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On the Development of Emotional Intelligence: Two-Wave Study on Early Adolescents

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Abstract

This study focuses on the developmental changes in emotional intelligence (EI) abilities during early adolescence. During class hours, 561 students in the first wave (M_{age} = 12.32, SD_{age} = 1.22, 54.5% of boys) and 369 students in the second wave (M = 13.40; SD = 0.98, 52.3% of boys) completed *Perception of Affective Content in Art Test*, *Analysis of Emotions Test*, *Emotion Management Test* and rated their peers' EI at two waves, 18 months apart. They also completed a *Mill Hill Vocabulary Scale* within the first wave. Students' EI was also rated by their home room teacher and one teacher who completed *Teacher Ratings of EI Questionnaire* specifically designed for this study. Results showed that girls and older students scored higher on EI tests and peers' ratings. Oldest students achieved the lowest scores on teacher ratings. The longitudinal analysis confirmed positive changes between the first and the second wave. Results of both the cross-sectional and two waves analysis revealed significant effects of gender and general cognitive ability, measured with vocabulary test, on EI measures.

Keywords: emotional intelligence, emotional abilities, early adolescence, development, gender differences

Introduction

Research on emotional intelligence (EI) thus far has shown that EI is an important factor for many aspects of life success, like emotional and social functioning as well as school, academic and business success (e.g., Brackett, Rivers,

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& Salovey, 2011; Casale, Tella, & Fioravanti, 2013; Schutte & Loi, 2014; Zeidner & Matthews, 2016). According to EI theory, emotional abilities develop across the life span, and different external influences, like family context and school interventions, can foster their development (Mayer, Caruso, & Salovey, 2016). Knowledge about the courses and correlates of the development of emotional abilities is critical if we think of possibilities of EI growth by planned interventions. However, that knowledge is still deficient, especially when speaking of middle childhood and adolescent age groups (Costa & Faria, 2016).

The first EI conceptualization (Mayer & Salovey, 1997) suggests four levels of emotional abilities ranging from the simplest (i.e., Perception, appraisal, and expression of emotion, 1st level) to the most complex ones (i.e., Reflective regulation of emotions, 4th level). The model still dominates in the field of ability EI research, with some revisions being proposed recently (Mayer et al., 2016). Some new specific abilities were added to each of the initial levels and an idea that specific mental abilities should necessarily coincide with the specific problem-solving areas was abandoned. Following recently proposed Elfenbein and MacCanns (2017) revision, EI consists of six narrow abilities (emotion perception, emotion expression, emotion attention regulation, emotion understanding, emotion regulation of self, and emotion regulation of other) that converge to one general EI factor. Many abilities included in both of these models have been present in psychology research even before EI research occurred. Various empirical data, especially on the development of EI abilities, come from that previous research. The complexity of EI models and a lack of measures intended to measure EI abilities in young samples seem to impede the study of emotional abilities development in the context of EI models.

EI Development

It is well documented that early childhood is a period of intensive development of emotions and emotional abilities, which continues over middle childhood and adolescence (Arterberry, Perry, Price, & Steimel, 2020; Bazhydai, Ivcevic, Brackett, & Widen, 2019; Burnett, Thompson, Bird, & Blakemore, 2010; Chaplin & Aldao, 2013). Adolescence is a period of large changes in physical, cognitive, social and emotional functioning. Thus, progress in emotional abilities is also expected to be noticed during that period. However, available empiric data do not provide clear evidence about the course of its development (Costa & Faria, 2016). Considering perception of emotions, research suggests that it improves throughout adolescence, with different developmental pathways for different emotions (Rodger, Vizioli, Ouyang, & Caldara, 2015; Thomas, De Bellis, Graham, & LaBar, 2007). Still, the dynamics of the development of abilities to perceive particular emotions differs across studies. The evidence on the development of the second level abilities, i.e., those related to emotional facilitation of thinking, is rather scarce (Saarni, 2000). A potential reason could be a lack of sound operationalisations as also suggested by Mayer et al. (2016). The advancement in the emotional understanding abilities during

adolescence is much better documented. It applies, for instance, to the understanding of basic, mixed, and ambivalent emotions (Burnett et al., 2010; Costa & Faria, 2016; Smrtnik Vitulić, 2009; Zajdel, Myerow Bloom, Fireman, & Larsen, 2013) and the awareness of social emotions (Burnett et al., 2010). Furthermore, emotion vocabulary generally improves in this period (Bazhydai et al., 2019) as well as the awareness of one's own emotional cycles (Mayer & Salovey, 1997).

Emotional regulation strategies also show to develop throughout adolescence (De France & Hollenstein, 2019; Demetriou, 2000), but the findings diverge between studies (Silk, Steinberg, & Morris, 2003; Zeman & Shipman, 1997; Zimmermann & Iwanski, 2014). Expressive suppression is thus considered to be a dysfunctional strategy and expected to decline during adolescence. Some data support this hypothesis (De France & Hollenstein, 2019; Gullone, Hughes, King, & Tonge, 2010) albeit others find no change in its usage (Sullivan, Helms, Kliever, & Goodman, 2010) or report on the opposite trend (Zimmermann & Iwanski, 2014). Furthermore, the strategy of reappraisal is expected to increase during adolescence. Some studies show that early adolescents use this strategy more often than late childhood children (Jaffe, Gullone, & Huges, 2010) and that its usage increases from adolescence to adult age (De France & Hollenstein, 2019; McRae et al., 2012). On the contrary, Gullone and associates (2010) found that older adolescents use it less than younger adolescents. Different strategies show different courses of development (Zimmermann & Iwanski, 2014) and their usage seem to vary depending on specific emotion involved (Zeman & Shipman, 1997).

There is considerable evidence showing that women are more successful than men in emotional abilities in different periods of life (e.g., Babić Čikeš & Buško, 2015; Bazhydai et al., 2019; Wright, Riedel, Sechrest, Lane, & Smith, 2018). However, these differences are generally small (e.g., Fischer, Kret, & Broekens, 2018; Salavera, Usan, & Jarie, 2017), or dependent on the type of emotion involved and the context of measurement (Chaplin & Aldao, 2013; Lawrence, Campbell, & Skuse, 2015). For example, when objective measures are used, girls show more of positive emotions, fear, sympathy, shame, contempt and interest while boys show more of anger and joy (Chaplin & Aldao, 2013). Emotions are also more expressed in line with gender stereotypes if a person is in a company of strangers or peers compared to situations when s/he is alone or with parents. Some research showed that gender differences are almost absent during infancy and become more pronounced with increasing age (Chaplin & Aldao, 2013; Zimmermann & Iwanski, 2014). The differences appear larger when abilities are measured by self- or other people reports than by objective measures (Chaplin & Aldao, 2013). Although the differences are to a certain extent related to the innate biological differences, like genetic differences and hormone differences in puberty (Domes et al., 2010), socialization effects also seem to be obvious (Chaplin & Aldao, 2013; Charbonneau & Nicol, 2002). Preschool children acquire emotional skills in the family or other preschool context by learning rule-based skills for emotion regulation, which are to

some extent different for boys and girls. Older, school-age children, apparently use gender-specific knowledge about self as a social being to develop more sophisticated emotional skills (Zeidner, Matthews, Roberts, & MacCann, 2003).

Among important factors considered to contribute to the development of EI are general cognitive abilities. It is well known that cognitive and emotional development are interconnected (Labouvie-Vief, 2015). Also, research shows that EI tests significantly correlate with measures of general cognitive abilities (Evans, Hughes, & Steptoe-Warren, 2019; Kong, 2014) and verbal abilities (e.g., Gil-Olarte Márquez, Martin, & Brackett, 2006; Kong, 2014). Verbal and fluid intelligence, are shown to contribute to the development of emotion understanding in early childhood (Rodger et al., 2015), but there is a lack of data for later developmental periods.

The EI research on younger age groups is generally scarce (Billings, Downey, Lomas, Lloyd, & Stough, 2014) which particularly applies to studies of EI development within ability-based models. This lack of empirical evidence on younger ages can at least partly be attributed to the methodological demands of developmental research, as well as to shortage of EI measures for children and adolescents.

Measuring EI in Younger Age Groups

Different measures of EI abilities – ability tests vs. self-reports – show to converge only mildly, suggesting that they measure different constructs (ability vs. trait EI; Buchich & MacCann, 2019). A main disadvantage of self-reports as measures of own abilities is especially obvious in studies of children and adolescents because the development of their abilities has mostly not finished yet and thus they could have less insight into own abilities compared to adults (Billings at al., 2014).

In EI studies of children, usage of reports provided by persons close to examinees, such as teachers and parents, appears more appropriate (Buško & Babić Čikeš, 2013; Van Rooy, Viswesvaran, & Pluta, 2005). The advantage of other person's reports is access to information about the behaviour of target persons in everyday situations. Moreover, other reports can serve as a valuable source of validation data for EI performance measures. The main disadvantage of this approach is potentially questionable rater reliability. However, it can be attenuated by combining different observers' reports, training of observers' and providing clear and specific descriptions of behaviours in the report questionnaires. Not many EI tests exist for children and adolescents. In addition to *MSCEIT - Youth version* (Mayer, Salovey, & Caruso, 2005, in Rivers, Brackett, & Salovey, 2008), *Swinburne University Emotional Intelligence Test - Early Years* (*SUEIT - EY*; Billings et al., 2014) combines maximum performance tests with self-reports. Other tests that can be found in the literature typically measure just single abilities (Buško & Babić Čikeš, 2013; MacCann, Fogarty, Zeidner, & Roberts, 2011). One of the major problems in EI tests development refers to the answer keys as there is usually not

only one correct response to an item or one algorithm for solving the problem (MacCann, Roberts, Matthews, & Zeidner, 2004; Petrides, Furnham, & Mavroveli, 2007). As far as studies of children and adolescents are concerned, expert scoring is undoubtedly preferable. Nevertheless, any of these EI assessment tools intended for children and adolescents call for more validity evidence. In this study we, therefore, used multiple operationalizations, including performance measures and other reports of specific EI branches.

Aims of This Study

Given rather deficient data on the development of EI in early adolescence, as well as lack of validity data of different methods for measuring EI ability on adolescent samples, this study aimed to compare age and gender effects on EI assessed by different sorts of measures, tests, peer and teacher reports. The second aim was to detect potential changes in EI between two waves 18 months apart, taking into account the role of cognitive abilities in EI development.

Having in mind the findings from different factor-analytic studies conducted under Mayer and Salovey's model, our study included the measures of the first (perception of emotions), third (understanding emotions), and fourth level (managing own and others emotions) abilities of their model (Buchich & MacCann, 2019; Fan, Jackson, Yang, Tang, & Zhang, 2010; Mayer et al., 2016; Roberts et al., 2006).

Following theoretical expectations, we hypothesized that scores on all EI measures would increase with age. Gender, age, and cognitive abilities were expected to contribute to the changes in EI scores, based on the evidence on gender differences in EI (e.g. Bazhydai et al., 2019; Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006), correlations between emotional and general abilities (Evans et al., 2019; Gil-Olarte Márquez et al., 2006; Pardeller, Frajo-Apor, Kemmler, & Hofer, 2017; Van Rooy et al., 2005), and links between emotional and cognitive development (Labouvie-Vief, 2015; Oatley & Jenkins, 2003).

Method

Procedure and Design

This study is a part of a larger research project dealing with the issues of measurement in the area of cognitive and emotional abilities (see *Acknowledgments*). The analyses presented here are based on the project data collected in two waves, 18 months apart. This period was estimated as sufficiently long as to observe the hypothesized developmental changes as well as to avoid eventual retest effects. The data gathered just in the first wave included the measures of verbal abilities, and teacher and peer reports on EI abilities. The data on three ability-based EI measures

were gathered in both waves. The timing for the data collection was negotiated and adjusted to the regular schedules and routines of the schools. Thus, the period between the two waves that this study refers to, covers two school years, from the second month of the first school year (October) until the eighth month of the second school year (April). Headmasters', teachers' and parents' informed consents were gathered before the start of the data collection. Only children who obtained parents' consent participated in the study. Children were informed by investigators about the aims of investigation, confidentiality and their right to give up at any moment. Participants completed the instruments during school classes (two 45 minutes' classes in the first and one 45 minutes' class in the second wave). Having in mind participants' motivation and possible effects of fatigue, instruments were ordered as follows: *The Mill Hill Vocabulary Scale*, *Emotion Management Test* (*TUE*), *Emotion Analysis Test* (*TAE*), *Perception of Affective Content in Art Test* (*TOES*), *Peers' Reports Questionnaire (PR*). Teachers filled out questionnaires (TR) after their classes.

Participants

In the first wave, 561 primary-school students aged 10 to 15 (M = 12.33; SD = 1.22) participated in the study. The students were attending higher grades (5^{th}, 6^{th}, 7^{th} and 8^{th}) of two primary schools in Croatia (convenient sample). The first wave sample consists of 54.5% of male and 45.5% of female participants. There were no gender differences between cohorts ($\chi^2(3) = 2.55$, $p > .05$) and no age differences between boys and girls ($t(559) = 1.37$, $p > .05$).

A total of N = 369 six, seven and eight graders (M = 13.40; SD = 0.98) who attended the fifth, sixth and seventh grade in the first wave participated in the second wave. One hundred and fifty-six students who attended the eighth grade in the first wave did not participate in the second part of the study as they were no longer primary school students. Thus, 65.78% of the beginning total sample or 91.11% of the three cohorts covered by the whole study, took part in the second wave of the study. There were no gender differences between the second wave cohorts ($\chi^2(2) = 3.44$, $p > .05$) and no age differences between boys and girls ($t(367) = 1.82$, $p > .05$). We tested the differences on key study variables between students who participated in the second part of the study and those who did not. It was shown that students who did not participate in the second wave ranked somewhat lower on the *Mill Hill Vocabulary Scale* ($t(559) = 2.50$, $p < .05$), as well as in the TOES ($t(559) = 2.37$, $p < .05$), TAE ($t(559) = 2.43$, $p < .05$) and peer ratings of understanding emotions ($t(559) = 2.10$, $p < .05$). The differences were taken into account in the interpretation of the results of longitudinal analyses.

Instruments

The Mill Hill Vocabulary Scale (Revision; Raven, Court, & Raven, 1988, cited in Križan & Matešić, 2001) was used as a measure of general cognitive capacity intended for early adolescents. Two parallel test forms composed of 32 multiple-choice items and 32 open-ended items were administered. Total score is the sum of correct answers given in all tasks. Cronbach alpha coefficients for all instruments are presented in Table 1.

Perception of Affective Content in Art Test (*TOES*; Takšić, Arar, & Molander, 2004) was used to assess the ability to perceive emotions. Two images (paintings of abstract motives) along with accompanying descriptions of emotions were administered in this study, one showing positive and the other one negative emotion. The participants were asked to assess the degree of presence of each of the 20 descriptors of emotional states in the images and to rate them on a scale from 0 (*not at all present*) to 4 (*fully present*). The test is scored so that the participants' answers to particular items were subtracted from the average expert ratings (3 art therapists and 9 art teachers). The overall score is calculated as the sum of the differences between the participant's ratings and the average expert ratings on specific descriptors. In addition, this sum was subtracted from 100 so that higher overall test scores reflected higher abilities to perceive emotions. Internal consistency of this test in the previous investigation on the adolescent sample was $\alpha = .83$ (Babić Čikeš & Buško, 2012) with a similar value obtained for the present sample (Table 1).

Analysis of Emotions Test (*TAE*; Kulenović, Balenović, & Buško, 2000) is intended to measure the ability to understand emotions. A 32-item version of the test was administered where participants were asked to recognize the emotions that a particular complex emotional state consisted of. For each emotion there are five possible answers (a combination of two emotions), with only one correct. The test is scored according to expert criteria, and the total score is the sum of correct answers to all items.

The test showed reasonable validity and reliability indices in previous uses on early adolescent samples ($\alpha = .74$; Babić Čikeš & Buško, 2012, 2015). Internal consistency of scores obtained on the present sample is satisfactory (Table 1).

Emotion Management Test (*TUE*; Buško & Babić Čikeš, 2013) is designed to assess the abilities to regulate own and others' emotions in early adolescents. It consists of descriptions of situations in which different emotions appear and four possible behavioural answers offered for each of these situations. The task of the participants is to assess the extent to which each of the suggested options is useful in mitigating the negative or maintaining the positive emotions in the situation described on a 5-point scale (1 = *totally useless*, 5 = *very useful*). The accuracy of the answers is determined by the expert criteria where the correct answer is awarded 2, the adjacent answer 1, and others 0 points. The total score is the sum of points in individual items. In this study, a test version composed of 13 situations and 52 items

was administered. Five situations relate to managing own emotions and remaining eight situations to managing emotions of other persons. The emotions of fear, sadness, disappointment, anger, jealousy, happiness and pride were included.

Lower reliability of this test especially in the first wave (Table 1) could be due in part to the complexity of emotion management ability that makes its measurement rather difficult. Internal consistency of other tests intended to measure emotion management was also found lower compared to measures of other branches of EI (Austin, 2010; Côté, Lopes, Salovey, & Miners, 2010). Increase in the alpha coefficient in the second wave suggests that age interval of participants could also affect the reliability of this test.

Peer ratings of EI were collected using the nominations method (Papić & Kulenović, 2003). Participants were asked to nominate three students being, in their opinion, the best and three being the worst in class in a particular EI ability, respectively. The assessed abilities were: recognizing other people's feelings, expressing emotions in words, and controlling one's emotions. Total scores were calculated as the difference between the number of positive and negative selections for each ability. To avoid the scores of negative sign, a constant of 20 was added to each overall score.

Teacher Ratings of EI Questionnaire is applied for the first time in this investigation. It was constructed to measure EI abilities following Mayer and Salovey's model. It is composed of a total of 12 statements, 3 per assessment of each EI ability level (perception of emotions, understanding of emotions, managing own and others emotions). On the Likert-type 5-point scale (1 = *completely inaccurate*, 5 = *completely accurate*) teachers rated the extent to which each statement applied to each student. Each student was rated by two raters – the class teacher and the home room teacher. Each of 31 teachers completed the questionnaires for 26 students on average (Min = 9; Max = 46). The total score for each EI ability was calculated as the average rating by two teachers. The internal consistency measures of the subscales of these questionnaires are given in Table 1.

Results

Main descriptive statistics of variables in both waves are shown in Table 1.

Table 1

Descriptive Statistics and Internal Consistency Measures (α) of Variables Applied in the Two Measurement Points (N_1 = 561; N_2 = 369)

							Skewness		Kurtosis		
	N	Min	Max	*M*	*SD*	K-S	value	*S.E.*	value	*S.E.*	α
1. point											
The Mill Hill Vocabulary Scale	561	8	61	35.89	10.52	0.93	-0.06	0.10	-0.49	0.21	.90
Perception of affective content in art test (TOES)	561	5.89	75.06	52.00	11.58	1.54*	-0.72	0.10	0.66	0.21	.84
Emotional analysis test (TAE)	561	3	29	16.20	5.10	1.55*	-0.22	0.10	-0.41	0.21	.76
Emotion management test (TUE)	561	21	76	55.43	8.59	1.53*	-0.51	0.10	0.50	0.21	.66
Peer ratings of perception of emotions	561	7	35	20.16	3.94	2.67***	0.26	0.10	1.25	0.21	
Peer ratings of understanding of emotions	561	3	35	20.22	4.04	2.29***	-0.27	0.10	1.64	0.21	
Peer ratings of managing of emotions	561	6	33	20.13	3.50	2.07***	-0.32	0.10	1.48	0.21	
Teacher ratings of perception of emotions	517	5	15	10.97	1.99	1.93**	-0.21	0.11	-0.48	0.21	.82
Teacher ratings of understanding of emotions	517	4	15	11.39	2.033	1.73**	-0.26	0.11	-0.42	0.21	.85
Teacher ratings of managing of emotions	517	4	15	10.90	1.916	2.02**	-0.34	0.11	-0.01	0.21	.78
2. point											
Perception of affective content in art test (TOES)	367	7.77	77.81	52.35	11.072	1.03	-0.66	0.13	0.61	0.25	.82
Emotional analysis test (TAE)	369	1	29	16.98	5.520	1.91**	-0.32	0.13	-0.57	0.25	.80
Emotion management test (TUE)	369	16	78	56.46	10.517	2.19***	-1.05	0.13	1.37	0.25	.77

Note. K-S = Kolmogorov-Smirnov test values; *S.E.* = standard error; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Although distributions of the majority of variables departed to some extent from normality, the indices of asymmetry and kurtosis varied within acceptable range which, along with the reasonably large sample size (N_1 = 561; N_2 = 369) and a comparable number of participants in different groups, made the implementation of planned data analyses justified.

Age and Gender Differences in Scores on EI Measures

To test the differences in scores on EI measures among students of different grades (5th to 8th grade) and gender, a multivariate analysis of covariance (2 x 4) was conducted on the first wave data. The scores on the *Mill Hill Vocabulary Scale* were entered as a covariate into analysis to control for the linear effects of general cognitive abilities on the observed differences. Means and standard deviations of EI measures for groups defined by grade and gender are shown in Table 2.

Table 2

Means and Standard Deviations of EI Measures for Groups Defined by Grade and Gender (1st Time Point)

The test	Grade	5th		6th		7th		8th	
	Gender	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
TOES	M	47.71	12.64	49.53	12.14	50.21	11.63	52.13	11.77
	F	49.71	11.59	52.10	10.88	56.58	9.86	56.53	9.96
	T	48.71	12.12	50.72	11.59	52.81	11.35	54.13	10.58
TAE	M	11.94	4.31	11.79	4.07	13.84	4.74	14.06	4.60
	F	13.03	4.21	13.80	3.82	16.36	4.56	17.87	3.59
	T	12.48	4.28	12.72	4.07	14.87	4.82	15.79	4.58
TUE	M	53.68	7.99	51.37	9.11	53.29	9.53	52.72	7.96
	F	56.36	8.12	59.06	6.70	58.48	7.82	60.15	7.77
	T	55.02	8.14	54.95	8.92	55.41	9.21	56.10	8.68
PR of perception	M	18.92	2.89	18.44	2.79	18.65	3.68	18.55	3.35
	F	21.29	3.60	21.57	3.46	22.42	4.47	22.58	4.00
	T	20.11	3.46	19.90	3.48	20.19	4.42	20.38	4.16
PR of understanding	M	18.79	3.74	18.63	3.17	18.75	4.44	18.69	3.59
	F	21.80	3.21	21.70	3.61	22.14	3.98	22.34	3.49
	T	20.30	3.39	20.06	3.71	20.13	4.56	20.35	3.98
PR of managing	M	19.55	2.69	19.19	3.38	19.58	4.02	19.49	3.22
	F	20.88	3.26	21.00	3.14	21.11	3.25	20.76	4.05
	T	20.21	3.05	20.03	3.38	20.20	3.79	20.07	3.67
TR of perception	M	10.54	2.19	10.23	1.51	10.77	2.03	9.64	1.72
	F	11.80	1.54	12.07	1.51	11.84	1.91	11.46	2.02
	T	11.17	1.99	11.09	1.77	11.17	2.05	10.47	2.06
TR of understanding	M	10.95	2.11	10.76	1.61	11.30	2.08	9.98	1.90
	F	12.11	1.76	12.23	1.51	12.57	1.90	11.86	1.93
	T	11.53	2.02	11.44	1.72	11.77	2.10	10.84	2.13

The test	Grade	5th		6th		7th		8th	
	Gender	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
TR of managing	M	10.73	2.06	10.31	1.82	10.59	2.17	9.94	1.73
	F	11.48	1.48	11.87	1.49	11.76	1.80	11.10	1.73
	T	11.11	1.83	11.03	1.84	11.03	2.11	10.47	1.82

Note. TOES = Perception of Affective Content in Art Test; TAE = Emotion Analysis Test; TUE = Emotion Management Test; PR = Peer ratings of perception, understanding and managing emotions; TR = Teacher ratings of perception, understanding and managing emotions; T = total sample size.

The analysis showed significant main effects of both, gender, $F(9, 500) = 13.79$, $p < .001$, Wilks' $\lambda = .80$, partial $\varepsilon^2 = .20$, and classes, $F(27, 1460.90) = 3.63$, $p < .001$, Wilks' $\lambda = .83$, partial $\varepsilon^2 = .06$. Covariate's effect proved significant too, $F(9, 500) = 51.17$, $p < .001$, Wilks' $\lambda = .52$, partial $\varepsilon^2 = .48$, whereas the gender x age interaction was not found statistically significant, $F(27, 1460.90) = 1.26$, $p > .05$, Wilks' $\lambda = .94$, partial $\varepsilon^2 = .02$.

Following the outcomes of the multivariate tests, two discriminant analyses were performed using the same nine discriminant variables (EI tests, peer and teacher ratings of EI abilities) and groups defined by gender and cohorts of students, respectively. The first analysis yielded significant discriminant function showing that around 24% of the overall variance can be attributed to gender differences (Table 3).

Table 3

Significance Test, Eigenvalue (λ), *Wilks' Λ, and Canonical Correlation of Discriminant Function for Groups Defined by Gender*

Function	Canonical correlation	Eigenvalue (λ)	Wilks' Λ	Chi-Square	*df*	Sig.
1	.49	0.31	.76	138.43	9	.000

Note. df = degrees of freedom; Sig.= significance of Chi-Square Test.

Majority of performance and rating EI measures contributed to the meaning of derived function, with an emphasis on peer and teacher ratings of perceiving and understanding emotions (Table 4).

The values of group centroids showed that girls scored somewhat higher ($C_F = 0.62$) than boys ($C_M = -0.50$) on the derived discriminant function. A posteriori classification data also spoke of rather modest albeit significant intergroup differences based on the performed multivariate test (69.62% accurately classified cases).

Table 4

Standardized Discriminant Function Coefficients and Structure Coefficients with Groups Defined by Gender

EI measures	Standardized Coefficients	Correlations
TOES	-0.01	.28
TAE	0.01	.44
TUE	0.27	.55
P.- perception	0.44	.82
P.- understanding	0.39	.81
P.- managing	-0.21	.38
T.- perception	0.40	.71
T.- understanding	0.21	.66
T.- managing	-0.31	.55

The second discriminant analysis examined the differences among different cohorts of pupils. The analysis produced only one significant discriminant function (Table 5) defined by scores on TAE (r = .67) and TOES (r = .40) and to a lesser extent by teacher ratings of EI ability (r's ranging from -.28 to -.30; Table 6). Correlations of other variables with that function were low (p < .20). High scores on the function were achieved by students who scored higher on performance measures of perception and understanding of emotions and lower on teacher ratings.

Table 5

Significance Tests, Eigenvalue (λ), *Wilks' Λ, and Canonical Correlation of the First Two Discriminant Function for Groups Defined by Cohorts of Students*

Function	Canonical correlation	Eigenvalue (λ)	Wilks' Λ	Chi-Square	*df*	Sig.
1	.40	0.19	.80	111.49	27	.000
2	.19	0.04	.96	21.74	16	.152

Note. df = degrees of freedom; Sig. = significance of Chi-Square Test.

Table 6

Standardized Discriminant Function Coefficients and Structure Coefficients for the First Canonical Discriminant Function with Groups Defined by Cohorts of Students

EI measures	Standardized Coefficients	Correlations
TOES	0.25	.40
TAE	0.93	.67
TUE	-0.04	.13
P.- perception	0.20	.09
P.- understanding	0.04	.02
P.- managing	-0.18	-.05
T.- perception	-0.39	-.30
T.- understanding	-0.44	-.28
T.- managing	-0.06	-.29

Group centroids for the 4 groups of students are given in Table 7. The students of the fifth grade scored the lowest, whereas the eighth graders scored the highest on the function. The adjacent classes showed the biggest difference between the seventh and the eighth grade, while the difference between fifth and sixth grade was the smallest. However, all the observed differences appeared quite small. Also, the TAE and TOES positively correlated with the function, while teacher ratings correlated negatively. The results indicated the growing trajectory of change on EI tests, as we expected, while the trend was opposite on teacher ratings.

Table 7

Group Centroids of Participants from Different Classes on the First Discriminant Function

	5th grade	6th grade	7th grade	8th grade
Function 1	-0.44	-0.35	0.07	0.66

Changes in EI Test Scores

Repeated measures multivariate analysis of covariance (MANCOVA 2 x 2) was performed to examine the changes in EI test scores for boys and girls within the 18 months' interval, while controlling the effect of general cognitive capacity. Significant differences in EI test scores were found between the two waves ($F(3, 362) = 3.78$, $p < .05$, Wilks' $\lambda = .97$, partial $\varepsilon^2 = .03$) and between male and female participants ($F(3, 362) = 18.75$, $p < .001$, Wilks' $\lambda = .87$, partial $\varepsilon^2 = .14$). Interaction of wave and gender was also found significant ($F(3, 362) = 8.03$, $p < .001$, Wilks' $\lambda = .94$, partial $\varepsilon^2 = .06$). Effect of the covariate was significant ($F(3, 362) = 127.03$, $p < .001$, Wilks' $\lambda = .49$, partial $\varepsilon^2 = .51$), while interaction of wave and general cognitive ability was not ($F(3, 362) = 2.04$, $p > .05$, Wilks' $\lambda = .98$, partial $\varepsilon^2 = .02$).

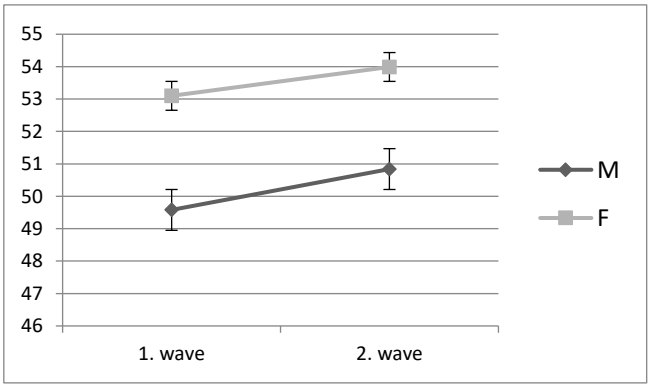

Figure 1. Means of male and female participants on Perception of affective content in art test (TOES) results in two time points.

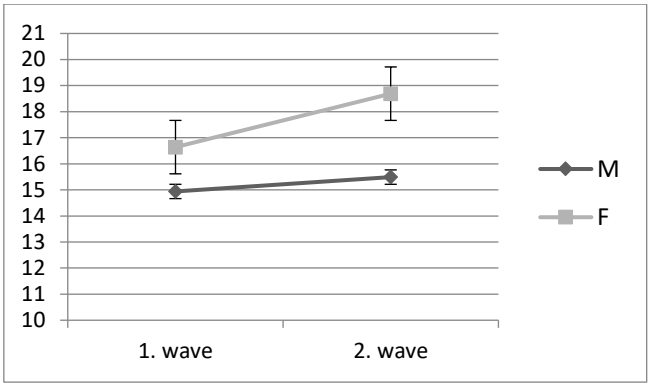

Figure 2. Means of male and female participants on Emotional analysis test (TAE) results in two time points.

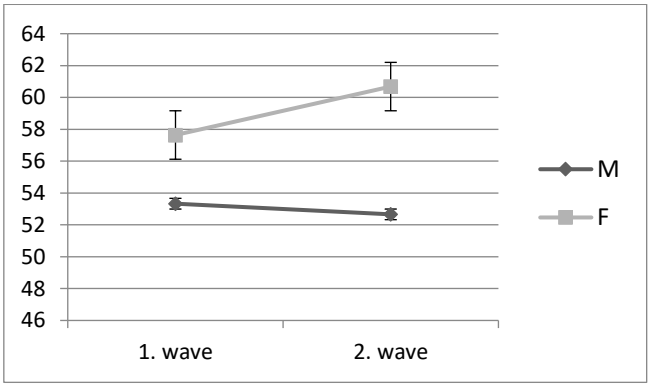

Figure 3. Means of male and female participants on Emotion management test (TUE) results in two time points.

Univariate tests (ANCOVAs) showed that TOES ($M_1 = 51.26 > M_2 = 52.35$, $F(1, 364) = 3.93$, $p < .05$) and TUE ($M_1 = 55.39 > M_2 = 56.51$, $F(1, 364) = 7.45$, $p < .01$) scores could account for the observed differences between two waves, and TAE ($F_{TAE}(1, 364) = 10.98$, $p < .01$, and TUE, $F_{TUE}(1, 364) = 16.97$, $p < .001$) for the interaction of gender and repeated measurements. A greater increase in TAE scores during the eighteen-month period was observed in girls than in boys. Similarly, a greater increase in TUE scores was shown in girls than in boys, whose scores decreased. Figures 2 and 3 show the means of boys and girls in these tests at two waves of measurement. As for the TOES scores, no significant interaction between wave and gender occurred ($F(1, 364) = 0.00$, $p > .05$). Effect of general cognitive ability was significant for all EI tests ($F_{TOES}(1, 364) = 95.97$, $p < .001$, $F_{TAE}(1, 364) = 374.52$, $p < .001$, $F_{TUE}(1, 364) = 55.79$, $p < .001$), as well as gender effect ($F_{TOES}(1, 364) = 5.58$, $p < .05$, $F_{TAE}(1, 364) = 18.83$, $p < .001$, $F_{TUE}(1, 364) = 50.50$, $p < .001$).

Finally, the scores of students of same grades, but different cohorts in EI tests were compared (that is, the students attending 6th, 7th, and 8th grade in the first wave were compared to students attending 6th, 7th, and 8th grade in the second wave, respectively) by ANOVA. Majority of differences appeared to be insignificant. The only significant differences were shown for TAE in the 6th ($M_1 = 14.63 < M_2 = 15.96$, $F(1, 228) = 4.40$, $p < .05$) and 7th grade ($M_1 = 17.03 > M_2 = 15.71$, $F(1, 262) = 4.02$, $p < .05$).

Discussion

Three different measurement methods (performance-based tests, peer and teacher reports) were used in this study to assess age and gender differences in EI. Still, EI tests were administered in two waves to examine average changes in the EI measures employed. Age-related changes can be deduced entirely based on longitudinal data differentiating between the age effect and the cohort effect. However, we analysed cross-sectional data too, because the age range of participants (10 to 15) was wider than the age range followed longitudinally (1.5 years). The analysis of cohort differences revealed age variations in EI that mainly applies to the abilities to perceive and understand emotions, suggesting the existence of developmental trends. However, the direction of the observed age differences appears to depend on the source of EI data, that is, the way the EI dimensions were assessed. Older students scored higher on ability-based tests, but lower on teacher ratings. Yet, it should be noted that the obtained differences were rather small. Previous studies showed that the ability to perceive emotions improves in adolescence, but developmental pathways differ for different emotions (Rodger et al., 2015). The test of emotion perception used in our study includes tasks of perceiving emotions in art pictures with emotionally positive and negative content. Participants were to appraise the presence of twenty different emotional states in the pictures, so the repertoire of emotions included was rather wide. It might have been the case that the differences in perception of some emotions appeared to be considerable but non-existent for some other emotions so that taken together, an improvement throughout adolescence, as observed on the level of composite scores, appeared rather small. Another potential reason for the obtained small differences between cohorts might have to do with an aspect of the perception of emotion that we measured. Saarni (2000) stated that during adolescence the progress is detected in awareness of one's emotions, and we assessed perception of emotions in an outside, inanimate object in which the progress could be smaller. Besides, the differences in TAE are in line with other research showing the improvement in understanding of mixed emotions (Burnett et al., 2010; Costa & Faria, 2016; Zajdel et al., 2013).

Furthermore, no cohort differences in the adolescents' ability to manage emotions were detected. Albeit the result is unexpected, no other studies, at least to

our knowledge, reported findings on similar age groups differences in the abilities to manage emotions conceptualized within Mayer and Salovey's model. Available studies investigated some specific regulation strategies, with inconsistent findings on the development (De France & Hollenstein, 2019; Silk et al., 2003; Zimmermann & Iwanski, 2014). Beside somewhat lower reliability estimated for TUE, we might have failed to include some aspect of the ability to manage emotions which is supposedly subject to change at early adolescent age. Moreover, we measured the ability in general, including different emotions, different strategies and managing one's own and others' emotions. That complexity could have affected results in a way that eventual specific change occurring in early adolescence happened to remain hidden.

Another unexpected result was the teachers' lower scores of emotional abilities given to older students. Behavioural manifestations of students' capacities might be affected by hormonal changes and related heightened level of emotionality. On the other hand, older students, and eighth-graders in particular, might fit poorly into the primary education system, both because of manifold pubertal changes and the approaching completion of primary education, which may explain why they are assessed by teachers as less emotionally capable. Teachers' expectations are also likely to have an impact on their own ratings, so that higher expectations from older students may result in lower ratings of EI abilities.

Nevertheless, different trajectories of changes in measures of the same abilities gathered from different sources have brought about the question of whether we measure the same construct, or do different sorts of measures used, measure unrelated aspects of emotional functioning of adolescents. Further studies using new and improved operationalisations of this EI branch, e.g., situation-specific measures, use of objective tests with situations presented through video materials, use of ability ratings given by family members, close friends, and the like, should help clarify whether the observed differences have more to do with measurement issues or the structure of emotional abilities.

Previous investigations suggested that females were slightly better in all EI abilities and that gender differences were more pronounced in self and other people reports compared to ability tests (e.g., Babić Čikeš & Buško, 2015; Bazhydai et al., 2019; Chaplin & Aldao, 2013; Downey, Mountstephen, Lloyd, Hansen, & Stough, 2008). However, early adolescence is the period of intensive development that girls enter earlier than boys. Accordingly, we expected girls to score higher in all EI measures, including peers' and teachers' reports. Our study confirmed these expectations, with some exceptions. All EI measures contributed to the observed gender differences, the most evident being peer and teacher ratings of recognizing and understanding emotions. It seems that differences are more obvious at the behavioural level in everyday situations than at the level of latent abilities. At least two possible explanations could be offered. One is that, regardless of the degree to which they possess them, women use their emotional abilities more widely in their

everyday life, which is why such abilities are more visible to those who rate them. The other interpretation is that observers are more inclined to perceive emotional skills in women. Given the socialization processes underlying gender differences in processing of emotions (e.g., Kennedy Root & Denham, 2010) both explanations look grounded to some extent.

Gender differences were the least visible on the TOES and peer ratings of managing emotions. Other studies also report higher scores of girls on peer-rated ability to perceive and understand emotions (Charbonneau & Nicol, 2002), but not on the ability to manage emotions (Buško & Babić, 2006). It seems that girls are seen as having more knowledge about emotions, but not having better regulation strategies. Furthermore, results revealed no gender by age interaction in cross-sectional data which challenges the findings of an increase of gender differences with age (Chaplin & Aldao, 2013; Zimmermann & Iwanski, 2014).

The analyses of two-wave data revealed the changes in TOES and TUE test scores over the year and a half period on a sample of students who attended the fifth, sixth and seventh grade in the first wave. These results are only partially consistent with the results of the cross-sectional data analysis, where the differences among cohorts were most pronounced in TAE and TOES. TAE measures the understanding of emotional speech, and out of all EI measures used it shows the highest correlation with verbal abilities. The observed progress in TAE scores might be due to the advancement in verbal abilities, especially given the age differences in Vocabulary Scale scores. In longitudinal research on high school students (Costa & Faria, 2016) verbal abilities correlated with the initial level of understanding emotion, but not with the progress in that ability during the investigated period.

Interestingly, TUE scores showed no progress with age in cross-sectional analysis while two waves analysis revealed significant improvement in this ability. Individual changes in emotional management ability are not visible on the average level. The fact that longitudinal analysis covers shorter period than cross-sectional makes this finding even more interesting. The same analysis demonstrated gender differences in changes in TAE and TUE scores. In both tests an increase over a year and a half period was shown by girls, whereas a slight decrease in TUE scores was recorded in boys. The finding is probably explainable by the developmental differences, i.e., a delayed occurrence of pubertal changes in boys when compared to girls, which was also visible both on the level of cognitive abilities and in gender differences in verbal abilities, found in our and other studies (Davies & Rose, 1999).

Results of both the cross-sectional and two waves analysis revealed a significant effect of general cognitive ability on all EI measures. This is probably partly due to verbal content of EI tests but is also theoretically expected in view of the role of verbalization of emotional experience in emotion processing (Austin, 2010; Ackerman & Izard, 2004). The results of the longitudinal analysis could be affected by the retention of participants. Students who did not participate in the second wave scored somewhat lower in the *Mill Hill Vocabulary Scale*, TOES and TAE. The

observed changes in the EI tests might thus have been underestimated to some extent, especially considering the role of verbal abilities in the development of EI abilities.

Longitudinal-sequential design enabled us to compare EI scores of participants of the same age but belonging to different cohorts. In general, no noted differences were observed between cohorts. The only significant differences were found in 6th and 7th grade participants in TAE scores, with the opposite directions of the observed differences. There seems that no confounding factors related to the cohorts compared nor repeated measurement had an effect on the obtained results.

Finally, several limitations of this study should be stated. They primarily refer to the research design and the selection of some measurement methods and instruments. Although our research enabled analyses and mutual comparisons of cross-sectional and the data on the changes of EI in early adolescence, only performance-based measures were administered twice. Longitudinal design with more waves and repeated measurements of all the variables used would provide a more complete and clearer picture of EI development. Research problems dealt with in this study focused on average intergroup differences with groups defined by age, and the average differences in scores of the same groups in different time points, that it, observed prospectively. Thus, all the data are analysed on a group level using multivariate analyses of (co)variance with the cross-sectional and repeated measures data. Albeit the analyses applied are suitable for the stated research questions and the given methodological circumstances, its obvious limitations are worth mentioning. Stronger prospective designs including more waves of data, as well the analyses done on latent variables would, of course, enable studying the trajectories of latent changes. Furthermore, psychometric properties of some of the instruments (i.e., TUE) were weaker than expected. The nature of the measured constructs, i.e., its complexity and developmental aspects, could have affected the reliability of the measures. This issue, however, should be explored in further studies with multiple waves and different sources of reliability estimates. Additionally, for the peer ratings, it should be checked if an unlimited number of nominations results with better interindividual score discrimination. Regarding teacher ratings, the obtained high correlations between ratings of different EI abilities, suggesting the presence of hallo effect, speak of its low discriminant validity in EI research. Prior training of teachers about EI abilities as well as collecting data from a larger number of raters should lessen these effects and make teacher ratings more effective.

Conclusion

The study showed that girls and older adolescents scored higher on EI measures. The exceptions of these general findings were the results based on teacher ratings of EI abilities showing lower scores for eighth graders compared to others. Furthermore, the study confirmed significant changes in EI in the 18 months' period

as measured by performance-based instruments. Overall, it could be concluded that both the size and trajectories of change in EI abilities during early adolescence vary with gender, the EI dimension examined and the measures applied. These results should be re-examined by new longitudinal studies including preferably a longer period of development, more waves and smaller periods between waves. Challenge for developmental research is certainly a construction of comparable instruments intended to measure EI in different developmental periods. Lastly, investigation of emotional abilities in an emotion-specific manner and with reference to specific contexts (e.g., family, school) might be a promising research path.

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