The interaction between emotional intelligence and cognitive ability in predicting scholastic performance in school-aged children

Sergio Agnoli, Giacomo Mancini, Tiziana Pozzoli, Bruno Baldaro, Paolo Maria Russo, Paola Surcinelli

* Marconi Institute for Creativity, MIC, University of Bologna, Italy
b Department of Psychology, University of Bologna, Italy
c Department of Developmental and Socialization Psychology, University of Padova, Italy

ARTICLE INFO

Article history:
Received 9 March 2012
Received in revised form 14 May 2012
Accepted 15 May 2012
Available online 8 June 2012

Keywords:
Trait emotional intelligence
Emotion recognition ability
Cognitive ability
Scholastic performance
Children

ABSTRACT

The aim of the present study is to offer an exploration of the predictive validity of cognitive ability and emotional intelligence (EI) on scholastic achievement in a sample of Italian school-aged children (8–11 years). In particular, cognitive ability was measured through Raven’s Coloured Progressive Matrices, while trait EI was measured through the Trait Emotional Intelligence Questionnaire–Child Form (TEIQue-CF). In addition to trait EI, we measured also a basic emotional ability, the emotion recognition ability, through an emotional face recognition task. The results demonstrated an interaction between trait EI and cognitive ability in predicting academic performance. In particular, trait EI was positively associated with better language performance in children characterised by low or medium cognitive ability, but not in pupils characterised by high cognitive ability. Moreover, results showed that trait EI had a unique power to predict math performance. Similarly, the analyses showed an interaction between emotion recognition ability and cognitive ability in predicting both language and math performance. Differences between the two emotional measures were discussed.

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1. Introduction

An analysis of the wide literature dealing with the predictors of academic success indicates that it is generally associated with cognitive intelligence. In particular, past research in this field has primarily focused on cognitive abilities (Colom & Flores-Mendoza, 2007; Farsides & Woodfield, 2003; Neisser et al., 1996) demonstrating the important predictive role of IQ on academic performance (Neisser et al., 1996). Recently, another construct has attracted a lot of interest in this area of research: emotional intelligence (EI; Petrides & Furnham, 2000). EI theorists proposed a new perspective in the study of emotions by suggesting that the intelligent use of emotions is essential for one’s physical and psychological adaptation (Extremera & Fernández-Berrocal, 2006). The aim of the present work is to offer an exploration of the predictive validity of different types of intelligence, in particular of trait EI, on scholastic success.

The literature on EI is mainly characterised by the distinction between trait EI (or trait emotional self-efficacy) and ability EI (or cognitive-emotional ability) (Mavroveli, Petrides, Shove, & Whitehead, 2008; Petrides & Furnham, 2000). Trait EI is conceptualised as a lower-order personality construct and it is defined as a constellation of emotional self-perceptions and behavioural dispositions (Petrides, Pita, & Kokkinaki, 2007). Ability EI is conceived as an actual ability that comprises emotion-related cognitive abilities. While trait EI is measured through self-report questionnaires and is associated with the realm of personality, ability EI is instead measured through maximum-performance tests and is associated to the realm of cognitive ability (Petrides, Frederickson, & Furnham, 2004; Petrides, Furnham, & Mavroveli, 2007). According to ability EI theorisation, the emotional abilities are organised along a continuum from those that are relatively lower level (e.g., capacity to perceive emotions accurately), to those that are more developmentally complex (e.g., ability to manage emotions properly) (Mayer, Salovey, & Caruso, 2008).

Several studies have explored whether EI may help explain academic achievement (Di Fabio & Palazzeschi, 2009; Laborde, Doss- seville, & Scelles, 2010; Mavroveli, Petrides, Sangareau, & Furnham, 2009; Mavroveli & Sanchez-Ruiz, 2011; O’Connor & Little, 2003; Parker et al., 2004; Petrides et al., 2004; Song et al., 2010). On the basis of trait EI definition, it could be expected that trait EI would not correlate strongly with cognitive ability, verbal intelligence, or academic achievement. Indeed, as previously mentioned, trait EI is considered a personality trait rather than a cognitive ability. That said, it would not be expected to be highly associated either
with psychometric intelligence or proxies thereof (Petrides et al., 2004). Nevertheless, although emotion-related self-perceptions would not be expected to be directly associated with better or poorer scholastic achievement, it is possible that they may interact with variables that are (e.g., cognitive abilities). The results of several studies by Mavroveli et al. (2008, 2009), and Petrides et al. (2004) confirmed these assumptions.

A moderating effect of trait EI on the relation between IQ and academic performance was demonstrated, so that high trait EI was associated with better English (but not math or science) performance (Petrides et al., 2004). However, a direct but modest correlation between trait EI and academic performance in high school and university students has also been reported (Parker, Creque et al., 2004; Parker, Summerfeldt, Hogan, & Majeski, 2004). Similarly, Mavroveli and Sanchez-Ruiz (2011) recently showed a significant relationship between trait EI and math scores in children aged 3 years but not in older pupils (4–6 years). The different findings that emerged from these studies suggested that the effects of trait EI may vary across educational levels, age, and subjects.

Other studies explored the relation between ability EI and academic achievement with mixed results. In one study with university students, ability EI predicted academic performance over and above general mental abilities (Song et al., 2010). However, another study with 18- to 32-year-old students showed that emotional understanding ability, but not overall ability EI, was associated with academic performance (O’Connor & Little, 2003). The emerging findings revealed again an inconsistent pattern, probably depending both on how scholastic performance is operationalised in the different studies and on the characteristics of the sample (e.g., gender, age).

To date, the research on the relationship between EI and academic achievement has been mainly based on samples of college students and adolescents. In contrast, there is little evidence from child samples, partly because of a lack of appropriate measures. Moreover, the results on children are not always fully consistent (for a review, see Mavroveli & Sanchez-Ruiz, 2011). The current study aims to fill this gap by analysing the effects of cognitive ability (operationalised through Raven’s Coloured Progressive Matrices) and EI in predicting scholastic achievement in a sample of school-aged children. Moreover, since the simultaneous contribution of both trait EI and ability EI in explaining scholastic success has barely been explored (O’Connor & Little, 2003) and, as far as we know, it has never been investigated in primary school students, we tested the effect of EI components on children’s scholastic achievement by considering both self-report and performance measures. Instead of seeing the two types of EI as contrasting constructs, we considered them as different ways of approaching the study of EI, which could bring different and incremental contributions in explaining scholastic achievement. In particular, taking into account the developmental trajectory followed by emotional abilities, we explored only the effect of the lower-level and fundamental skill—that is, emotional perception (specifically, the ability to accurately perceive emotions in the face). The most-used ability EI measurement methods (e.g., the Mayer–Salovey–Caruso Emotional Intelligence Test [MSCEIT]) consider emotional facial expression recognition as a central task to measure emotional perception ability; for this reason, in the present study we measured emotional perception ability through an emotional face recognition task. The choice of using only the recognition task among the eight tasks provided by MSCEIT to assess EI abilities is also due to the lack of published methodologies to measure ability EI in young children.

Furthermore, emotion recognition, on the basis of a long research tradition in developmental literature (Camras & Allison, 1985; Herba, Landau, Russell, Ecker, & Phillips, 2006), is, at present, the only EI ability that can be tested with a reliable task in children (i.e., the recognition of emotions from prototypical emotional facial expressions). In addition to this basic ability, we measured trait EI through TEIQue-CF (Mavroveli et al., 2008). We hypothesised that the two measures would separately predict academic achievement, interacting with cognitive abilities in predicting children’s performance across different subjects (i.e., mathematics and language). According to Petrides et al. (2004), the effect of trait EI on academic performance should be stronger when the demands of the situation outweigh students’ intellectual resources. On the basis of this assumption, we hypothesised that the effects of trait EI on scholastic performance should be more pronounced in children with low levels of cognitive ability. We hypothesised that the same trend should emerge in emotion recognition ability; this ability represents a basic emotional competence, and its impact should emerge as soon as the situation requires more than intellectual resources.

2. Method

2.1. Participants

Four hundred and forty-seven children ranging in age from 8 to 11 years participated in the study. All participants were recruited from primary (third- to fifth-grade) state schools in the districts of Bologna. Pupils with special educational needs (n = 12) were excluded from subsequent analyses; complete data were available for 352 pupils (188 females) ranging in age from 8 to 11 years old (mean age = 9.35 years; SD = 0.8 years). Children with missing data were excluded from the analyses.

2.2. Measures

2.2.1. Trait Emotional Intelligence Questionnaire–Child Form (Mavroveli et al., 2008)

The TEIQue-CF comprises 75 short statements (e.g., ‘It’s easy for me to show how I feel’) that are responded to on a 5-point Likert scale, ranging from ‘completely disagree’ to ‘completely agree’. TEIQue-CF has shown satisfactory levels of internal consistency (alpha > .72) and temporal stability over a 3-month interval (r = 0.79; Mavroveli & Sanchez-Ruiz, 2011; Mavroveli et al., 2008). In the present study, we used the Italian version of the TEIQue-CF (Russo et al., 2012). For each participant, a score for the global trait EI was computed. The reliability of the global TEIQue-CF score was very high (Cronbach alpha = .88).

2.2.2. Raven’s Progressive Matrices (Raven, 1981)

Raven’s Progressive Matrices are a measure of pure non-verbal reasoning ability that is thought to be relatively independent of specific learning acquired in a particular cultural or educational context. In this study, we administered the Coloured Progressive Matrices (CPM), a simpler version of the test often used with children. It consists of 36 items presented in three sets of 12 each. Research in many different samples and settings has consistently revealed good psychometric properties for the Raven matrices (Raven, Raven, & Court, 2000). CPM scores were transformed in percentile scores according to Italian age norms (see Belacchi, Scalisi, Cannoni, & Cornoldi, 2008).

2.2.3. Emotional facial expression recognition

Forty-eight colour pictures of faces representing five basic emotions (anger, fear, sadness, happiness, and disgust) and neutral expressions were selected from the Karolinska Directed Emotional

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1 Although a MSCEIT version for the use with children (MSCEIT-Youth Version) is available for research purposes, it is still in development and has no validation in European countries (Widingstad, McCallum, Mee Bell, & Dunn, 2011).
Face System (KDEF; Ludqvist, Flykt, & Ohman, 1998). Eight faces, balanced for gender, were selected for each emotional expression. The 48 pictures were divided into two sets of 24 facial expressions, and each set was arranged in four blocks of six expressions, such that there was one exemplar from each of the six stimulus types in each block. For each set, four different orders of picture presentation were constructed. Stimulus presentation was conducted with an Acer laptop computer with a 2.4 GHz processor and a 21-inch monitor. A refresh rate of 60 Hz and a resolution of 1440 × 900 pixels were used. For each participant, a global emotion recognition ability score was computed on the basis of the accuracy in the recognition of the six facial expressions.

2.2.4. Scholastic achievement
End-of-year grades in language and math were obtained for each pupil from school offices and ranged for both language and math from 4 to 10, with a mean of 7.8 (SD = 1.1) for language and 7.9 (SD = 1.2) for math grades.

2.3. Procedure
The purpose of the study was presented to the school principals and teachers. Informed consent was obtained from parents and all the participants were asked for their personal assent. Children were first given Raven's CPM. It was administered according to standard instructions (Raven et al., 2000) as a group test and took place in classrooms without any time limits. Subsequently, all participants were given the emotion recognition task. Pupils were tested individually in a quiet room arranged for the experimental procedure. Participants sat approximately 1 m from the computer screen on which the pictures were presented. Each face was presented on the screen for a 6-s interval, and after each picture offset, participants were asked to complete a facial expression recognition task. In particular, participants were asked to select one of six emotion labels (anger, sadness, happiness, fear, disgust, and neutral) that best described the emotional expression they saw before. Participants were given 10 s to make their selection, and they were asked to respond as accurately as possible. Finally, the TEIQue-CF was administered in each classroom. All participants filled out the questionnaire individually in their classrooms, after brief group instructions on the answer formats. Administration lasted between 15 and 30 min.

3. Results
Means and standard deviations and correlations between all the study variables are presented in Table 1. A positive correlation between language and math performance emerged, and both of them were positively related to cognitive ability, emotion recognition ability, and trait EI. No relation between trait EI and recognition ability emerged.

Table 1
Descriptive statistics and correlations among the study variables.

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>1. Math performance</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Language performance</td>
<td>.74***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cognitive ability</td>
<td>.40***</td>
<td>.36***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Emotion recognition ability</td>
<td>.12*</td>
<td>.13*</td>
<td>.17**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5. Trait EI</td>
<td>.13</td>
<td>.18**</td>
<td>.13</td>
<td>.02</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>8.19</td>
<td>8.03</td>
<td>61.85</td>
<td>85.99</td>
<td>3.63</td>
</tr>
<tr>
<td>SD</td>
<td>1.09</td>
<td>1.00</td>
<td>25.28</td>
<td>12.07</td>
<td>.38</td>
</tr>
</tbody>
</table>

*p < .05.
***p < .01.
**p < .001.

3.1. Multilevel analyses
Because our data (students nested within classes) are multilevel in nature (Lee, 2000), two multilevel analyses, also known as hierarchical linear modelling, were performed (HLM 6.04 Software; Raudenbush & Bryk, 2002). Given that the aim of this study was to investigate the relations between individual characteristics and academic performance, we focused only on explaining within-class variability in language and math performance.

Since previous studies reported that age and gender could affect our dependent variables (e.g., Hyde, Fennema, Ryan, Frost, & Hopp, 1990), these demographic variables were included in the analyses as control variables together with the three predictors (i.e., cognitive ability, emotion recognition ability, and trait EI). Moreover, on the basis of our hypotheses regarding the interaction between the two emotional measurements and cognitive ability, two-way interaction terms, which were created by mean-centring continuous predictors, were entered. The equations are reported in the appendix.

3.2. Intraclass correlation coefficients
As a preliminary step, for each outcome the unconditional model was estimated. This step yielded the intraclass correlation coefficients (ICC), which revealed the amount of the variability in each academic performance that occurred between or within classrooms. ICC indices showed that 87.8% of the total variance of language performance and 89.6% of the variation of math performance were explained by within-classroom variables.

3.3. Language performance
Results (see Table 2) showed that, controlling for class membership and demographic variables, cognitive ability as well as emotion recognition ability and trait EI positively predicted participants’ final scores in language performance. The positive associations of children’s ability to recognise emotions and trait EI with language performance were specified by the moderating role played by children’s cognitive ability. In order to interpret the nature of these interactions, simple slopes were derived for high (+1 SD), medium (0 SD), and low levels (−1 SD) of cognitive ability (Aiken & West, 1991).

Simple slopes computations revealed that emotion recognition ability was associated with better language performance in pupils with low (b = .02, SE = .003, t = 6.38, p < .001) and medium (b = .01, SE = .003, t = 3.16, p = .002) cognitive ability. In contrast, students’ ability to recognise emotions did not affect language performance at high levels of cognitive ability. As far as the interaction between cognitive ability and trait EI is concerned, similar results were obtained. Indeed, students with low (b = .66, SE = .11, t = 5.99, p < .001) or medium (b = .37, SE = .11, t = 3.36, p = .001) cognitive ability showed better language performance with the increasing of trait EI, while the benefit of trait EI was negligible at high levels of cognitive ability. Overall, individual predictors and interaction terms explained 20.89% of the variance in participants’ language performance (out of 87.8% of the total variability attributable to students’ characteristics).

3.4. Math performance
Results of the model predicting math performance are reported in Table 3. Math scores were positively predicted by cognitive ability and trait EI. Moreover, a significant interaction between emotion recognition and cognitive ability emerged, showing that this emotional ability improved math performance in students with medium (b = .01, SE = .004, t = 2.29, p = .02) or low (b = .02, SE = .004,
In contrast, participants with high cognitive ability showed good performance regardless of the level of their emotion recognition. No significant interaction between trait EI and cognitive ability emerged. The model predicting students’ math performance from demographic variables, individual characteristics, and interaction terms explained 19.2% of within-class variability (89.6%).

4. Discussion

The main purpose of the present study was to determine the predictive validity of trait EI on scholastic achievement in a sample of school-aged children. In addition to trait EI, we explored the impact of a basic emotional ability, the emotion recognition ability, on scholastic success. As hypothesised, both trait EI and emotion recognition ability uniquely predicted academic performance and interacted with cognitive ability in explaining academic performance.

In agreement with Petrides’s results (Petrides et al., 2004), we found an interaction between trait EI and cognitive ability in predicting academic performance. In particular, trait EI was associated with better language performance in children characterised by low or medium cognitive ability. In contrast, trait EI effect did not emerge in pupils characterised by high cognitive ability. This result demonstrated that the importance of trait EI in predicting language performance emerges when the demands of the subject outweigh the child’s intellectual resources. In contrast to high cognitive ability children, students with lower abilities could be forced to draw on other resources (e.g., trait EI) in order to cope with the demands of the subject (Petrides et al., 2004).

We did not find any moderating effect of trait EI on the relation between cognitive ability and math performance. Consistently with the findings of Parker, Creque et al. (2004), Parker, Summerfeldt et al. (2004) and Mavroveli and Sanchez-Ruiz (2011), we found only a direct effect of trait EI on math scores. These data showed that trait EI improved math performance regardless of the children’s cognitive ability. Compared with language, math requires higher levels of mental resources (Downey, Mountstephen, Lloyd, Hansen, & Stough, 2008). Thus, while in language a high level of cognitive ability may be sufficient to cope with the subject demands, the higher complexity of math may require more resources. High trait EI could, for example, help in coping with the anxiety that sometimes is associated with mathematical tasks. Math anxiety is a widely described phenomenon in literature (Ashcraft, 2002), and it is commonly defined as a feeling of tension, apprehension, or fear that interferes with math performance. On the basis of our results, we could hypothesise that, irrespective of students’ cognitive ability level,
trait EI could enable children to cope more effectively with the sources of stress associated with math subjects.

In addition, while previous studies detected a direct influence of specific emotional ability (O’Connor & Little, 2003) on scholastic success, the results of this study also showed an interaction effect between emotion recognition ability and cognitive ability in predicting both language and math performance. Similarly to the trend that emerged in trait EI results, we found that higher emotion recognition ability was associated with better language and math performance only in children characterised by low and medium cognitive ability. In contrast, students’ ability to recognise emotions did not affect language and math performance at high levels of cognitive ability. On the basis of these results, we could assume that when the task demands outweigh the student’s cognitive resources, the child could draw both on basic (emotional perception) and on more complex (trait EI) emotional resources.

Consistently with the independence of trait EI and emotional abilities (i.e., ability EI) constructs, which has been sustained and demonstrated in previous studies (Petrides, 2011), our data did not show any relationships between trait EI and recognition ability. Moreover, an interesting difference between trait EI and recognition ability emerged regarding their effect on math performance. The present study showed that, differently from emotion recognition ability, trait EI had a unique power to predict math performance. In other words, while recognition ability affected math performance only at low and medium levels of cognitive ability and did not have any effect at high levels of cognitive ability, the predictive value of trait EI on math performance was independent from cognitive ability. According to the four branches model of EI (Mayer et al., 2008), the emotional abilities are arranged from more basic psychological processes to higher, more psychologically integrated processes. The emotion recognition ability is a low-level skill, and represents a relatively simple ability. Our findings suggested that this basic ability is effective only at low and medium levels of cognitive ability. Since math is a complex subject and its performance is often associated with negative feelings (e.g., math anxiety), high performance in this subject may require more complex resources when also intellectual abilities are insufficient for facing up to the subject’s problematic requests. From this point of view, trait EI represents a more complex construct than just emotion recognition ability, in that it encompasses various dispositions from the personality domain (e.g., empathy, impulsivity, and assertiveness) as well as elements of social intelligence and personal intelligence, the latter two in the form of self-perceived abilities (Petrides & Furnham, 2000; Petrides et al., 2004). Finally, some limitations should be addressed. Although other studies have explored, among the various emotional abilities, only the emotion recognition ability (e.g., Mavroveli et al., 2009), this emotional process is probably not exhaustive in explaining the predictability of ability EI on scholastic performance. Further studies are needed to explore the effects of the complex ability EI construct on scholastic achievement during development and their incremental validity over trait EI. However, a necessary preliminary step is the development of ability EI measurement methods suitable for use in youths and children and their validation in different countries. Without the diffusion of these instruments, it is impossible to understand whether ability EI could be considered an useful predictor of scholastic achievement during childhood. Moreover, further studies are needed to understand the generalisability of these results across different ages and cultures. Despite these limitations, the present study represents a first exploration of the utility of a multi-method approach to explore how emotional dispositions and abilities influence scholastic achievement. This approach may represent a significant step towards understanding the individual differences emerging during childhood in scholastic performance.

Acknowledgement

We wish to thank K.V. Petrides for his helpful comments on previous versions of the draft.

Appendix A

Equations to test the effect of emotional intelligence and cognitive ability on language and math performance.

Individual level:

\[ Y_i = \beta_0 + \beta_{ij}(\text{age}) + \beta_{2j}(\text{gender}) + \beta_{3j}(\text{cognitive ability}) \]

\[ + \beta_{4j}(\text{emotion recognition ability}) + \beta_{5j}(\text{trait EI}) \]

\[ + \beta_{6j}(\text{emotion recognition ability} \times \text{cognitive ability}) \]

\[ + \beta_{7j}(\text{trait} \times \text{cognitive ability}) + \epsilon_{ij} \]

Class level:

\[ \beta_{0j} = \gamma_0 + \epsilon_{0j} \]

\[ \beta_{ij} = \gamma_{ij} \text{ for } 1 < i < 7 \]

References


