations among low- and high- income youth. *Journal of Research on Adolescence*, *22*(1), 14-30. Doi: 10.1111/j.1532-7795.2011.00747.x

Ashcraft, M. H., & Krause, J. A. (2007). Working memory, math performance, and math anxiety. *Psychonomic bulletin & review*, *14*(2), 243-248.

Ashcraft, M. H., & Moore, A. M. (2009). Mathematics Anxiety and the Affective Drop in Performance. *Journal of Psychoeducational Assessment*, *27*(3), 197–205. doi:10.1177/0734282908330580

Ashkenazi, S., & Danan, Y. (2017). The role of mathematical anxiety and working memory on the performance of different types of arithmetic tasks. *Trends in Neuroscience and Education*, *7*, 1-10. doi:10.1016/j.tine.2017.05.001

Baddeley, A. D. (1986). *Working Memory*. Oxford, England: Clarendon Press.

Baddeley, A. D. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Sciences*, *4*(11), 417–423. doi:10.1016/S1364-6613(00)01538-2

Baddeley, A. D. (2012). Working memory: theories, models, and controversies. *Annual review of psychology*, *63*, 1-29. doi:10.1146/annurev-psych-120710-100422

Baddeley, A. D., & Hitch, G. J. (1974). Working memory. In G. A. Bower (Ed.), *The Psychology of Learning and Motivation: Advances in Research and Theory* (Vol. 8, pp. 47–90). New York: Academic Press.

Baker, J. A. (2006). Contributions of teacher–child relationships to positive school adjustment during elementary school. *Journal of school psychology*, *44*(3), 211-229. doi:10.1016/j.jsp.2006.02.002

Bandalos, D. L., Yates, K., & Thorndike-Christ, T. (1995). Effects of Math Self-Concept, Perceived Self-Efficacy, and Attributions for Failure and Success on Test Anxiety. *Journal of Educational Psychology*, *87*(4), 611–623. doi:10.1037/0022-0663.87.4.611

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of social and clinical psychology*, *4*(3), 359-373.

doi:10.1521/jscp.1986.4.3.359

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman and Company.

Bernstein, G. A., & Borchardt, C. M. (1991). Anxiety disorders of childhood and adolescence: A critical review. *Journal of the American Academy of Child & Adolescent Psychiatry*, *30*(4), 519-532. doi:10.1097/00004583-199107000-00001

Barrett, P. M. (1998). Evaluation of cognitive-behavioral group treatments for childhood anxiety disorders. *Journal of Clinical Child Psychology*, *27*(4), 459-468. doi:10.1207/s15374424jccp2704_10

Barrett, P. M., & Pahl, K. M. (2006). School-based intervention: Examining a universal approach to anxiety management. *Journal of Psychologists and Counsellors in Schools*, *16*(1), 55-75. doi:10.1375/ajgc.16.1.55

Barrett, P., & Ryan, S. (2004). *Friends for life: For children*. Australia: Australian Academic Press.

Beck, A. T. (1967). *Depression: Clinical, experimental, and theoretical aspects*. Philadelphia: University of Pennsylvania Press.

Beidel, D. C., & Turner, S. M. (1988). Comorbidity of test anxiety and other anxiety disorders in children. *Journal of abnormal child psychology*, *16*(3), 275-287. doi:10.1007/BF00913800

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. *Proceedings of the National Academy of Sciences*, *107*(5), 1860-1863. doi:10.1073/pnas.0910967107

Benetti, C., & Kambouropoulos, N. (2006). Affect-Regulated Indirect Effects of Trait Anxiety and Trait Resilience on Self-Esteem. *Personality and Individual Differences*, *41*(2), 341–352. doi:10.1016/j.paid.2006.01.015

Benson, J., Moulin-Julian, M., Schwarzer, C., Seipp, B., & El-Zahhar, N. (1992). Cross validation of a revised test anxiety scale using multi-national samples. In K. A. Hagvet & T. B. Johnsen (Eds.), *Advances in Test Anxiety Research* (Vol. 7, pp. 62–83). Lisse: Swets & Zeitlinger.

Block, J. H., & Block, J. (1980). The role of ego-control and egoresiliency in the organization of behavior. In W.A. Collins (Ed.), *Minnesota symposia on child psychology* (Vol. 13, pp. 39–101). Hillsdale, NJ: Erlbaum.

Block, J. H., & Gjerde, P. F. (1990). Depressive symptoms in late adolescence: A longitudinal perspective on personality antecedents. In J. Rolf, A. S. Masten, D. Cicchetti, K. H. Nuechterlein, & S. Weintraub (Eds.), *Risk and protective factors in the development of psychopatology* (pp. 334–360). New York, NY: Cambridge University Press.

Block, J., & Kremen, A. M. (1996). IQ and ego-resiliency: conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology*, *70*(2), 349-361. doi:10.1037/0022-3514.70.2.349

Blum, R. W., & Libbey, H. P. (2004). Executive summary. *Journal of School Health*, *74*(7), 231-232. doi:10.1111/j.1746-1561.2004.tb08278.x

Bong, M., & Skaalvik, E. M. (2002). Academic Self-Concept and Self-Efficacy: How Different Are They Really? *Educational Psychology Review*, *15*(1), 1–40. doi:10.1023/A:1021302408382

Borella, E., Carretti, B., & Pelegrina, S. (2010). The specific role of inhibition in reading comprehension in good and poor comprehenders. *Journal of Learning Disabilities*, *43*(6), 541–552. doi:10.1177/0022219410371676

Borella, E., & de Ribaupierre, A. (2014). The role of working memory, inhibition, and processing speed in text comprehension in children. *Learning and Individual*

*Differences*, *34*, 86–92. doi:10.1016/j.lindif.2014.05.001

Borkovec, T. D., & Roemer, L. (1995). Perceived functions of worry among generalized anxiety disorder subjects: distraction from more emotionally distressing topics? *Journal of Behavior Therapy and Experimental Psychiatry*, *26*(1), 25–30. doi:10.1016/0005-7916(94)00064-S

Bracken, B. A. (1996). *Handbook of self-concept: Developmental, social, and clinical considerations*. Oxford, England: John Wiley & Sons.

Bracken, B. A. (2003). *Multidimensional Self Concept Scale*. Trento, Italy: Edizioni Erickson.

Bråten, I., Ferguson, L. E., Anmarkrud, Ø., & Strømsø, H. I. (2013). Prediction of learning and comprehension when adolescents read multiple texts: The roles of word-level processing, strategic approach, and reading motivation. *Reading and Writing*, *26*(3), 321-348. doi:10.1007/s11145-012-9371-x

Campbell, J. R., & Mandel, F. (1990). Connecting math achievement to parental influences. *Contemporary Educational Psychology*, *15*(1), 64-74. doi:10.1016/0361-476X(90)90006-M

Campbell, M. A., & Rapee, R. M. (1996). Current Issues in the Assessment of Anxiety in Children and Adolescents: A Developmental Perspective. *Behaviour Change, 13*(3)*,* 185-193. doi:10.1017/S0813483900004952

Carey, E., Devine, A., Hill, F., & Szűcs, D. (2017). Differentiating anxiety forms and their role in academic performance from primary to secondary school. *Plos One, 12*(3): e0174418. doi:10.1371/journal.pone.0174418

Carroll, J. M., & Iles, J. E. (2006). An Assessment of Anxiety Levels in Dyslexic Students in Higher Education. *British Journal of Educational Psychology*, *76*(3), 651-662. doi: 10.1348/000709905X66233

Cattell, R. B., & Cattell, A. K. S. (1981*). Measuring intelligence with the culture fair tests.* Champaign, IL: Institute for Personality and Ability Testing.

Caviola, S., Primi, C., Chiesi, F., & Mammarella, I. C. (2017). Psychometric Properties of the Abbreviated Math Anxiety Scale (AMAS) in Italian Primary School Children. *Learning and Individual Differences*, *55*, 174–182. doi:10.1016/j.lindif.2017.03.006

Chang, H., & Beilock, S. L. (2016). The math anxiety-math performance link and its relation to individual and environmental factors: a review of current behavioral and psychophysiological research. *Current Opinion in Behavioral Sciences*, *10*, 33-38. doi:10.1016/j.cobeha.2016.04.011

Christenson, S. L., Rounds, T., & Gorney, D. (1992). Family factors and student achievement: An avenue to increase students' success. *School Psychology Quarterly*, *7*(3), 178-206. doi:10.1037/h0088259

Christopher, G., & MacDonald, J. (2005). The Impact of Clinical Depression on Working Memory. *Cognitive Neuropsychiatry, 10*(5), 379–399. doi:10.1080/13546800444000128.

Chuang, S. S., Lamb, M. E., & Hwang, C. P. (2006). Personality development from childhood to adolescence: A longitudinal study of ego-control and ego-resiliency in sweden. *International Journal of Behavioral Development*, *30*(4), 338–343. doi:10.1177/0165025406072795

Cole, D. A., Martin, J. M., Powers, B., & Truglio, R. (1996). Modeling causal relations between academic and social competence and depression: A multitrait-multimethod longitudinal study of children. *Journal of Abnormal Psychology*, *105*(2), 258-270. doi:10.1037/0021-843X.105.2.258

Conway, A. R., Kane, M. J., Bunting, M. F., Hambrick, D. Z., Wilhelm, O., & Engle, R.

W. (2005). Working Memory Span Tasks: A Methodological Review and User's Guide. *Psychonomic Bulletin & Review*, *12*(5), 769-786. doi: 10.3758/BF03196772

Cook, L. L., & Eignor, D. R. (1991). IRT equating methods. *Educational Measurement: Issues and Practice, 10*(3), 37–45. doi:10.1111/j.1745-3992.1991.tb00207.x

Covington, M.V. (1992). *Making the grade:Aself-worth perspective on motivation and school reform*. New York, NY, US: Cambridge University Press.

Covington, M. V. (1998). *The will to learn: A guide for motivating young people*. New York, NY, US: Cambridge University Press.

Covington, M. V., & Omelich, C. L. (1979). Effort: The double-edged sword in school achievement. *Journal of Educational Psychology*, *71*(2), 169-182. doi:10.1037/0022-0663.71.2.169

Craven, R. G., Marsh, H. W., & Debus, R. L. (1991). Effects of internally focused feedback and attributional feedback on enhancement of academic self-concept. *Journal of educational psychology*, *83*(1), 17-27. doi:10.1037/0022-0663.83.1.17

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, *19*(4), 450–466. doi:10.1016/S0022-5371(80)90312-6

De Beni, R., Palladino, P., Pazzaglia, F., & Cornoldi, C. (1998). Increases in intrusion errors and working memory deficit of poor comprehenders. *The Quarterly Journal of Experimental Psychology*, *51*, 305–320. doi:10.1080/713755761

Deković, M. (1999). Risk and protective factors in the development of problem behavior during adolescence. *Journal of youth and adolescence*, *28*(6), 667-685.

Derakshan, N., & Eysenck, M. W. (2009). Anxiety, processing efficiency, and cognitive performance: New developments from attentional control theory. *European Psychologist*, *14*(2), 168–176. doi:10.1027/1016-9040.14.2.168

Deroma, V. M., Leach, J. B., & Leverett, J. P. (2009). The Relationship between Depression and College Academic Performance. *College Student Journal*, *43*(2), 325-334.

Devine, A., Fawcett, K., Szűcs, D., & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and brain functions*, 8:33. doi:10.1186/1744-9081-8-33

Donolato, E., Marci, T., Altoè, G., & Mammarella, I. C. (under review). Measuring Test Anxiety in primary and middle-school children: Psychometric evaluation of the the Test Anxiety Questionnaire for Children (TAQ-C).

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*(1), 405–432. doi:10.1111/j.1467-8624.2010.01564.x

Eccles, J. S. (1999). The development of children ages 6 to 14. *The future of children*, 30-44. doi:10.2307/1602703

Eisenberg, N., Guthrie, I. K., Fabes, R. A., Reiser, M., Murphy, B. C., Holgren, R., . . .& Losoya, S. (1997). The relations of regulation and emotionality to resiliency and competence social functioning in elementary school children. *Child Development, 68*(2), 295–311. doi:10.1111/j.1467-8624.1997.tb01941.x

Ellis, H. C., & Moore, B. A. *(*1999*)*. Mood and Memory. In T. Dalgleish & M. J. Power (Eds.), *Handbook of cognition and emotion* (pp. 193-210). New York, NY: John Wiley & Sons Ltd.

Ergene, T. (2003). Effective interventions on test anxiety reduction: A meta-analysis. *School Psychology International, 24*(3), 313-328.

doi:10.1177/01430343030243004

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and Performance: The Processing Efficiency Theory. *Cognition & Emotion, 6*(6), 409-434. doi:10.1080/02699939208409696

Eysenck, M. W., & Derakshan, N. (2011). New perspectives in attentional control theory. *Personality and Individual Differences*, *50*(7), 955–960. doi:10.1016/j.paid.2010.08.019

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*(2), 336–353. doi:10.1037/1528-3542.7.2.336

Eysenck, M. W., Payne, S., & Derakshan, N. (2005). Trait anxiety, visuospatial processing, and working memory. *Cognition & Emotion*, *19*(8), 1214–1228. doi:10.1080/02699930500260245

Fennema, E., Peterson, P. L., Carpenter, T. P., & Lubinski, C. A. (1990). Teachers' attributions and beliefs about girls, boys, and mathematics. *Educational Studies in Mathematics*, *21*(1), 55-69. doi:10.1007/BF00311015

Fisak, B. J., Richard, D., & Mann, A. (2011). The prevention of child and adolescent anxiety: A meta-analytic review. *Prevention Science*, *12*(3), 255-268. doi:10.1007/s11121-011-0210-0

Fischbach, A., Keller, U., Preckel, F., & Brunner, M. (2013). PISA proficiency scores predict educational outcomes. *Learning and Individual Differences*, *24*, 63–72. doi:10.1016/j.lindif.2012.10.012

Flannery-Schroeder, E. C., & Kendall, P. C. (2000). Group and individual cognitive-behavioral treatments for youth with anxiety disorders: A randomized clinical trial. *Cognitive Therapy and Research*, *24*(3), 251-278. doi:10.1023/A:1005500219286

Fletcher, C., Lovatt, C., & Baldry, C. (1997). A study of state, trait, and test anxiety, and their relationship to assessment center performance. *Journal of Social Behavior & Personality*, *12*(5), 205-214.

Fletcher, D., & Sarkar, M. (2013). Psychological resilience: A review and critique of definitions, concepts, and theory. *European Psychologist*, *18*(1), 12-23. doi:10.1027/1016-9040/a000124

Fraley, C., & Raftery, A. E. (2002). Model-Based Clustering, Discriminant Analysis, and Density Estimation. *Journal of the American Statistical Association*, *97*, 611–631. doi:10.1198/016214502760047131

Fraley, C., Raftery, A. E., Murphy, T. B., & Scrucca, L. (2012). Mclust Version 4 for R: Normal Mixture Modeling for Model-Based Clustering, Classification, and Density Estimation. *Technical Report 597, University of Washington*, 1–50.

Friso-van den Bos, I., van der Ven, S. H., Kroesbergen, E. H., & van Luit, J. E. (2013). Working memory and mathematics in primary school children: A meta-analysis. *Educational research review*, *10*, 29-44. doi:10.1016/j.edurev.2013.05.003

Fröjd, S. A., Nissinen, E. S., Pelkonen, M. U., Marttunen, M. J., Koivisto, A. M., & Kaltiala-Heino, R. (2008). Depression and school performance in middle adolescent boys and girls. *Journal of adolescence*, *31*(4), 485-498. doi:10.1016/j.adolescence.2007.08.006

Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of educational psychology*, *95*(1), 148-162. doi:10.1037/0022-0663.95.1.148

Garmezy, N. (1991). Resilience in children's adaptation to negative life events and stressed environments. *Pediatric annals*, *20*(9), 459-466. doi:10.3928/0090-4481-19910901-05

Gathercole, S. E., Pickering, S. J., Knight, C., & Stegmann, Z. (2004). Working memory skills and educational attainment: Evidence from national curriculum assessments at 7 and 14 years of age. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *18*(1), 1-16. doi:10.1002/acp.934

Giofrè, D., Borella, E., & Mammarella, I. C. (2017). The relationship between intelligence, working memory, academic self-esteem, and academic achievement. *Journal of Cognitive Psychology*, *29*(6), 731-747. doi:10.1080/20445911.2017.1310110

Giofrè, D., Mammarella, I. C., & Cornoldi, C. (2014). The relationship among geometry, working memory, and intelligence in children. *Journal of Experimental Child Psychology*, *123*, 112–128. doi:10.1016/j.jecp.2014.01.002

Goetz, T., Preckel, F., Zeidner, M., & Schleyer, E. (2008). Big Fish in Big Ponds: A Multilevel Analysis of Test Anxiety and Achievement in Special Gifted Classes. *Anxiety, Stress and Coping*, *21*(2), 185–198. doi:10.1080/10615800701628827

Gottfredson, L. S. (2002a). Where and why g matters: Not a mystery. *Human Performance, 15*, 25–46. doi:10.1080/08959285.2002.9668082

Gottfredson, L. S. (2002b). g: Highly general and highly practical. In R. J. Sternberg, & E. L. Grigorenko (Eds.), *The general factor of intelligence: How general is it?* (pp. 331–380). Mahwah, NJ: Erlbaum.

Greenberg, M. T., Weissberg, R. P., O'brien, M. U., Zins, J. E., Fredericks, L., Resnik, H., & Elias, M. J. (2003). Enhancing school-based prevention and youth development through coordinated social, emotional, and academic learning. *American psychologist*, *58*, 466-474. doi:10.1037/0003-066X.58.6-7.466

Gregor, A. (2005). Examination anxiety: Live with it, control it or make it work for

you?. *School Psychology International*, *26*(5), 617-635. doi:10.1177/0143034305060802

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex roles*, *66*(3-4), 153-166. doi:10.1007/s11199-011-9996-2

Hagenauer, G., & Hascher, T. (2014). Early adolescents' enjoyment experienced in learning situations at school and its relation to student achievement. *Journal of Education and Training Studies, 2*(2), 20–30. doi:10.11114/jets.v2i2.254.

Hancock, D. R. (2001). Effects of test anxiety and evaluative threat on students' achievement and motivation. *The Journal of Educational Research*, *94*(5), 284-290. doi:10.1080/00220670109598764

Hembree, R. (1988). Correlates, Causes, Effects, and Treatment of Test Anxiety. *Review of Educational Research*, *58*(1), 47–77. doi:10.3102/00346543058001047

Hembree, R. (1990). The Nature, Effects, and Relief of Mathematics Anxiety. *Journal for Research in Mathematics Education*, *21*(1), 33-46. doi:10.2307/749455

Higa-McMillan, C. K., Francis, S. E., & Chorpita, B. F. (2014). Anxiety disorders. In E. J.Mash, & R. A. Barkley (Eds.), *Child psychopathology* (pp. 345–428). New York: Guilford Press.

Hill, F., Mammarella, I. C., Devine, A., Caviola, S., Passolunghi, M. C., & Szűcs, D. (2016). Maths Anxiety in Primary and Secondary School Students: Gender Differences, Developmental Changes and Anxiety Specificity. *Learning and Individual Differences*, *48*, 45–53. doi:10.1016/j.lindif.2016.02.006

Ho, H. Z., Senturk, D., Lam, A. G., Zimmer, J. M., Hong, S., Okamoto, Y., ... & Wang, C. P. (2000). The affective and cognitive dimensions of math anxiety: A cross-national study. *Journal for research in mathematics education, 31*(3), 362-379.

doi:10.2307/749811

Hopko, D. R., Mahadevan, R., Bare, R. L., & Hunt, M. K. (2003). The Abbreviated Math Anxiety Scale (AMAS) Construction, Validity, and Reliability. *Assessment*, *10*(2), 178-182. doi:10.1177/ 1073191103010002008

Hu, L., & Bentler, P. M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. doi:10.1080/10705519909540118

INVALSI. (2011). *Servizio nazionale di valutazione 2010–11 [National evaluation service 2010–11]*. Rome, Italy: INVALSI. Retrieved from http://www.invalsi.it/areadati/swdati.php?page=snv1011

Jackson, D., Firtko, A., & Edenborough, M. (2007). Personal resilience as a strategy for surviving and thriving in the face of workplace adversity: a literature review. *Journal of advanced nursing*, *60*(1), 1-9. doi:10.1111/j.1365-2648.2007.04412.x

Kane, M. J., Hambrick, D. Z., Tuholski, S. W., Wilhelm, O., Payne, T. W., & Engle, R. W. (2004). The generality of working memory capacity: a latent-variable approach to verbal and visuospatial memory span and reasoning. *Journal of Experimental Psychology: General*, *133*(2), 189–217. doi:10.1037/0096-3445.133.2.189

Karbach, J., Gottschling, J., Spengler, M., Hegewald, K., & Spinath, F. M. (2013). Parental involvement and general cognitive ability as predictors of domain-specific academic achievement in early adolescence. *Learning and Instruction*, *23*, 43-51. doi:10.1016/j.learninstruc.2012.09.004

Killu, K., Marc, R., & Crundwell, A. (2016). Students with anxiety in the classroom: Educational accommodations and interventions. *Beyond Behavior*, *25*(2), 30-40. doi:10.1177/107429561602500205

Kirkcaldy, B., & Siefen, G. (1998). Depression, anxiety and self-image among children

and adolescents. *School Psychology International*, *19*(2), 135-149. doi:10.1177/0143034398192003

Kline, R. B. (2016). *Principles and practice of structural equation modeling*. New York, NY: Guilford Press.

Korhonen, J., Nyroos, M., Jonsson, B., & Eklöf, H. (2018). Additive and multiplicative effects of working memory and test anxiety on mathematics performance in grade 3 students. *Educational Psychology*, *38*(5), 572-595. doi:10.1080/01443410.2017.1356449

Kovacs, M. (1988). *Children's depression inventory*. North Tonawanda, NY: Multi-Health Systems.

Kovacs, M., & Devlin, B. (1998). Internalizing disorders in childhood. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 3*9(1), 47–63.

Kovacs, M., & Goldston, D. (1991). Cognitive and social cognitive development of depressed children and adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, *30*(3), 388-392. doi:10.1097/00004583-199105000-00006

Kuncel, N. R., Hezlett, S. A., & Ones, D. S. (2004). Academic performance, career potential, creativity, and job performance: Can one construct predict them all?. *Journal of personality and social psychology*, *86*(1), 148-161. doi:10.1037/0022-3514.86.1.148

Kuster, F., Orth, U., & Meier, L. L. (2013). High self-esteem prospectively predicts better work conditions and outcomes. *Social Psychological and Personality Science*, *4*(6), 668-675. doi:0.1177/1948550613479806

Kwok, O. M., Hughes, J. N., & Luo, W. (2007). Role of resilient personality on lower achieving first grade students' current and future achievement. *Journal of School Psychology*, *45*(1), 61–82. doi:10.1016/j.jsp.2006.07.002

Lang, J., & Lang, J. (2010). Priming competence diminishes the link between cognitive test anxiety and test performance: Implications for the interpretation of test scores. *Psychological Science, 21*(6), 811–819. doi:10.1177/0956797610369492

Larson, H., Ramahi, M., Conn, S., Este, L., & Ghibellini, A. (2010). Reducing test anxiety among third-grade students through the implementation of relaxation techniques. *Journal of School Counseling, 8*(19), 1–19.

Lee, J. H. (1999). Test anxiety and working memory. *The Journal of Experimental Education*, *67*(3), 218-240. doi:10.1080/00220979909598354

Liew, J., Cao, Q., Hughes, J. N., & Deutz, M. H. (2018). Academic Resilience Despite Early Academic Adversity: A Three-Wave Longitudinal Study on Regulation-Related Resiliency, Interpersonal Relationships, and Achievement in First to Third Grade. *Early Education and Development*, *29*(5), 762-779. doi:10.1080/00223891003670166

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American psychologist*, *57*(9), 705-717. doi:10.1037/0003-066X.57.9.705

Lohbeck, A., Nitkowski, D., & Petermann, F. (2016). A control-value theory approach: Relationships between academic self-concept, interest, and test anxiety in elementary school children. *Child & Youth Care Forum*, *45*(6), 887-904. doi:10.1007/s10566-016-9362-1

Longobardi, C., Prino, L. E., Marengo, D., & Settanni, M. (2016). Student-teacher relationships as a protective factor for school adjustment during the transition from middle to high school. *Frontiers in psychology*, 7:1988. doi:10.3389/fpsyg.2016.01988

Lowe, P. A., Lee, S. W., Witteborg, K. M., Prichard, K. W., Luhr, M. E., Cullinan, C.

M., ... & Janik, M. (2008). The Test Anxiety Inventory for Children and Adolescents (TAICA) examination of the psychometric properties of a new multidimensional measure of test anxiety among elementary and secondary school students. *Journal of Psychoeducational Assessment*, *26*(3), 215-230. doi:10.1177/0734282907303760

Lowe, P. A., Papanastasiou, E. C., DeRuyck, K. A., & Reynolds, C. R. (2005). Test score stability and construct validity of the Adult Manifest Anxiety Scale-College Version scores among college students: A brief report. *Measurement and Evaluation in Counseling and Development*, *37*(4), 220-227. doi:10.1080/07481756.2005.11909762

Lowe, P. A., Peyton, V., & Reynolds, C. R. (2007). Test score stability and the relationship of adult manifest anxiety scale-college version scores to external variables among graduate students. *Journal of Psychoeducational Assessment*, *25*(1), 69-81. doi:10.1177/0734282906293698

Lowry-Webster, H. M., Barrett, P. M., & Dadds, M. R. (2001). A universal prevention trial of anxiety and depressive symptomatology in childhood: Preliminary data from an Australian study. *Behaviour Change*, *18*(1), 36-50. doi:10.1375/bech.18.1.36

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child development*, *71*(3), 543-562. doi:10.1111/1467-8624.00164

Lyons, I. M., & Beilock, S. L. (2012). When math hurts: math anxiety predicts pain network activation in anticipation of doing math. *PloS one*, *7*(10), e48076. doi:10.1371/journal.pone.0048076

Ma, X. (1999). A Meta-analysis of the Relationship Between Anxiety Toward

Mathematics and Achievement in Mathematics. *Journal for Research in Mathematics Education, 30*(5), 520–540. doi:10.2307/749772

Ma, X., & Kishor, N. (1997). Attitude toward self, social factors, and achievement in mathematics: A meta-analytic review. *Educational Psychology Review*, *9*(2), 89-120. doi:10.1111/j.1467-6494.1989.tb00484.x

Maloney, E. A., & Beilock, S. L. (2012). Math anxiety: Who has it, why it develops, and how to guard against it. *Trends in cognitive sciences*, *16*(8), 404-406. doi:10.1016/j.tics.2012.06.008

Mammarella, I. C., Caviola, S., Giofrè, D., & Szűcs, D. (2018). The underlying structure of visuospatial working memory in children with mathematical learning disability. *British Journal of Developmental Psychology*, *36*(2), 220-235. doi:10.1111/bjdp.12202

Mammarella, I. C., & Cornoldi, C. (2005). Difficulties in the control of irrelevant visuospatial information in children with visuospatial learning disabilities. *Acta Psychologica*, *118*(3), 211–228. doi:10.1016/j.actpsy.2004.08.004

Mammarella, I. C., Ghisi, M., Bomba, M., Bottesi, G., Caviola, S., Broggi, F., …& Nacinovich, R. (2016). Anxiety and depression in children with nonverbal learning disabilities, reading disabilities, or typical development. *Journal of learning disabilities*, *49*(2), 130-139. doi:10.1177/0022219414529336

Mammarella, I. C., Hill, F., Devine, A., Caviola, S., & Szűcs, D. (2015). Math anxiety and developmental dyscalculia: a study on working memory processes. *Journal of clinical and experimental neuropsychology*, *37*(8), 878-887. doi:10.1080/13803395.2015.1066759

Marsh, H. W. (1989). Age and sex effects in multiple dimensions of self-concept: Preadolescence to early adulthood. *Journal of Educational Psychology, 81*(3), 417-

430. doi:10.1037/0022-0663.81.3.417

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self- concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child development*, *76*(2), 397-416. doi:10.1111/j.1467-8624.2005.00853.x

Martin, A. J., Colmar, S. H., Davey, L. A., & Marsh, H. W. (2010). Longitudinal Modelling of Academic Buoyancy and Motivation: Do the 5Cs Hold Up Over Time? *British Journal of Educational Psychology*, *80*(3), 473–496. doi:10.1348/000709910X486376

Martin, A. J., Ginns, P., Brackett, M. A., Malmberg, L. E., & Hall, J. (2013). Academic buoyancy and psychological risk: Exploring reciprocal relationships. *Learning and Individual Differences*, *27*, 128-133. doi:10.1016/j.lindif.2013.06.006

Martin, A. J., & Marsh, H. W. (2003). Fear of failure: Friend or foe?. *Australian Psychologist*, *38*(1), 31-38. doi:10.1080/00050060310001706997

Martin, A. J., & Marsh, H. W. (2006). Academic resilience and its psychological and educational correlates: A construct validity approach. *Psychology in the Schools*, *43*(3), 267-281. doi:10.1002/pits.20149

Martin, A. J., & Marsh, H. W. (2008a). Academic Buoyancy: Towards an Understanding of Students' Everyday Academic Resilience. *Journal of School Psychology*, *46*(1), 53–83. doi:10.1016/j.jsp.2007.01.002

Martin, A. J., & Marsh, H. W. (2008b). Workplace and Academic Buoyancy: Psychometric Assessment and Construct validity Amongst School Personnel and Students. *Journal of Psychoeducational Assessment*, *26*(2), 168-184. doi:10.1177/0734282907313767

Martin, A. J., & Marsh, H. W. (2009). Academic Resilience and Academic Buoyancy:

Multidimensional and Hierarchical Conceptual Framing of Causes, Correlates and Cognate Constructs. *Oxford Review of Education*, *35*(3), 353–370. doi:10.1080/03054980902934639

Masia-Warner, C., Nangle, D. W., & Hansen, D. J. (2006). Bringing evidence-based child mental health services to the schools: General issues and specific populations. *Education and Treatment of Children*, *29*(2), 165-172.

Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American psychologist*, *56*(3), 227-238. doi:10.1037/0003-066X.56.3.227

Masten, A. S. (2014). Global perspectives on resilience in children and youth. *Child development*, *85*(1), 6-20. doi:10.1111/cdev.12205

Masten, A. S., & Obradović, J. (2006). Competence and resilience in development. *Annals of the New York Academy of Sciences*, *1094*(1), 13-27. doi:10.1196/annals.1376.003

McDonald, A. S. (2001). The prevalence and effects of test anxiety in school children. *Educational psychology*, *21*(1), 89-101. doi:10.1080/01443410020019867

McInerney, V., McInerney, D. M., & Marsh, H. W. (1997). Effects of metacognitive strategy training within a cooperative group learning context on computer achievement and anxiety: An aptitude–treatment interaction study. *Journal of Educational Psychology*, *89*(4), 686-695. doi:10.1037/0022-0663.89.4.686

Michl, L. C., McLaughlin, K. A., Shepherd, K., & Nolen-Hoeksema, S. (2013). Rumination as a mechanism linking stressful life events to symptoms of depression and anxiety: Longitudinal evidence in early adolescents and adults. *Journal of Abnormal Psychology*, *122*(2), 339–352. doi:10.1037/a0031994

Middleton, J. A., & Spanias, P. A. (1999). Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for research in*

*Mathematics Education*, 65-88. doi:10.2307/749630

Mirowsky, J., & Ross, C. E. (2008). Education and self-rated health: Cumulative advantage and its rising importance. *Research on Aging, 30*(1), 93-122. doi:10.1177/0164027507309649

Miyake, A., Friedman, N. P., Rettinger, D. A., Shah, P., & Hegarty, M. (2001). How are visuospatial working memory, executive functioning, and spatial abilities related? A latent-variable analysis. *Journal of Experimental Psychology: General*, *130*(4), 621-640. doi:10.1037//0096-3445.130.4.621

Moran, T. P. (2016). Anxiety and working memory capacity: A meta-analysis and narrative review. *Psychological Bullettin, 142*(8), 831-864. doi:10.1037/bul000005

Morrison, G. M., & Allen, M. R. (2007). Promoting student resilience in school contexts. *Theory into Practice*, *46*(2), 162-169. doi:10.1080/00405840701233172

Mugnaini, D., Lassi, S., La Malfa, G., & Albertini, G. (2009). Internalizing correlates of dyslexia. *World Journal of Pediatrics*, *5*(4), 255-264. doi:10.1007/s12519-009-0049-7

Muthén, L.K., & Muthén, B.O. (2010). *Mplus User's Guide*. LosAngeles, CA: Muthén & Muthén

Nelson, J. M., & Harwood, H. (2011). Learning disabilities and anxiety: A meta-analysis. *Journal of learning disabilities*, *44*(1), 3-17. doi:10.1177/0022219409359939

Newbegin, I., & Owens, A. (1996). Self-esteem and anxiety in secondary school achievement. *Journal of Social Behavior and Personality*, *11*(3), 521-530.

Ng, E., & Lee, K. (2015). Effects of trait test anxiety and state anxiety on children's working memory task performance. *Learning and Individual Differences*, *40*, 141-148. doi:10.1016/j.lindif.2015.04.007

Ng, E., & Lee, K. (2016). Test Anxiety and Children's Working Memory Task Performance: Does Trait or State Anxiety Matter More?. *Journal of Experimental Psychopathology*, *7*(3), 374-390. doi:10.5127/jep.054115

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, Competence, and Relatedness in the Classroom: Applying Self-Determination Theory to Educational Practice. *Theory and Research in Education, 7*(2), 133–144. doi:10.1177/1477878509104318

Nolen-Hoeksema, S. (2000). The Role of Rumination in Depressive Disorders and Mixed Anxiety/Depressive Symptoms. *Journal of Abnormal Psychology, 109*(3), 504–511. doi:10.1037//0021-843X.109.3.504.

Orth, U., Robins, R. W., Trzesniewski, K. H., Maes, J., & Schmitt, M. (2009). Low self-esteem is a risk factor for depressive symptoms from young adulthood to old age. *Journal of abnormal psychology*, *118*(3), 472-478. doi:10.1037/a0015922

Orth, U., Robins, R. W., & Widaman, K. F. (2012). Life-span development of self-esteem and its effects on important life outcomes. *Journal of personality and social psychology*, *102*(6), 1271-1288. doi:0.1037/a0025558

Owens, M., Stevenson, J., Hadwin, J. A., & Norgate, R. (2012). Anxiety and depression in academic performance: An exploration of the mediating factors of worry and working memory. *School Psychology International*, *33*(4), 433–449. doi:10.1177/0143034311427433

Palladino, P. (2005). A test for examining wm in primary school: Standardization and validity. *Psicologia Clinica dello Sviluppo*, *9*(1), 129–150. doi:10.1449/20152

Passolunghi, M. C., Caviola, S., De Agostini, R., Perin, C., & Mammarella, I. C. (2016). Mathematics anxiety, working memory, and mathematics performance in secondary-school children. *Frontiers in psychology*, 7:42. doi:10.3389/fpsyg.2016.00042

Passolunghi, M. C., Mammarella, I. C., & Altoè, G. (2008). Cognitive abilities as precursors of the early acquisition of mathematical skills during first through second grades. *Developmental Neuropsychology*, *33*(3), 229–250. doi:10.1080/87565640801982320

Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2017). Achievement emotions and academic performance: Longitudinal models of reciprocal effects. *Child Development, 88*(5)*,* 1653–1670. doi:10.1111/cdev.12704

Peng, P., Namkung, J., Barnes, M., & Sun, C. (2016). A meta-analysis of mathematics and working memory: Moderating effects of working memory domain, type of mathematics skill, and sample characteristics. *Journal of Educational Psychology*, *108*(4), 455-473. doi:10.1037/edu0000079.supp

Putwain, D. W. (2008). Deconstructing test anxiety. *Emotional and Behavioural Difficulties*, *13*(2), 141-155. doi:10.1080/13632750802027713

Putwain, D. W., Connors, L., & Symes, W. (2010). Do cognitive distortions mediate the test anxiety–examination performance relationship? *Educational Psychology*, *30*(1), 11–26. doi:10.1080/01443410903328866

Putwain, D. W., Connors, L., Symes, W., & Douglas-Osborn, E. (2012). Is academic buoyancy anything more than adaptive coping?. *Anxiety, Stress & Coping*, *25*(3), 349-358. doi:10.1080/10615806.2011.582459

Putwain, D. W., & Daly, A. L. (2013). Do clusters of test anxiety and academic buoyancy differentially predict academic performance?. *Learning and Individual Differences*, *27*, 157-162. doi:10.1016/j.lindif.2013.07.010

Putwain, D. W., Daly, A. L., Chamberlain, S., & Sadreddini, S. (2015). Academically Buoyant Students Are Less Anxious About and Perform Better in High-Stakes Examinations. *British Journal of Educational Psychology*, *85*(3), 247–263.

doi:10.1111/bjep.12068

Putwain, D. W., & Daniels, R. A. (2010). Is the Relationship Between Competence Beliefs and Test Anxiety Influenced by Goal Orientation? *Learning and Individual Differences*, *20*(1), 8–13. doi:10.1016/j.lindif.2009.10.006

Putwain, D. W., Nicholson, L. J., Connors, L., & Woods, K. (2013). Resilient Children Are Less Test Anxious and Perform Better in Tests at the End of Primary Schooling. *Learning and Individual Differences*, *28*, 41–46. doi:10.1016/j.lindif.2013.09.010

R Core Team. (2016). *R: A language and environment for statistical computing. vienna, austria: r foundation for statistical computing.* Vienna, Austria. Retrieved from http://www.r-project.org/

Rajchert, J. M., Żułtak, T., & Smulczyk, M. (2014). Predicting reading literacy and its improvement in the Polish national extension of the PISA study: The role of intelligence, trait-and state-anxiety, socio-economic status and school-type. *Learning and Individual Differences*, *33*, 1-11. doi:10.1016/j.lindif.2014.04.003

Rambaldo, L. R., Wilding, L. D., Goldman, M. L., McClure, J. M., & Friedberg, R. D. (2001). School-based interventions for anxious and depressed children. In L. VandeCreek, & T. L. Jackson (Eds.), *Innovations in clinical practice: A source book* (pp. 347−358). Sarasota, FL: Professional Resource Press.

Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development*, *14*(2), 187-202. doi:10.1080/15248372.2012.664593

Rapee, R. M., Schniering, C. A., & Hudson, J. L. (2009). Anxiety disorders during childhood and adolescence: Origins and treatment. *Annual review of clinical psychology*, *5*, 311-341. doi:10.1146/annurev.clinpsy.032408.153628

Reynolds, C. R., & Richmond, B. O. (2012). *RCMAS-2 Revised Children's Manifest Anxiety Scale — Second Edition.* Florence, Italy: Giunti O.S.

Richardson, F.C., & Suinn, R.M. (1972). The Mathematics Anxiety Rating Scale. *Journal of Counseling Psychology, 19*, 551–554. doi:10.1037/h0033456

Riglin, L., Petrides, K. V., Frederickson, N., & Rice, F. (2014). The Relationship Between Emotional Problems and Subsequent School Attainment: A Meta-Analysis. *Journal of adolescence*, *37*, 335-346. doi:10.1016/j.adolescence.2014.02.010

Rohde, T. E., & Thompson, L. A. (2007). Predicting academic achievement with cognitive ability. *Intelligence*, *35*(1), 83-92. doi:10.1016/j.intell.2006.05.004

Roick, J., & Ringeisen, T. (2017). Self-Efficacy, Test Anxiety, and Academic Success: A Longitudinal Validation. *International Journal of Educational Research*, *83*, 84–93. doi:10.1016/j.ijer.2016.12.006

Rose, Heather; Miller, Lynn; & Martinez, Y. (2009). "FRIENDS for Life": The Results of a Resilience-Building, Anxiety-Prevention Program in a Canadian Elementary School. *Professional School Counseling*, *12*, 400–407. doi:10.5330/PSC.n.2010-12.400

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*, 1–36. doi:10.1080/10705519909540118

Roth, P. L., BeVier, C. A., Switzer III, F. S., & Schippmann, J. S. (1996). Meta-analyzing the relationship between grades and job performance. *Journal of applied psychology, 81*(5), 548-556. doi:10.1037/0021-9010.81.5.548

Sameroff, A. J., & Rosenblum, K. L. (2006). Psychosocial constraints on the development of resilience. *Annals of the New York Academy of Sciences*, *1094*(1), 116-124. doi:10.1196/annals.1376.010

Schiefele, U., Schaffner, E., Möller, J., & Wigfield, A. (2012). Dimensions of reading motivation and their relation to reading behavior and competence. *Reading Research Quarterly*, *47*(4), 427-463. doi:10.1002/RRQ.030

Schunk, D. H., & Miller, S. D. (2002). Self-efficacy and adolescents' motivation. In F. Pajares & T. Urdan (Eds.), *Academic motivation of adolescents* (pp. 29-52). Greenwich, CT: Information Age.

Scrucca, L., Fop, M., Murphy, T. B., & Raftery, A. E. (2016). mclust 5: Clustering, classification and density estimation using gaussian finite mixture models. *The R journal, 8*(1), 289-317.

Segool, N. K., Carlson, J. S., Goforth, A. N., Von Der Embse, N., & Barterian, J. A. (2013). Heightened test anxiety among young children: elementary school students'anxious responses to high- stakes testing. *Psychology in the Schools*, *50*(5), 489-499. doi:10.1002/pits.21689

Seipp, B. (1991). Anxiety and academic performance: A meta-analysis of findings. *Anxiety Research*, *4*(1), 27-41. doi:10.1080/08917779108248762

Seligman, L. D., & Ollendick, T. H. (1998). Comorbidity of anxiety and depression in children and adolescents: An integrative review. *Clinical Child and Family Psychology Review, 1*, 125–144. doi:10.1023/A:1021887712873

Seligman, L. D., Ollendick, T. H., Langley, A. K., & Baldacci, H. B. (2004). The utility of measures of child and adolescent anxiety: a meta-analytic review of the Revised Children's Manifest Anxiety Scale, the State–Trait Anxiety Inventory for Children, and the Child Behavior Checklist. *Journal of Clinical Child and Adolescent Psychology*, *33*(3), 557-565. doi:10.1207/s15374424jccp3303_13

Sena, J. D. W., Lowe, P. A., & Lee, S. W. (2007). Significant predictors of test anxiety among students with and without learning disabilities. *Journal of Learning Disabilities, 40*, 360 – 376. doi:10.1177/00222194070400040601

Shadach, E., & Ganor-Miller, O. (2013). The role of perceived parental over-involvement in student test anxiety. *European journal of psychology of education*, *28*(2), 585-596. doi:10.1007/s10212-012-0131-8

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of educational research*, *46*(3), 407-441. doi:10.3102/00346543046003407

Shen, C., & Pedulla, J. J. (2000). The relationship between students' achievement and their self-perception of competence and rigour of mathematics and science: A cross-national analysis. *Assessment in Education: Principles, Policy & Practice*, *7*(2), 237-253. doi:10.1080/713613335

Sica, C., Chiri, L. R., Favilli, R., & Marchetti, I. (2011). *Questionario per la Valutazione della Psicopatologia in Adolescenza (Q-PAD)*. Trento, Italy: Edizioni Erickson.

Silverman, W. K., Pina, A. A., & Viswesvaran, C. (2008). Evidence-based psychosocial treatments for phobic and anxiety disorders in children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, *37*(1), 105-130. doi: 10.1080/15374410701817907

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. *The Journal of Educational Research*, *95*(6), 323-332. doi:10.1080/00220670209596607

Smith, C., & Carlson, B. E. (1997). Stress, coping, and resilience in children and youth. *Social service review*, *71*(2), 231-256. doi:10.1086/604249

Sowislo, J. F., & Orth, U. (2013). Does low self-esteem predict depression and anxiety? a meta-analysis of longitudinal studies. *Psychological Bulletin*, *139*, 213–240. doi:10.1037/a0028931

St Clair-Thompson, H. L., & Gathercole, S. E. (2006). Executive functions and achievements in school: shifting, updating, inhibition, and working memory. *Quarterly Journal of Experimental Psychology*, *59*, 745–759. doi:10.1080/17470210500162854

Stallard, P., Simpson, N., Anderson, S., Hibbert, S., & Osborn, C. (2007). The FRIENDS emotional health programme: Initial findings from a school- based project. *Child and Adolescent Mental Health*, *12*(1), 32-37. doi:10.1111/j.1475-3588.2006.00421.x

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology*, *52*, 83–110. doi:10.1146/annurev.psych.52.1.83

Struthers, C. W., Perry, R. P., & Menec, V. H. (2000). An examination of the relationship among academic stress, coping, motivation, and performance in college. *Research in higher education*, *41*(5), 581-592. doi:10.1023/A:1007094931292

Sub, A., & Prabha, C. (2003). Academic performance in relation to perfectionism, test procrastination and test anxiety of high school children. *Psychological Studies, 48*, 7-81.

Swanson, J., Valiente, C., Lemery-Chalfant, K., & Caitlin O'Brien, T. (2011). Predicting early adolescents' academic achievement, social competence, and physical health from parenting, ego resilience, and engagement coping. *The Journal of Early Adolescence*, *31*, 548–576. doi:10.1177/0272431610366249

Tabachnik, B. G. (2001). *Fidell LS using multivariate statistics*. Boston: Allyn and

Bacon.

Trzesniewski, K. H., Donnellan, M. B., Moffitt, T. E., Robins, R. W., Poulton, R., & Caspi, A. (2006). Low self-esteem during adolescence predicts poor health, criminal behavior, and limited economic prospects during adulthood. *Developmental psychology*, *42*(2), 381-390. doi:10.1037/0012-1649.42.2.381

Unrau, N., & Schlackman, J. (2006). Motivation and its relationship with reading achievement in an urban middle school. *The Journal of Educational Research*, *100*(2), 81-101. doi:10.3200/JOER.100.2.81-101

Valentine, J. C., DuBois, D. L., & Cooper, H. (2004). The Relation Between Self-Beliefs and Academic Achievement: A Meta-Analytic Review. *Educational psychologist*, *39*, 111-133. doi:10.1207/s15326985ep3902_3

Vecchione, M., Alessandri, G., Barbaranelli, C., & Gerbino, M. (2010). Stability and change of ego resiliency from late adolescence to young adulthood: A multiperspective study using the ER89–R Scale. *Journal of personality assessment*, *92*(3), 212-221. doi:10.1080/00223891003670166

Von Der Embse, N., Barterian, J., & Segool, N. (2013). Test anxiety interventions for children and adolescents: A systematic review of treatment studies from 2000–2010. *Psychology in the Schools*, *50*(1), 57-71. doi:10.1002/pits.21660

Vukovic, R. K., Kieffer, M. J., Bailey, S. P., & Harari, R. R. (2013). Mathematics anxiety in young children: Concurrent and longitudinal associations with mathematical performance. *Contemporary Educational Psychology, 38*(1), 1–10. doi:10.1016/j.cedpsych.2012.09.001.

Vukovic, R. K., Roberts, S. O., & Green Wright, L. (2013). From parental involvement to children's mathematical performance: The role of mathematics anxiety. *Early Education & Development*, *24*(4), 446-467. doi:10.1080/10409289.2012.693430

Walkenhorst, E., & Crowe, S. F. (2009). The effect of state worry and trait anxiety on working memory processes in a normal sample. *Anxiety, Stress, and Coping*, *22*, 167–187. doi:10.1080/10615800801998914

Wang, M. T. (2009). School climate support for behavioral and psychological adjustment: testing the mediating effect of social competence. *School Psychology Quarterly*, *24*(4), 240-251. doi:10.1037/a0017999

Wang, Z., Hart, S. A., Kovas, Y., Lukowski, S., Soden, B., Thompson, L. A., ... & Petrill, S. A. (2014). Who is afraid of math? Two sources of genetic variance for mathematical anxiety. *Journal of child psychology and psychiatry*, *55*(9), 1056-1064. doi:10.1111/jcpp.12224

Weems, C. F., Scott, B. G., Graham, R. A., Banks, D. M., Russell, J. D., Taylor, L. K., ... & Marino, R. C. (2015). Fitting anxious emotion-focused intervention into the ecology of schools: Results from a test anxiety program evaluation. *Prevention Science*, *16*(2), 200-210. doi:10.1007/s11121-014-0491-1.

Weems, C. F., Scott, B. G., Taylor, L. K., Cannon, M. F., Romano, D. M., Perry, A. M., … & Triplett, V. (2010). Test anxiety prevention and intervention programs in schools: Program development and rationale. *School Mental Health, 2*, 62–71. doi:10.1007/s12310-010-9032-7

Weems, C. F., Zakem, A. H., Costa, N. M., Cannon, M. F., & Watts, S. E. (2005). Physiological response and childhood anxiety: Association with symptoms of anxiety disorders and cognitive bias. *Journal of Clinical Child and Adolescent Psychology*, *34*(4), 712-723. doi:10.1207/s15374424jccp3404_13

Wickham, H. (2009). *ggplot2: Elegant Graphics for Data Analysis.* New York, NY: Springer-Verlag.

Wigfield, A., & Meece, J. L. (1988). Math anxiety in elementary and secondary school

students. *Journal of educational Psychology*, *80*(2), 210-216. doi:10.1037/0022-0663.80.2.210

Williams, L. J., & Brown, B. K. (1994). Method variance in organizational behavior and human resources research: Effects on correlations, path coefficients, and hypothesis testing. *Organizational Behavior and Human Decision Processes, 57*, 185–209. doi:10.1006/obhd.1994.1011

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology*, *21*(2), 152-169. doi:10.1186/1477-7525-9-8

Wren, D. G., & Benson, J. (2004). Measuring test anxiety in children: Scale development and internal construct validation. *Anxiety, Stress & Coping*, *17*, 227-240. doi:10.1080/10615800412331292606

Wu, S. S., Barth, M., Amin, H., Malcarne, V., & Menon, V. (2012). Math Anxiety in Second and Third Graders and Its Relation to Mathematics Achievement. *Frontiers in Psychology*, *3*, 1–11. doi:10.3389/fpsyg.2012.00162

Zeidner, M. (1998). *Test anxiety: The state of the art*. Springer Science & Business Media.

Zeidner, M. (2007). Test anxiety in educational contexts: Concepts, findings, and future directions. In P. A. Schutz & R. Pekrun (Eds.), *Educational psychology series. Emotion in education* (pp. 165-184). San Diego, CA, US: Elsevier Academic Press.

Zeidner, M., & Matthews, G. (2005). Evaluation anxiety. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 141–163). London, UK: Guilford Press.

Zeidner, M., & Schleyer, E. J. (1999). The big-fish–little-pond effect for academic self-concept, test anxiety, and school grades in gifted children. *Contemporary*

*Educational Psychology*, *24*(4), 305-329. doi:10.1006/ceps.1998.0985

Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (2007). The scientific base linking social and emotional learning to school success. *Journal of educational and psychological consultation, 17*(2-3), 191-210. doi:10.1080/10474410701413145