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Trajectories of implicit theories of intelligence and emotional intelligence in secondary school

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Abstract
This study examined and compared how the trajectories of two types of implicit theories (IT; general intelligence and emotional intelligence EI) evolve over the 3-year period of the Portuguese secondary school period. The effects of students' gender, academic achievement, and EI on the developmental path of IT were also explored. Two hundred twenty-two students participated in a 3-wave study from 10th to 12th grade, were aged 14 to 18 years old (M_{age}= 15.4; SD=0.63) in the first round of data collection, and were mostly female (58.6%). The findings indicate the stability of students' implicit beliefs of intelligence over secondary school and, in turn, the continuous evolution of students' incremental IT of EI. Students' gender and previous levels of trait EI influenced the IT's change patterns. The findings are discussed based on the relevance of the educational context to foster incremental beliefs about school-related attributes for all students.

Keywords Implicit theories · Intelligence · Emotional intelligence · Secondary school · Parallel process models · Latent growth curve modeling

1 Introduction

Adolescents face important developmental challenges during the transition to secondary school, with substantial changes occurring in academic, social and familial environments that pose both setbacks as opportunities for individual growth (Crockett & Silbereisen, 2000; Sawyer et al., 2018; Somerville et al., 2010). In addition to increasing autonomy and the adoption of different and/or new roles in familial and social contexts (Lerner & Steinberg, 2009) in parallel with progressive responsibility for educational outcomes, adolescence can pose quite a challenge (Benner, 2011; Benner & Graham, 2009). Moreover, secondary school represents an important flex-

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ibility of students' educational trajectories (Yeager et al., 2019), whether in terms of alternative vocational courses or students' autonomy to define their educational paths. The literature has shown that students' grades tend to decrease during the transition to secondary school and frequently do not recover (Yeager et al., 2019) and that academic and emotional experiences in this period will likely determine students' future academic and professional paths.

Since difficulties in the transition to secondary school can lead to marked differences in human capital over time in adulthood (Yeager et al., 2019), educational agents and researchers have made significant efforts to address the factors that can contribute to students' adaptation, coping, and emotional and academic progress throughout this period (Lerner et al., 2005). Accordingly, implicit theories (IT) research which refers to individuals' beliefs of malleability or predeterminism of certain attributes has extended from its original domain (intelligence; Dweck 1999) to general and specific personal and collective dimensions, since it has been confirmed that different beliefs can either strengthen or undermine diverse outcomes and that people might hold relatively independent implicit beliefs across domains (Dweck, 2012). Moreover, the literature has shown that IT can change spontaneously over time in learning contexts (e.g., Dai & Cromley, 2014; Gonida et al., 2006; Shively & Ryan, 2013).

Therefore, the current study focuses on the developmental changes of IT during the secondary school period as a relevant developmental period for individuals' emotional and academic progress and explores and compares different types of IT of intelligence (general and emotional intelligence) during the 3-year secondary school period.

1.1 Implicit theories (IT) research

People who hold beliefs about the non-malleability or predeterminism of different attributes are considered "entity or fixed theorists", while those who understand such domains to be malleable and, at some extent, mutable are referred to as "incremental theorists" (Dweck et al., 1995). Thus, implicit theories are conceptions related to people's ability to control or change certain domains, yet to change those attributes, opportunity, motivation or instruction are required (Carr et al., 2012).

To this point, the literature in the field of IT has moved forward from the original IT of intelligence's model and extended research to different personal or collective domains. There is strong empirical evidence that having incremental IT (e.g., emotion, intelligence, relationships, health) is related to positive effects or outcomes such as mental health, well-being, social relationships, academic achievement, and job performance (Burnette et al., 2010; Chiu et al., 1997; Costa & Faria, 2018; Dweck, 2012; Knee et al., 2004; Tabernero & Wood, 1999; Tamir et al., 2007).

IT research is grounded in Dweck and colleagues' social-cognitive model of achievement motivation (Dweck, 1986, 1999; Dweck et al., 1995; Dweck & Leggett, 1988), which states that implicit theories of intelligence support different types of achievement goals that lead to specific patterns of learning results. In this model, the individual who holds the belief that intelligence is an unchangeable trait, i.e., a fixed trait, is considered to have an entity theory of intelligence, whereas the individual who perceives it as malleable or dynamic endorses an incremental theory of intel-

ligence (Dweck, 1999; Dweck et al., 1993; Dweck & Leggett, 1988; Plaks et al., 2005). Research has provided support that these two types of beliefs lead to different considerations about the role of ability and effort in achieving performance; entity theorists tend to consider ability or inability as the source of their performance and, thus, in case of failure are more likely to give up, whilst incremental theorists tend to value effort as the base of their performance and thus, when facing challenges, will probably try harder and persevere (Dweck, 1999; Dweck & Leggett, 1988; Hong et al., 1995, 1999). Entity theorists often present strategies for achieving goals (performance goals), avoiding challenging tasks, working to gain favourable judgements or avoiding negative judgements of their ability when they face difficulties, and they are less confident in their potential success (Nussbaum & Dweck, 2008; Thompson & Musket, 2005). Incremental theorists focus on the learning process by developing their competence through hard work (mastery goals), engaging in difficult tasks as learning opportunities, and exhibiting more confidence about their potential success (Henderson & Dweck, 1990; Robins & Pals, 2002), greater school persistence intentions or motivation (Renaud-Dubé et al., 2015). Recent meta-analytic reviews have indicated that endorsing an incremental IT of intelligence is associated with better academic achievement, students' learning goals, mastery-oriented strategies and positive expectations for success (see reviews Burnette et al., 2013; Costa & Faria, 2018; Sisk et al., 2018).

The IT of emotion or emotion-related attributes was more recently explored in the literature and provided evidence of the particular leverage of incremental theorists (Cabello & Fernández-Berrocal, 2015; Costa & Faria, 2020b; Tamir et al., 2007; Romero et al., 2014), indicating that incremental theorists are more likely to engage in greater self-regulation and experience positive emotions (Dweck & Molden, 2005; Shih, 2011). In particular, the precursory work of Tamir and colleagues (2007) on IT of emotion, that assessed the individual's belief about the possibility of changing their emotional states, conducted within the transition to college found that incremental emotion theory is associated with emotional and social adjustment and supports the medium effects of IT. At the end of the first year of college, incremental theorists describe higher levels of well-being, fewer depressive symptoms, and better social adjustment. Additionally, with younger middle school students, research has found that incremental theorists achieve better academic outcomes, choose harder options for math courses, demonstrate well-being, and report fewer depressive symptoms over time (Romero et al., 2014).

Within the domain of emotion-related constructs, the IT of emotional intelligence, which refers to people's belief about the ability to control or change their emotional expression and perception, understanding, use of emotion to facilitate thought or emotional regulation, has been recently explored. The findings show that more dynamic implicit beliefs of emotional intelligence (EI) are related to better EI performance, which is a conclusion that could result from the likelihood that incremental theorists consider new challenges or difficult emotional situations as both needed and significant to improve their abilities and competencies (Cabello & Fernández-Berrocal, 2015). In a study of secondary school, the IT of emotional intelligence predicted future students' EI perceptions but not their performance at this level (Costa & Faria, 2020b). Nonetheless, although the IT of EI did not impact students'

academic achievement (GPA), reinforcing the IT domain specificity, it did have an effect on trait EI dimensions that, in turn, predicted academic outcomes. Thus, the recent literature has highlighted that the implicit beliefs that individuals endorse can have effects on performance and motivation, independent of their actual abilities or aptitudes (Dweck, 1999, 2006). This finding supports the relevance of IT in the face of transitions or challenging periods, such as those that take place frequently in the academic context.

Currently, research in the field provides support for the domain specificity of implicit beliefs and the relative independence of implicit beliefs regarding different attributes (Chiu et al., 1997; Dweck et al., 1995; Hong et al., 1997). First, one person can endorse different types of IT (Dweck, 2012) and, second, outcomes related specifically to a given type of IT will entail a stronger association than to other unrelated IT (Costa & Faria, 2020b; Dweck et al., 1995).

The influence of gender on IT has been vastly explored in the field. In general, gender has different effects across IT domains. Regarding the IT of intelligence, previous studies have found that female students present more entity perspectives of intelligence than male students (Dweck, 1999; Pepi et al., 2006), but recent meta-analytic reviews have exhibited non-significant moderation results (Burnette et al., 2013; Costa & Faria, 2018). In the field of emotion-related attributes, although the number of studies is still scarce, some inconsistency is present regarding whether girls are more likely than boys to endorse incremental theories of emotion and emotional intelligence (Cabello & Fernández-Berrocal, 2015), while another work did not find support for differences across gender groups (Romero et al., 2014).

1.2 Developmental Trajectories of Implicit Theories

Within the range of motivational dispositional traits, IT is generally interpreted as a predisposition that is relatively stable in nature (Dweck, 1999). Nonetheless, based on the findings of diverse interventions, some studies have accounted for the possibility of change on IT (e.g., 2007; Burnette & Finkel, 2012).

Additionally, Dweck and Molden (2005) considered that IT could change over time without a formal intervention or programme because such beliefs are conditional on the surrounding context and environment. Concerning the academic context, where the trajectories of IT of intelligence have been explored, the different educational periods could influence students' beliefs about their intelligence. Eccles et al. (1993) suggested that students could develop an increasing entity perspective through elementary and extending into secondary school because the elementary periods are based on the learning process instead of performance, while at secondary school, as the final stretch of mandatory educational training, the future academic and/or professional path is mostly determined by the level of students' performance or academic outcomes on progressively difficult subjects, content and academic evaluations. The level of academic demand can make students revise their beliefs about their ability to address the requirements, which can lead them to endorse a more entity perspective of intelligence when considering that to succeed on that period, top ability and not only effort has to be present (Eccles et al., 1993).

Studies reporting potential changes in IT over time are relatively scarce, and to this point, only the developmental trajectories of IT of intelligence have been addressed in the literature. While few studies have found results that have indicated that entity beliefs tend to increase over time when compared to incremental perspectives (e.g., Dai & Cromley, 2014; Flanigan et al., 2017; Shively & Ryan, 2013), most of the previous work did not find the growth of any implicit beliefs (Robins & Pals, 2002). Notably, most of the research conducted has included college students (Dai & Cromley, 2014; Flanigan et al., 2017; Robins & Pals, 2002; Shively & Ryan, 2013), while one focused on elementary school students (Gonida et al., 2006), and only one addressed the secondary school period (Lee & Seo, 2019). In general, most of the studies found an increase in the entity perspective of intelligence over the analysed period of time, and in the recent work of Lee and Seo (2019) they also found a simultaneous increase in incremental IT. On the other hand, Robins and Pals (2002) found stable trajectories of IT of intelligence, yet the authors adopted a wider period of time (4-year longitudinal design). Thus, these inconsistent results could be explained mainly by the lack of longitudinal studies, the different longitudinal studies' lengths and number of measurement points, or even the distinctive academic periods addressed (Lee & Seo, 2019).

1.3 The Present Study

Secondary school represents a particular challenging period in students' experience that is marked by increased stress and a decline in self-esteem, perceived ability, school engagement, and academic achievement (Fredricks et al., 2004; Jacobs et al., 2002; Watt, 2004; Wigfield et al., 1996). This normative developmental phase becomes a relevant specific stimulating period given the possibility of shaping and producing significant changes in the way students perceive their personal abilities, whether academic, emotional, or social. Because the development of positive attributes can have lifelong impacts, it is important to clarify how IT develops through particular relevant stages. However, to date, the lack of studies has not clarified the possible patterns of change in students' IT; to the best of our knowledge, only one study has addressed the change in IT in secondary school and late adolescence (IT of intelligence; Lee & Seo, 2019).

Thus, the present study intends to extend the available empirical evidence of the developmental trajectories of IT over a 3-year secondary school period by analysing and comparing the IT of general intelligence and of emotional intelligence. The option for analysing two independent IT domains is based (1) on the implicit theories' domain specificity, (2) on the lack of research comparing different IT domains' trajectories and (3) on the relevance of students' beliefs at the academic and emotional levels at an important transitional stage. Moreover, the effect of students' gender, academic achievement and emotional intelligence on the developmental path of IT will be explored. To achieve the study's general goal, particular research questions are defined as follows: (a) Does IT of intelligence and of emotional intelligence develop throughout the three years of secondary school period?; (b) Are the developmental paths of IT of intelligence and of emotional intelligence throughout the secondary school period similar?; and (c) Does students' gender, academic achievement, and

emotional intelligence act as moderators of the developmental trajectories of students' IT?

2 Method

2.1 Participants

A total of 222 Portuguese secondary school[1] students (129 female and 93 male) took part in a longitudinal study throughout three years of secondary school (10th to 12th grade; 42.4% of the initial students' sample in 10th grade, $N=523$, 26 classrooms; 64.8% of the students' sample in 11th grade, $N=343$, 24 classrooms). In 10th grade, the participants ranged from 14 to 18 years old ($M=15.4$; $SD=0.63$), and the largest share were from a high parental socioeconomic status (37.7% high, 28.8% middle, and 33.5% low). The participants were enrolled in different academic courses, with the majority of the sample enrolled in science and technology (76.1%), followed by languages and humanities (19.4%) and other courses (4.6%), which follows the national trend (DGEEC, 2018).

2.2 Measures

Implicit Theories of Intelligence Scale. The ITIS assesses students' IT or beliefs about the malleability of intelligence and comprises 12 items: six incremental (e.g., *"Whenever I learn new things my intelligence increases"*) and six entity (e.g., *"Personally I don't think I can do much to increase my intelligence"*), which are rated on a 6-point Likert-type scale ranging from 1 (*strongly agree*) to 6 (*strongly disagree*). The ITIS is founded on an adaptation of the Personal Conceptions of Intelligence Scale developed by Faria (2006) to the Portuguese context. Incremental items are reverse-scored so that the total score of the scale indicates a measure of students' incremental beliefs. In this study, the ITIS presented very good internal consistency (total scale, $\alpha=0.88$; incremental ($\alpha=0.82$) and entity dimensions ($\alpha=0.86$)).

Implicit Theories of Emotional Intelligence Scale. The ITEIS evaluates individuals' IT about the malleability of emotional intelligence and includes a total of 12 items rated on a 6-point Likert-type scale, ranging from 1 (*strongly agree*) to 6 (*strongly disagree*), with six incremental IT items (e.g., *"Every time I learn with new experiences, my emotional intelligence increases"*) and six entity IT items (e.g., *"My emotional intelligence is something about me that I personally can't change very much"*). Based on Dweck's (1999) original theorization of IT of intelligence, the ITEIS was developed and adapted by Costa & Faria (2020a) for the Portuguese secondary school context. The scale has a two-factor structure and sound psychomet-

[1] In Portugal, secondary school corresponds to the 3rd level of the International Standard Classification of Education (ISCED), lasts for 3 years, comprises 10th, 11th and 12th grades, and covers adolescents aged 15 to 18 years old. Access to secondary school is achieved after the successful completion of 9 years of basic education and its completion is mandatory for progression to college educational period.

ric validity (Costa & Faria, 2020a) and very good reliability in this study (total scale $\alpha = 0.87$; entity scale $\alpha = 0.86$; incremental $\alpha = 0.80$).

Emotional Skills and Competence Questionnaire. The ESCQ is a self-reported EI measure with 42 items that assesses individuals' perceptions across three dimensions: perceive and understand emotion (14 items - *"When I see how someone feels, I usually know what has happened to him or her")*, express and label emotion (14 items - *"I am able to express my emotions well"*) and manage and regulate emotion (14 items - *"When I am in a good mood, every problem seems solvable"*). Based on Mayer and Salovey's (1997) EI ability theoretical model, the ESCQ was developed by Takšić et al. (2009) in the Croatian context and adapted to the Portuguese context (Faria et al., 2006). The ESCQ has shown adequate psychometric proprieties in terms of underlying structure, moderate correlations between the dimensions (between .49 and .54), internal consistency (between 0.72 and 0.91) (Faria et al., 2006; Takšić et al., 2009), measurement invariance and good fit indices (Costa et al., 2016).

2.3 Procedure

After receiving formal approval for the study, data collection was administered in classrooms in the presence of the researcher and teacher of the class. The participants filled out the paper-and-pen measures individually after receiving brief group instructions regarding the aim of the study, the meaning of the intelligence and emotional intelligence concepts and the answer formats. The participants were also informed about the voluntary nature of their participation and the confidential nature of the study and that nonparticipation would not result in any type of consequence. The participants who were underage at the time of the study had to present signed informed parental consent to participate, while the non-underage students had to sign their own consent to participate. All the instruments were pre-tested with secondary school students with similar features of the main sample to ensure that all the items were adapted and understood by the students. Students' final academic marks were obtained from school records, and students' grade point average (GPA) was computed based on the average of students' final marks (a total of 6 mandatory academic subjects in secondary school that range from 0 to 20 values). The survey administration typically occurred from February to March (2^{nd} period of secondary school) of each academic year. This study received a favourable opinion from the Portuguese National Data Protection Commission, Directorate-General for Education and Faculty's Ethics Committee.

2.4 Data analysis

Since this is a study of individual differences, latent growth curve modelling (LGC; Duncan et al., 2006) was used to predict trajectories of changes in IT of intelligence (ITI) and of emotional intelligence (ITEI) throughout secondary school (i.e., parallel process models). The individual growth for the ITI and ITEI is a function of a latent intercept and a latent slope. The latent intercept corresponds to the initial status of a student's ITI and ITEI at 10^{th} grade (time 1; baseline). The latent intercept reflects the average initial value at the start of the longitudinal change process. The second factor,

Table 1 *Descriptive statistics, internal consistencies and zero-order correlations for all measures*

Measure	*M*(*SD*)	*alpha*	1	2	3	4	5	6	7	8	9
1. ITI 10th	57.46 (8.79)	0.88	1								
2. ITI 11th	56.61 (9.96)	0.93	.43**	1							
3. ITI 12th	56.56 (9.24)	0.92	.47**	.43**	1						
4. ITEI 10th	55.23 (9.08)	0.89	.34**	.27**	.30**	1					
5. ITEI 11th	56.37 (7.31)	0.92	.40**	.34**	.33**	.68**	1				
6. ITEI 12th	57.65 (8.64)	0.86	.13	.16*	.33**	.19**	.33**	1			
7. GPA	14.71 (2.31)	-	−.03	−.05	−.02	.14*	.10	.11	1		
8. EI	185.84 (20.40)	0.89	.16*	.16*	.02	.27**	.22**	.11	−.06	1	
9. Gender (0 = female; 1 = male)	-	-	.14*	.05	−.01	.10	.02	−.03	−.05	.16*	1

Note: ITI = implicit theories of intelligence; ITEI = implicit theories of emotional intelligence; GPA = grade point average; EI = emotional intelligence; ** $p < .01$; * $p < .05$.

the latent slope, represents the rate of change (increase or decrease) in IT over the period of study (Duncan et al., 2006). The factor loadings of the observed composite variables were fixed at 1 for each measurement point. The loadings for the linear change factor were fixed in ascending order (in this case 0, 1, and 2, which represent the measurement years).

Moreover, with LGC models, it is possible to explore whether supposed predictors are able to explain the variance in the growth process. In this study, the impact of students' gender and academic achievement on the ITI and emotional intelligence on the ITEI was explored. The LGC model analyses included two steps and were tested with the AMOS 26.0 program using maximum likelihood estimation. First, an individual's change in IT was explored throughout the three-year period using the unconditional growth curve model, which focused on the factor loadings' intercept and slope. Next, the model was improved by adding predictor variables (the conditional model). To reduce the possibility of Type I error, only if the level of significance confirmed the differences between the new conditional model and the unconditional model would the individual trajectories with the influence of the selected predictors be analysed. The goodness of fit of the LGC models was evaluated considering the following indices (Hu & Bentler, 1999): Chi-square statistics, root-mean-square error of approximation (RMSEA) of 0.06 or less, comparative fit index (CFI) and the Tucker-Lewis Index (TLI, or Non-Normed Fit Index: NNFI): best if above 0.95.

3 Results

First, to ensure that the statistical procedures assumption of normality was met for all the variables, the absolute values of skewness (sk) and kurtosis (K) values should be lower than 3.0 and 8.0, respectively (Kline, 2005). In this study, the skewness values ranged from −1.285 (ITI 11th grade) to 0.181 (GPA), and the kurtosis values ranged from −0.833 (GPA) to 2.820 (ITI 11th grade).

The descriptive statistics, intercorrelations, and internal consistencies for all key variables are reported in Table 1. In general, the ITI had a moderately stable correla-

tion across the three time points, regardless of whether the ITEI was more correlated in the 10th and 11th years of secondary school than in the 11th to 12th grade. All the ITI variables correlated positively with the ITEI variables. Moreover, students' grades (GPA) were associated with the ITEI in 10th grade. The EI variable correlated with the ITI and the ITEI in 10th and 11th grades. Gender was significantly correlated with both the ITI and EI in 10th grade.

To evaluate the global change in IT levels across three years of secondary school, descriptive statistics were examined for each year (Table 2). While the students' ITI levels remained stable from 10th to 12th grade, their ITEI levels increased continuously and reached the highest average level in 12th grade (Table 2). These results substantiated further LGC analyses to estimate whether these patterns of changes could be confirmed in longitudinal models.

3.1 Individual trajectories

The LGC model identified the trajectories of changes of the ITI and the ITEI during the three-year measurement points of secondary school (10th, 11th, and 12th grade). An unconditional linear growth model, with the factor loadings of the intercepts constrained to 1 and the factor loadings of the slopes constrained to 0, 1 and 2, was estimated for both IT models (the ITI and ITEI domains; Fig. 1).

Model M1 had a satisfactory fit, X^2 (9)=4.08; p=.54, CFI=0.977, RMSEA (HI90)=0.06 (0.11). The ITI intercept was significant and indicated the initial students' ITI level in the 1st year of secondary school ($M_{\text{ITI intercept}}$=57.3, SE=0.572, p<.001). The ITI slope that indicated the ITI rate of change across time was not significant ($M_{\text{ITI Slope}}$=−0.45, SE=0.310, p=.143). The correlation between the ITI intercept and slope was not significant (r=−.398, p=.944), which means that the initial levels of ITI at the 10th grade did not influence the students' ITI rate of change. On the other hand, the ITEI intercept was significant and indicated the initial level of students' ITEI ($M_{\text{ITEI intercept}}$=55.2, SE=0.592, p<.001). The ITEI slope was positive and significant, indicating students' ITEI growth throughout secondary school ($M_{\text{ITEI Slope}}$=1.19, SE=0.358, p<.001). The significant negative correlation between the ITEI intercept and slope (r = -26.68, p<.001) indicated that the students with lower levels of ITEI experienced faster growth throughout the secondary school period. Moreover, the ITI and ITEI intercepts were positively correlated, which means that students' ITI and ITEI initial levels were associated, regardless of whether the ITI and ITEI slopes were not significantly associated, which indicates that the rate growth change of ITI is not related to the rate growth change of ITEI.

3.2 Predictors of IT individual trajectories

To identify the predictors of the individual differences in the evolution of IT during the secondary school period, the gender, EI and GPA variables were added to the linear growth model. A conditional linear growth model was estimated for both IT variables (cf. Figure 2). The LGM conditioned on gender, academic achievement (GPA) and emotional intelligence (EI; M2) also had satisfactory fit, X^2 (22)=1.811; p=.011, CFI=0.951, RMSEA (HI90)=0.06 (0.09; Fig. 2).

Table 2 *Descriptive statistics of IT variables (ITI, ITEI) for students by secondary school grade and t-test results*

	10^{th} grade			11^{th} grade			12^{th} grade			*t* tests (df)		
	M	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	10^{th} -11^{th} grade	11^{th} -12^{th} grade	10^{th} -12^{th} grade
ITI	57.46	8.79	222	56.61	9.96	222		9.24	222	1.258 (221)	0.065 (221)	1.430 (221)
ITEI	55.23	9.08	222	56.37	7.31	222		8.64	222	-2.524 (221)**	-2.049 (221)*	-3.201 (221)**

Note: ITI=implicit theories of intelligence; ITEI=implicit theories of emotional intelligence; *M*=mean; *SD*=standard deviation; *t* tests - paired samples *t* test score; significance for t-tests: ** $p<.01$, *$p<.05$

In the ITI model, gender significantly and positively affected the baseline values of ITI ($\beta_{gender.intercept}=0.18$, $p=.048$), which indicated that male students had higher initial levels of incremental ITI but that gender also affected the rate of growth in ITI ($\beta_{gender.slope}=-0.59$, $p=.043$); this showed that female students had a faster improvement in their incremental ITI beliefs throughout the secondary school period. The results showed that GPA did not affect the initial values of students' ITI ($\beta_{GPA.intercept}=-0.13$, $p=.124$) or students' growth rate ($\beta_{GPA.slope}=0.01$, $p=.993$), which provided no evidence of different ITI trajectories based on students' academic achievement.

For the ITEI model, gender parameters were not significant ($\beta_{gender.intercept}=0.07$, $p=.315$; $\beta_{gender.slope}=-0.13$, $p=.134$). Students' EI levels, on the other hand, had a significant effect on the baseline values of ITEI ($\beta_{EI.intercept}=0.24$, $p<.001$), which demonstrated that students with higher initial levels of EI (at 10^{th} grade) also had higher levels of ITEI. The EI slope was nonsignificant ($\beta_{gender.slope}=-0.16$, $p=.061$), which meant that students' EI levels did not affect the ITEI growth rate.

4 Discussion

The purpose of this study was to inspect and compare the developmental paths of adolescents' IT of intelligence and of emotional intelligence, without any manipulated stimuli, throughout the secondary school period. This work intended to extend the markedly lacking prior data on developmental trajectories of IT, especially in secondary school, thus enabling the exploration and comparison of different IT developments and controlling for the potential moderating effects of gender, academic achievement and trait emotional intelligence on the trajectory patterns of secondary school students.

The findings of the present study indicated that Portuguese secondary school students' IT presented different developmental patterns depending on the type of implicit belief analysed. While the IT of intelligence was stable throughout grades 10 to 12, the IT of emotional intelligence changed over this period. Contradicting the most recent results found in the literature (e.g., Dai & Cromley, 2014; Lee & Seo, 2019; Flanigan et al., 2017), in this study, the IT of intelligence which refers to the students' belief that the level of intelligence can be changed, remained stable over the three-year secondary school time. Although unexpected, these findings were similar to those found in Robins and Pals's (2002) previous work with college students that did not find evidence of change and considered a relatively longer period of analysis (4 years). Moreover, only one study has addressed the change of IT of intelligence during secondary school period, and that study found an increase in students' entity perspective of intelligence, although at a slow rate (Lee & Seo, 2019), as well as an increase in the incremental perspective, which indicated a particular pattern in this period. Therefore, the stability of students' beliefs about the malleability of intelligence could be due to the extended period analysed, which could capture a broader perspective of effective changes throughout this period. Previous work has generally analysed short periods of time (e.g., semesters), and the results might have detected fluctuations in the IT of intelligence that were influenced by students' motivation and

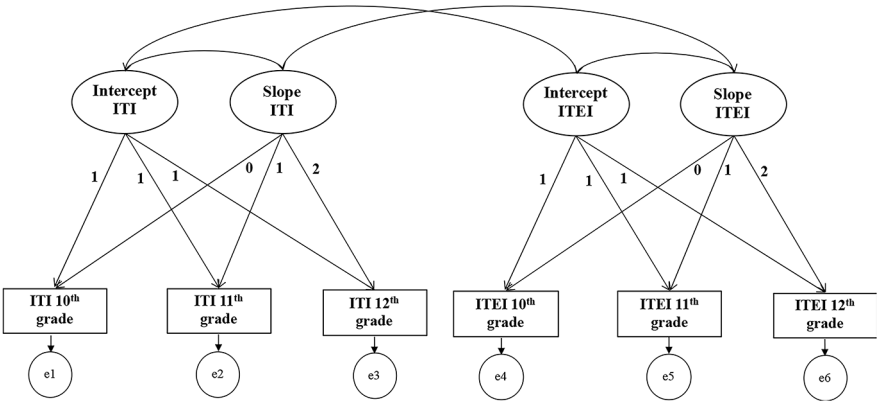

Fig. 1 Unconditional latent growth curve model for intraindividual variability of the ITI and ITEI. Intercept loadings constrained to 1 and slope loadings constrained to 0, 1 and 2

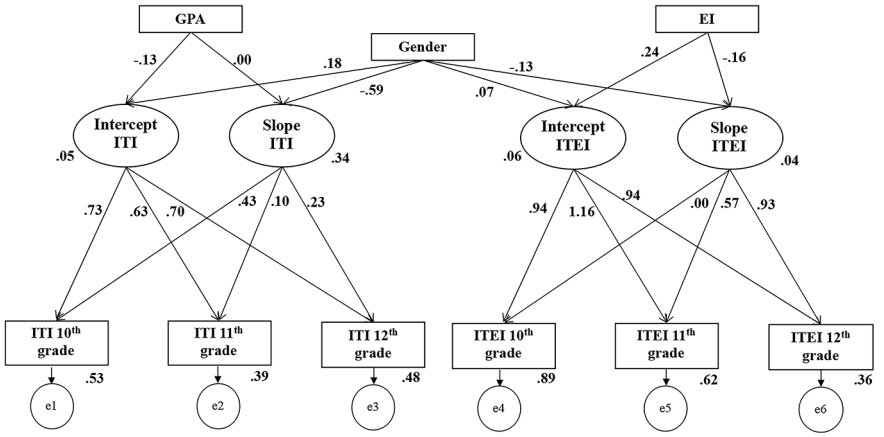

Fig. 2 Conditional latent growth curve model for intraindividual variability of ITI and ITEI variables explained by the predictors (gender, GPA, EI). Intercept loadings constrained to 1 and slope loadings constrained to 0, 1 and 2

outcomes through the course of the semester; however, these fluctuations can return to initial levels shortly after and become less fixed when the examined trajectory's length is extended (Lee & Seo, 2019).

Another reason for the stability of the IT of intelligence could be the specificity of the academic period. Secondary school is an educational context marked by challenging tasks and evaluations in domain-specific subjects, which could perhaps explain the stability of beliefs about a general domain as IT of intelligence. As found in Robins and Pals's (2002) work in the college setting, students' implicit beliefs about intelligence in secondary school might tend to stabilize or already be stable since in the last period of the mandatory educational system, the processes and dynamics

are well established; thus, students might not have the opportunity to challenge their beliefs about what it is to be intelligent or what it is to be smart in a general way and, somehow, reinforce or crystallize their previous IT.

On the other hand, the incremental IT of emotional intelligence, which relates to the students' belief that emotional intelligence competencies are changeable, increases continuously from 10th to 12th grade. Although there was no previous empirical evidence to support the developmental trajectories of ITEI, the literature has referred to the perspective of greater malleability of emotion-related domains compared to cognitive domains based on their temporal features, since emotions are transitory states and general intelligence is a higher trait quality (Chaplin et al., 1988; Tamir et al., 2007). Moreover, in parallel with great changes at developmental, intra- and interpersonal levels, the demands of a competitive and difficult academic period force students to take risks at the emotional level and face a wider range of emotional experiences and opportunities for emotional learning. This can promote better abilities and lead them to reconsider their implicit beliefs of emotion-related attributes. Moreover, the findings also demonstrated that students with lower levels of incremental IT of EI have a higher rate of growth of their implicit beliefs, which highlights the relevance of the educational system for providing resources and opportunities that support the development and progress of less skilled students.

Although the students' implicit beliefs presented differential trajectories over time, they were associated in the 10th grade, which means that although they correspond to independent constructs, they are indeed related at the beginning of secondary school; thus, a student which believe that intelligence can be changed, thus with an incremental perspective of general intelligence, is more likely to believe that emotional intelligence levels can also be modified and have an incremental perspective of emotional intelligence.

The literature has documented relevant differences for gender groups both in the IT of intelligence and in the IT of EI. This study provided evidence on the effect of gender on IT developmental paths during secondary school. While in general, no changes were found across time in students' IT of intelligence, the findings indicated that boys had higher levels of incremental beliefs about malleability at the beginning of secondary school. This result, although not confirmed in recent meta-analytic reviews (Burnette et al., 2013; Costa & Faria, 2018) was found previously in the literature (Dweck, 1999; Pepi et al., 2006), and it might imply cultural differences in gender roles based on stereotypes of scholastic abilities in the Portuguese context. Additionally, girls increased their incremental perspective of IT of intelligence throughout secondary school at a higher rate than that of boys, possibly because they held lower levels of incremental (i.e., higher entity) IT of intelligence at the beginning of secondary school and thus had greater room for improvement.

On the other hand, no particular gender effect was found for the IT of EI through late adolescence. While gender studies in the IT of emotion-related attributes tend to find that girls hold more incremental beliefs (Cabello & Fernández-Berrocal, 2015), in this study, girls and boys did not exhibit differences in their perspectives on the malleability of EI at the beginning of secondary school, and the continuous development of IT of emotional intelligence observed was similar for both groups over time. These results might demonstrate the substantial emotional progression that, in gen-

eral, boys and girls, encounter throughout late adolescence. Although marked biological and physiological differences emerge in late adolescence, in terms of emotional and social opportunities, challenges and events, both gender groups must face, adapt to and accommodate emotional experiences (e.g., higher responsibility, frustration with bad academic results, insecurity about the academic future, the decline of self-esteem, social comparison) to progress through this period.

To investigate the possible influence of students' previous academic achievement level on implicit beliefs about intelligence, students' GPA was explored as a moderator in this study. In general, the results indicated that students with better academic levels did not differ from students with lower achievement in the way in which they perceived the malleability of intelligence, and students with distinct achievement exhibited the same developmental paths. These results are unexpected, as the literature has provided extensive support for the relation of incremental IT of intelligence and academic outcomes (Costa & Faria, 2018; Burnette et al., 2013; Sisk et al., 2018). As mentioned previously, this educational period might not challenge students' beliefs about a general and more abstract domain such as intelligence. Adding to that, students might have consolidated their beliefs based on several years of academic instruction but have a much more fine-grained effect on students' perceptions of their domain-specific abilities.

Since there was a possibility that students' prior perceptions of EI could stimulate or limit their IT developmental paths, which has never been previously addressed, this specific moderator was also considered in the analysis. However, the results showed that secondary school students with different levels of trait EI grew through this period in a similar way. Nonetheless, it seems that at the beginning of secondary school, the students who perceive themselves as being more emotionally intelligent tended to have a more incremental IT of EI. This result, which was also found previously in the literature (Costa & Faria, 2020b), might be explained by the fact that individuals who believe emotional intelligence to be an attribute that can be improved over time, implicitly tend to engage with and learn through emotional experiences, since they consider challenges and difficulties as presenting opportunities to promote and assist their emotional development, which in time could influence their actual perceptions of emotional competencies.

4.1 Limitations

The present study has limitations that should be acknowledged and addressed in further research. First, the longitudinal study used three measurement points, one for each year of secondary school. The use of more measurement points within the period of study would have allowed more detailed and reliable trajectory results and, in this case, would have provided more information on eventual fluctuations in IT over the course of each academic year. Second, and although expected within a multiyear longitudinal design (Denham et al., 2009), sample attrition throughout the three years of study was another important limitation. Additionally, in this study, it was not possible to follow students who moved to other academic courses, who were retained, who transferred to other schools or who dropped out, which contributed to the sample

attrition. Thus, the sample of this study was relatively small, which limited the generalizability of these results and reinforced the need for replication studies.

Additionally, the independent examination of changes in both the entity and incremental IT of secondary school students and how these patterns of change are related to each other would have provided more information on the dynamics of these beliefs throughout this period. However, to serve the main goal of this study of providing a comparative pattern of change of different domain IT, no further analyses were conducted. Moreover, the exploration of other moderators and the use of mediators (e.g., achievement goals) and outcome measures such as adaptation, well-being, emotional intelligence (ability and trait) and academic achievement would allow us to explore how IT trajectories impact students' outcomes in a more comprehensive way. Future research should also address the patterns of change of IT in earlier academic stages in which there is a broad diversity of students across emotional, motivational and academic levels.

4.2 Conclusions

The findings of this study highlighted the differential trajectories of two distinct IT types and inspected the moderating role of gender, academic achievement and trait emotional intelligence on those developmental patterns. The results showed that throughout the secondary school period, the IT of intelligence remained stable, whereas the incremental IT of EI grew continuously. Additionally, boys scored higher incremental levels of IT of intelligence at the start of secondary school, while girls developed their incremental beliefs faster throughout the period. In this study, students from different achievement levels did not differ in their IT of intelligence or in their developmental path. Moreover, students who perceive themselves as being more emotionally intelligent had a higher incremental perspective of EI at start of secondary school, yet students with different emotional competencies progressed similarly over time.

These findings have practical implications for educational contexts. These results support the natural change over time of IT even without an intentional stimulus. Therefore, the current paper highlights the relevance and potentiality of the educational context to support the development of different skills and challenge less adaptative beliefs of students' school-related attributes, such as performance, emotions or relationships. While further research should extend the available evidence on the IT change patterns, there is revelant support for the adaptive role of IT across domains and about the need to address and stimulate more incremental and flexible perspectives among students.

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Declarations

Conflict ofinterest The authors declare that they have no conflict of interest.

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