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A longitudinal developmental analysis of students' causality beliefs about school performance

Isabel Roque · Marina Serra de Lemos · Teresa Gonçalves

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Abstract This study examined the development of school-related causality beliefs which are children's generalized perceptions of the utility or power of different categories of specific means in producing school outcomes. Based on the action theory perspective, we analyzed the developmental model of these beliefs as well as the trajectories of the five perceived causes of school success and failure: ability, effort, luck, teacher's help, and unknown causes. On a 5-year longitudinal study, following a group of 63 students over an 8-year period (from the second to the ninth grades), using hierarchical linear models, intraindividual changes and interindividual differences in these changes were identified; also, factors that might account for this variability were tested. The results showed a decrease of the effectiveness attributed to the various causes, but their differentiated trajectories, and a relative independence of gender and achievement factors (engagement and school grades) in the evolution of these beliefs. School children in the lower grades value most highly ability and effort as causes of school success. Student's beliefs about the causes of school performance become both more conservative and more differentiated along schooling, which is probably a normative general tendency. Findings from this longitudinal study corroborate, to a large extent, a consistent set of important developmental findings based on previous cross-sectional designs.

Keywords Motivation · Causality beliefs · Developmental trajectories

The social cognitive motivational perspectives recognize the relevant role of a set of cognitive processes that operate between a situation and the action n in which the individual is involved. Control beliefs, referring to the causes of school performance, have been shown

I. Roque (✉) · M. S. de Lemos
Faculty of Psychology and Education Science, University of Porto, Rua Alfredo Allen, 4200-135 Porto, Portugal
e-mail: pdpsi09036@fpce.up.pt

T. Gonçalves
School of Education, Polytechnic Institute of Viana do Castelo, Viana do Castelo, Portugal

to play a major role in students' motivation and performance. The present study examined causality beliefs which received special attention from different theories (e.g., attribution theory, Weiner 1979; learned helplessness, Seligman 1975; *locus* of control, Rotter 1966) dedicated to the study of motivation in achievement contexts. In spite of the different theoretical and methodological frameworks, the researchers have converged on the idea that children's school-related control beliefs play an important role in their actual school performance. This study used the action theory definition of causality beliefs (Baltes and Baltes 1986; Little, Oettingen, and Baltes 1995; Skinner 1995) which proposed a multidimensional conceptualization of perceived control that includes three specific types of beliefs (control, agency, and means–ends) viewed as distinct, independent, and with different functions. Means–ends beliefs[1] indicate children's general notions of causality and differ in important ways from other causality-related beliefs such as attributions, which are personal perceptions of the reasons for one's success or failure (e.g., Graham 1991), or strategy beliefs, which are personal views of the factors that influence one's school performance outcomes (Skinner 1995). In contrast, means–ends beliefs are not personal attributions of performance successes and failures, but instead refer to a set of generalized expectations about the extent to which certain classes of potential means result in outcomes. Means–ends beliefs help agents understand how actions can relate to outcomes, but say nothing about agentic regulation by themselves. The tripartite action-control model of psychological control proposes to disentangle the mix means–ends and agency beliefs that are undifferentiated in attribution theories.

According to this model, control and agency beliefs regulate the quality of action before and during engagement. Means–ends beliefs refer to the perceived relationships between certain causes and outcomes. Their primary function is to interpret performance. Depending on the attribution that is used to explain an outcome and its dimensional characteristics, expectancies, emotions, and subsequent behaviors will be differentially affected. In the school setting, the more frequently perceived causes of success and failure are effort, ability, teacher's help, luck, and unknown causes. In the cyclical sequence of beliefs–action–outcomes–beliefs that depict the way in which individual's beliefs contribute to their action (Skinner 1995), school performance acts both as a precursor and as a consequence of control beliefs. Some factors such as gender, school grades, and engagement can explain differences among students' beliefs at the initial status and over time.

One of the most important consequences of the way children explain their successes and failures is the implication for subsequent control beliefs. Thus, the belief that success was caused by a stable internal cause (e.g., lack of ability), in addition to cause emotional and motivational deficits, also contributes to expectations that future outcomes are not likely to be under one's control (Skinner and Greene 2008).

The present study analyzed the evolution of causality beliefs by trying to trace enabling or debilitating changes along schooling (Skinner 1992).

Causality beliefs development The research on the development of causality beliefs concluded that, from the ages 6 through 12, the main developmental pattern is a progressive dimensional differentiation of the various causes.

Along schooling, children progressively use new causal factors to explain success (and failure). This can be explained, in part, by the evolution in understanding of the meaning of the causal concepts. At ages 6 to 8, the distinction that children set off is between known and

[1] Acknowledging the distinctiveness of the term "means–ends beliefs," for simplicity, the term causality beliefs may be used along the article.

unknown causes. Children's thinking during this time is predominated by egocentric and magico-phenomenalistic thought (Skinner 1990; Piaget and Inhelder 1969). Children tend to overestimate their role as causal agents and they also confound intra-agentic and extra-agentic causes, for instance, believing that personal attributes can enhance performance on games of chance (Skinner 1990; Weisz 1980). At ages 9 to 10, there is a reduction of magico-phenomenalistic thought which contributes to an overall decrease in means–ends beliefs. Children come to distinguish between the contingent and noncontingent causes and they can form generalized perceptions of noncontingency based on uncontrollable causes. Increased independence during this period fosters the development of intra-agentic means–ends beliefs and the differentiation of causes which are related to agents and causes which are not related to agents (Geldhof and Little 2011; Little, Stetsenko, and Maier 1999). High beliefs in the effectiveness of non-agent-related causes (e.g., teacher's help or luck) would imply decreases in engagement and in subsequent performance (Skinner 1991). Not until ages 11 to 13 do children differentiate effort from ability (Chapman and Skinner 1989; Nicholls 1978, 1984; Nicholls and Miller 1984, 1985; Skinner and Chapman 1987; Skinner 1990; Weisz 1980, 1981). Now they know that to reach the same performance outcome, smart children have to try less.

The developmental study of causality beliefs would also contribute to research dealing with the consequences of causality beliefs. For example, when ability is not differentiated from effort, the attributions to ability will not necessarily have the negative effects that are typically associated with this type of attribution. Furthermore, developmental change in the meaning of a causal category would "activate" individual differences in level of beliefs about that category (Skinner 1990).

Research also shows that the correlation between the various causes decreases along age, suggesting a progressive differentiation among causes. Thus, in younger children (6 to 8 years), the correlations among the different causes are stronger. This indicates a more undifferentiated and nonspecific understanding of what determines good or poor school performance. In contrast, the 10- to 12-year-old students best discriminate within the causes which is reflected in a corresponding decrease in the correlations, particularly between effort and external causes (luck, teacher's help, and unknown causes) (Chapman, Skinner, and Baltes 1990).

The study of developmental differentiation of causal beliefs may also elucidate age change in the power of children's control-related beliefs to regulate their behavior. The developmental emergence of correlations between some causality beliefs, such as effort, and academic performance could result from at least two different causal processes. Children who think that effort plays the largest role in producing desired events might try harder and thereby perform better, or children who have tried hard and performed better in the past might be more likely to believe that effort is a good mean to produce desired events (Chapman, Skinner, and Baltes 1990).

Various cross-cultural investigations in Europe, North America, and Asia tried to find out if the developmental tendencies could be generalized into different contexts (Little, Stetsenko, and Maier 1999; Little and Lopez 1997; Karasawa, Little, Miyashita, Mashima, and Azuma 1997; Little et al. 1995; Oettingen, Little, Lindenberger, and Baltes 1994; Stetsenko, Little, Oettingen, and Baltes 1995). In general, results revealed differentiated developmental trajectories for each of the five causes, which were relatively consistent among the contexts.

Effort was the only perceived cause that, in general, increased with students' age. For ability, this increasing pattern was not so evident, even though it remained relatively stable, except for the Tokyo study where it increased. Luck and unknown causes decreased, in

general, although luck showed increases from ages 12 to 16 (Geldhof and Little 2011). The role of the teacher decreased initially, in some contexts, but increased later (Little and Lopez 1997; Skinner, Chapman, and Baltes 1988b). There was also uniformity in the development of the general model of differentiation among the causes and in their hierarchical relative importance. Effort was the most important cause, followed by ability. Unknown causes, teachers' help, and luck were the least important.

According to Little and Lopez (1997), structural cognitive, motivational, and sociocontextual perspectives can explain similarities and differences in the development of children's causality beliefs. The structural cognitive perspective is related with cognitive maturity. The motivational perspective highlights the adaptive and maladaptative self-regulatory processes, which means, for instance, that effort and ability are more effective causes for adaptation and adjustment than nonself-oriented causes. The sociocontextual perspective stresses some school-related factors such as schooling patterns and formats (e.g., classroom organization and structure) as well as general values and conceptions about formal education (e.g., parents' beliefs about the importance of education).

Some of the previously mentioned studies tested if there would be gender effects in the students' beliefs and if they were apparent in the different cultural contexts, taking into account that girls, when compared to boys, tended to value ability as the cause for failure, more than boys (Dweck and Elliot 1984). Furthermore, the investigation has been trying to identify factors such as achievement behavior (grades and academic engagement) that can predict interindividual differences in intraindividual stability or change (Musher-Eizenman, Nesselroade, and Schmitz 2002).

In sum, throughout school, there is a progressive focus on internal causes as the perceived determinant factors of school performance. This, in turn, is perceived less and less as dependent on luck or teacher's help. Unknown causes also decrease. This developmental pattern seems quite similar among different contexts, suggesting, on one hand, that students have a similar global view of school, perhaps due to the formal schooling's characteristics in the industrialized nations that share similar educational goals, teaching formats, procedures, and settings (Stetsenko et al. 1995). On the other hand, this pattern may be linked to cognitive development, reflecting a universal and normative developmental tendency rather than individual or contextual differences. However, this general pattern is consistent with the potential influence of proximal factors in producing individual differences.

The present study is part of a wider research project on the development of school performance-related control beliefs in Portuguese contexts (e.g., Gonçalves 2007; Lemos and Gonçalves 2004). This study used a longitudinal design over an 8-year period of elementary and high school, complementing the existent research that is typically cross-sectional and spans shorter intervals of time.

The major purpose of this study was to examine the longitudinal development of causality beliefs. More specifically, this study intended (a) to characterize the student's causality beliefs in order to understand how they explain the causes leading to success and failure in school; (b) to analyze the developmental differentiation of student's beliefs; (c) to trace the development of causality beliefs by analyzing stability and change tendencies; (d) to identify systematic differences among the students in those tendencies; and (e) to find out if factors like gender, school grades, and engagement are predictors of individual differences in the beliefs and in their trajectories.

Concerning the first goal, it is expected that, these students, similarly to what happened in the cross-cultural studies mentioned previously (e.g., Stetsenko et al. 1995), will perceive effort and ability as the most effective causes influencing school performance and will attribute less importance to external causes. It is also expected that the various causes will

show a progressive differentiation. Of special interest is the identification of transition points in this developmental pattern.

The third goal intends to analyze stability and change in student's beliefs from the second to the ninth grades and to examine whether different beliefs follow distinct trajectories. It is generally expected that, consistent with prior trend analyses (Little and Lopez 1997), beliefs in internal causes, such as effort and ability, show relatively stable or slightly increasing trajectories and that beliefs in external causes—luck, teachers, and unknown—show decreasing trajectories.

The other two goals of the study address the important questions as to understand whether there are individual differences in the beliefs' trajectories and still if such differences among the students depend on factors such as gender, school grades, and academic engagement.

It is expected that the students will not show large variability in the developmental tendencies. Rather, the initial differences in their causality beliefs will probably show continuity throughout their school years and will be dependent on some of those factors. By examining individual differences in level and change of causality beliefs, we will be able to better understand the possible developmental mechanism that underlies children's mental representations of school performance.

Method

Participants

Using a longitudinal design, this study followed the same group of students from the second through the ninth grades. Participants were 32 girls and 31 boys from a comprehensive school in the north of Portugal. This school admits students from a large region in the north of Portugal, providing rural, suburban, and urban diversity and including students from different socioeconomic origins. The average age of the students at the beginning of the study was 7.25 (standard deviation [SD]=0.4).

Instruments

Causality beliefs were assessed using the short Portuguese version (Lemos and Gonçalves 1995) of the *Control, Agency, Means–Ends Interview* (Skinner, Chapman, and Baltes 1988a), a 40-item questionnaire with 10 subscales, in a 4-point Likert scale format. This study analyzed data from the causality (means–ends) beliefs subscales for four causal factors: effort (four items), ability (four items), teacher's help (four items), luck (four items), and also for unknown causes (four items).

Engagement was assessed by means of a nine-item Inventory of Academic Engagement developed by Roque (2002), based on Skinner and collaborators (Skinner et al. 1990a, b, 1998), in which teachers rated students' behavioral and emotional involvement in the school tasks. Student's school grades in Math and Language were used as an index of their academic performance.

Procedure

Prior to the initiation of this study, informed consent was granted by the chair of the school and the student's parents. All students were repeatedly assessed at five time points—second, fourth, fifth, seventh, and ninth grades—over an 8-year period. The procedures used for

administering the questionnaires were adapted according to students' age. Taking into consideration their level of reading comprehension, second graders were interviewed individually by the researcher. For fourth graders, items were read aloud and the school classes were divided in half for a closer monitoring of student's answering. By the fifth, seventh, and ninth grades, students responded individually, in their classroom, during school time, in the absence of the teacher, and under the supervision of two research assistants.

Handling of missing data

Missing data, due to attrition, ranged from a low of 28 % at the second wave to a high of 33 % at the fifth wave. Little's (1988) Missing Completely at Random Test (χ^2=109.444, *df*=108, *p*=0.443) indicates that the data were likely missing completely at random and that it is safe to impute missing values. Missing values of the measures were estimated in IBM SPSS Statistics 19, using multiple imputations (MI) by fully conditional specification. MI produces a number of plausible datasets, with each missing value replaced by a likely estimate and produces more accurate parameter estimates and standard errors than traditional methods like listwise or pairwise deletion (Fries, Schmid, and Hofer 2007). We generated five imputations.

Data analyses

We planned a five-time point longitudinal study to investigate children's causality beliefs evolution along schooling and to explore interindividual differences in these trajectories as well as possible predictors. Descriptive analysis and correlation coefficients among the various causality beliefs allowed the general characterization of the students' beliefs along the five observations.

To examine intraindividual change in causality beliefs for each student as they moved from the second grade through the ninth grade, we used the Hierarchical Linear Modeling (HLM) 7.0 (Raudenbush, Bryk, Cheong, and Congdon 2004).

We considered a two-level hierarchical model with repeated observations over time (level 1) nested within subjects (level 2). Using the full maximum likelihood method for model estimation, we tested several hierarchical models, with increase in the number of parameters to be appreciated, running separate analysis for each causality belief, and we chose the model that best fit the data (Raudenbush et al. 2004). Level 1 of the HLM analysis (repeated measures) consisted of modeling change in the dependent variables over time. Two unconditional linear models of intraindividual change were tested: the null model (*intercept-only model*) and the model with time as a predictor of change. The first one describes the causality beliefs' trajectories, through the intercept, that is the mean at the initial level, the variance around the mean, and the residual variance and it tests if there is significant variance in the intraindividual change. Selection of this model indicates stability of that particular belief over time, causality beliefs' trajectories being best described uniquely by their mean level at the baseline. The second fixes the same slope for all subjects, and the trajectories are described by the mean intercept (level of the causality belief at the baseline) and slope. We also tested a curvilinear model of intraindividual change to analyze if trajectory over time was nonlinear. We further analyzed if there were interindividual differences in the slopes; in other words, we tested individual nonparallel trajectories, thus analyzing if the variance in the slope was significant. Finally, we tested grades and engagement at level 1, as time-varying predictors of changes in causality beliefs.

In level 2 of the HLM analysis, conditional models are tested by regressing level 1 within-person parameters (intercept and linear or quadratic slope) onto level 2 between-person variables. In this study, we examined whether gender, initial students' grades, and initial students' engagement predicted intraindividual change in causality beliefs. We tested these time-invariant predictors in level 2 intercept, linear slope, and quadratic slope. Predictors were removed from these conditional models whenever they did not contribute significantly to predicting level 1parameters. The null model showed the best fit for causality beliefs for unknown causes.

For effort, ability, teachers, and luck, a quadratic growth model provided a better fit to the data than a linear growth model. So, in these cases, to estimate the general trend of the development of the causality beliefs across the five time points, we separately estimated quadratic growth curve models with each causal factor as an outcome variable, which can be specified as:

$$\text{Level 1:}\quad \text{Cause}_{ti}=\pi_{0i}+\pi_{1i}(\text{Time}_{ti})+\pi_{2i}(\text{Time}_{ti}^{2})+\pi_{3i}\text{Predictor}_{ti}+e_{ti}$$

$$\begin{aligned}\text{Level 2}: \quad \pi_{0i} &= \beta_{00}+\beta_{0i}\text{Predictor}_i+r_{0i}\\ \pi_{1i} &= \beta_{10}+\beta_{1i}\text{Predictor}_i+r_{1i}\\ \pi_{2i} &= \beta_{20}+\beta_{2i}\text{Predictor}_i+r_{2i}\\ \pi_{3i} &= \beta_{30}+r_{3i}\end{aligned}$$

where π_{0i}, π_{1i}, π_{2i}, and π_{3i} are the random intercept, linear slope, quadratic slope, and time-varying predictor slope, respectively, and β_{00}, β_{10}, β_{20}, and β_{30} are the fixed intercept, linear slope, quadratic slope, and time-varying predictor, respectively.

Results

In order to characterize the causality beliefs and to analyze the differentiation among them, means, SDs, and correlations of all the causes in the five observations are presented in Table 1.

Effort was perceived as the most effective cause, followed by ability, in all of the measuring points. Unknown causes were systematically the less valued. The relative position of luck and teacher's help was not constant along the five periods since students attach relatively more importance to luck than to teacher's help in the second and fourth grades (see Fig. 1).

In the second grade, the causes were significantly correlated to each other. This correlational pattern substantially attenuated from the fourth grade onwards as effort in particular became clearly differentiated from the other causes.

The beliefs' trajectories were modeled independently for each of the different causes using several models. Individual growth curve modeling yielded fixed effect and random effect estimates of the intercept and slope parameters that define the average trajectories for each of the causes (Table 2). For effort, ability, teacher's help, and luck, the model that best fits the data is described by a second polynomial expression showing a linear and a nonlinear part (that is why the time was squared in the analysis). Engagement was not significantly associated with any of the causes over time.

Effort showed a nonlinear trajectory over time. The mean intercept for effort was 3.65± 0.03 (t=107.708, p<0.001) with a 95 % confidence interval (CI) of 3.59–3.71. One model part described a decrease in means–ends belief in effort (−0.37±0.06; t=−6.237, p<0.001)

Table 1 Means (*M*), SDs, and intercorrelations of means–ends beliefs

	M	SD	Correlations			
			1	2	3	4
Second grade						
1.Effort	3.69	0.28				
2. Ability	3.08	0.61	0.64**			
3. Teachers	2.17	0.53	0.38**	0.57**		
4. Luck	2.43	1.16	0.52**	0.70**	0.55**	
5. Unknown	2.03	0.81	0.28*	0.31*	0.43**	0.37**
Fourth grade						
1. Effort	3.26	0.38				
2. Ability	2.73	0.60	0.06			
3. Teachers	1.90	0.59	0.13	0.09		
4. Luck	2.00	0.74	0.00	0.27	0.22	
5. Unknown	1.86	0.67	−0.10	0.01	0.16	0.04
Fifth grade						
1.Effort	3.16	0.44				
2. Ability	2.33	0.74	0.12			
3. Teachers	1.89	0.70	0.00	0.46		
4. Luck	1.89	0.70	0.11	0.47**	0.38	
5. Unknown	1.96	0.76	0.04	0.48**	0.34	0.42*
Seventh grade						
1. Effort	3.19	0.54				
2. Ability	2.14	0.57	0.13			
3. Teachers	2.03	0.71	−0.33*	0.03		
4. Luck	1.95	0.50	−0.05	0.30	0.10	
5. Unknown	2.03	0.64	−0.06	0.08	0.14	0.49*
Ninth grade						
1. Effort	3.13	0.57				
2. Ability	2.12	0.55	0.14			
3. Teachers	2.27	0.60	0.09	0.28		
4. Luck	1.98	0.68	−0.02	0.25	0.40	
5. Unknown	1.83	0.48	−0.08	0.17	0.23	0.34*

Means, SDs, and correlations were calculated based on pooled results

*$p<0.05$, **$p<0.01$

and the other described a slight increase (0.06±0.02; $t=3.707$, $p<0.001$). In conditional models, gender, initial school grades, and initial engagement did not emerge as significant predictors of change in causality beliefs for effort.

As for ability, the mean intercept was 3.06±0.08 ($t=37.656$, $p<0.001$) with a 95 % CI of 2.90–3.22. There was an ability decrease (−0.57±0.08; $t=-6.578$, $p<0.001$) up to the ninth grade where there was an increase (0.08±0.02; $t=3.926$, $p<0.001$). Conditional models showed a negative effect on the intercept (−0.06±0.02; $t=-2.954$, $p=0.004$) and a positive effect on the linear slope (0.02±0.01; $t=-2.152$, $p=0.04$) for initial engagement as time-invariant predictor.

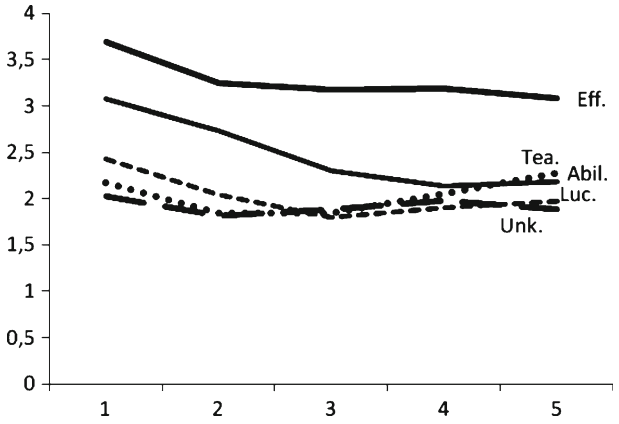

Fig. 1 Trajectories of means–ends beliefs along the five time points (second to ninth grades). *Eff.* effort, *Abil.* ability, *Tea.* teachers, *Luc.* luck, *Unk.* unknown. Mean values for each cause were based on pooled results

For teacher's help, the mean intercept was 2.54±0.17 (t=14.531, p<0.001) with a 95 % CI of 2.21–2.87. The trajectory of this belief showed a decrease (−0.47±0.14; t=−3.303, p=0.002), followed by an increase (0.08±0.02; t=3.398, p=0.002) in the seventh grade. The regression of the intercept for gender, grades, and engagement showed a negative effect of initial engagement on the intercept (−0.10±0.02; t=−4.008, p<0.001) but a positive effect on the linear slope (0.02±0.01; t=2.921, p=0.005).

For luck, the mean intercept was 2.41±0.13 (t=18.442, p<0.001) with a 95 % CI of 2.16–2.66. The trajectory of this belief showed a decrease (−0.41±0.12; t=−3.303,

Table 2 Fixed and random effects estimates—best model for the five causes

		Effort Coef. (SE)	Ability Coef. (SE)	Teachers Coef. (SE)	Luck Coef. (SE)	Unknown Coef. (SE)
Fixed effects	Intercept	3.65 (0.03)***	3.06 (0.08)***	2.54 (0.17)***	2.41 (0.13)***	1.81 (0.06)***
	Gender					0.21 (0.10)*
	Eng0		−0.06 (0.02)**	−0.10 (0.02)**		
	Linear slope	−0.37 (0.06)***	−0.57 (0.08)***	−0.47 (0.14)**	−0.41 (0.12)***	
	Eng0		0.02 (0.01)**	0.02 (0.01)**		
	Quad. slope	0.06 (0.02)***	0.08 (0.02)***	0.08 (0.02)**	0.07 (0.03)**	
	Grades slope				−0.15 (0.06)*	
		Variation (SD)	Variation (SD)	Variation (SD)	Variation (SD)	Variation (SD)
Random effects	Intercept	0.01 (0.01)	0.02 (0.14)*	0.01 (0.12)	0.06 (0.25)**	0.03 (0.17)*
	Residual	0.18 (0.43)	0.30 (0.55)	0.32 (0.56)	0.56 (0.75)	0.42 (0.65)

Table entries are maximum likelihood estimates based on five multiple imputed datasets. Time-varying variable: Grades—students' math and language grades; time-invariant variable: Eng0—initial students' engagement

SD standard deviation, *SE* standard error

*p<0.05, **p<0.01, ***p<0.001

$p<0.001$), followed by an increase (0.07±0.03; $t=2.783$, $p=0.006$). Grades as time-varying covariate at level 1 showed a negative effect (−0.15±0.06; $t=-2.286$, $p=0.024$). The variance around the baseline was significant ($p=0.003$). Neither gender nor school achievement effects were confirmed to explain the interindividual variation.

Unknown causes showed stable trajectories over time. The model that best described these stable trajectories was model 1 or the null model. The mean intercept of unknown causes was 1.81±0.06 ($t=29.313$, $p<0.001$) with a 95 % CI of 1.69–1.93. The variance around the mean was significant and a gender effect was evidenced (0.21±0.10; $t=2.173$, $p=0.034$). In the initial status, boys, when compared with girls, knew less about the causes that lead to school success.

Discussion

One of the goals of this study was to characterize the causality beliefs of the students in the five measurement points. Descriptive analysis revealed that children's estimations of the effectiveness of all causes declined with increasing age. Although there was a slight increase in the developmental trends during adolescence (except for unknown causes), the perceived importance of the causes did not increase the level of importance they were accorded in the elementary years. Effort was rated as the most important cause of school performance, followed by ability. This may represent a positive motivational factor by supporting children's sense of high self-efficacy and continuous motivation to work diligently. It allows them to develop a secure, consistent, and positive image of themselves and of their performance (Karoly 1993). However, it should be noticed that the effects of ability attributions can be more complex since ability is an internal cause often considered as stable and uncontrollable. Therefore, in the face of failure, ability beliefs may undermine student's motivation. These results offer longitudinal support to the developmental findings based on cross-sectional designs that have been published.

The relative importance of the other causes revealed some differences when compared with other studies. The one that stands out was the more powerful role assigned to teachers. As in other studies with Portuguese students (Gonçalves 2007; Lemos and Gonçalves 2004), teacher's help was the third most important cause, contrasting with studies carried out in other countries where this cause was relatively more devalued (e.g., Stetsenko et al. 1995).

One possible explanation is that this result may reflect teacher-centered pedagogical methods, suggesting that students' autonomy may be hindered. In future research, it would be particularly interesting to compare students' causality beliefs for teacher's help with the same student's agency beliefs for teacher's help. If student's perceived access (agency beliefs) to the teacher's help is low, the combination of the relatively high causality beliefs with low agency beliefs for teacher's help will be specially debilitating. The unknown causes' position also slightly differs from the other realities where, in general, it is the third in the rank order of the causal dimensions (Little and Lopez 1997). In our sample, by being the least valued, results indicate a positive motivational pattern since unknown control is, according to Connell (1985), a powerful predictor of poor school performance. Indeed, attributing the results to unknown causes is associated with noncontingency experiences that diminish the real ability to be effective in one's own environment.

In short, the students of this study believe that effort, ability, and teacher's help, in descending order, are the most efficient means to attain good school grades (and are responsible for school failure). Attribution to luck and unknown causes was less frequent. An overall decrease in the perceived effectiveness of the causes, with a lower point by the

fourth or fifth grade, was found, which confirms that these beliefs become more conservative.

In what respects the differentiation among causes, these were analyzed through the evolution of the correlational pattern between the different causes over time. Results showed that, by the second grade, all the causes appear much undifferentiated, strongly or moderately correlated among each other, supporting the findings of Nicholls and Miller (1984). After the fourth grade, attributions for the causes were clearly differentiated, thus indicating the ability to uniquely attribute effectiveness to various means (Geldhof and Little 2011), also supporting previous research results (Chapman and Skinner 1989; Karasawa et al. 1997). The pattern found in the present study suggests the existence of a clear point of differentiation from the fourth grade onwards, rather than a progressive differentiation along schooling, identifying a marked shifting in student's thinking about school performance. The acknowledgement of this differentiation process of casual categories related with age and school grade is important in educational contexts because it allows us to understand that motivation and achievement behavior can be influenced differently by the same beliefs at different ages. Moreover, the student's early and stable distinction between effort and ability should caution schools and teachers to create an environment clearly emphasizing learning and effort. This is all the more important as the differentiation between effort and ability is associated to the belief in a compensatory relation between effort and ability (Nicholls 1984; Nicholls and Miller 1984, 1985), meaning that more effort represents less ability.

To examine stability and change in student's causality beliefs throughout school, we used the modeling of the respective trajectories. In the first level of the analysis, we focused on the intraindividual development which is one indicator of change. Results confirmed that different specific beliefs showed different paths of evolution, despite the initial decrease being a common characteristic for the various causes.

Effort, ability, teacher's help, and luck perceived efficiency decreases initially but showed a slight increase at the end of middle school. Their trajectories are nonlinear, which is in contrast with other research where only the trajectory of teacher's help showed a similar evolution (Little and Lopez 1997). This could be explained by the longitudinal five-point time study, from second to ninth grades that can better catch these variations (namely, the inclusion of the early second grade school level).

The greater importance attributed to effort along all the school path contributes to a positive motivational pattern that can work as a protective element in failure situations (Skinner, Schindler, and Tschechne 1990). However, instead of the flat trajectory we expected, effort showed an initial decline from the second grade onwards, with a lower point by the fifth grade and a slight increase thereafter.

Ability, which in other studies reveals high stability, showed an initial decrease similar to that found in other Portuguese samples in this study. Its recovery in the final school years can be explained by the type of design, as previously mentioned, and possibly by the older students' high expectations of continuing their studies. In their last year (ninth grade), these students are required to pass a national exam to access secondary school. Students may have realized that this increasing educational challenge requires greater learning abilities, not just time and effort (Little et al. 1999).

For the unknown causes, a decrease throughout time is not statistically significant, so trajectories can be considered relatively stable showing low values. The increase of unknown causes in transition periods, which was found in some studies (Skinner et al. 1998), was not apparent in this study where these causes remained stable and low, revealing the students' effective knowledge of the contingencies between the causes and school performance even at moments of academic transition. This positive aspect may have benefitted

from a relatively constant context. In fact, despite the inherent changes implied by academic progression, students participating in the present study remained in the same educational institution along the school years.

In general, neither gender nor school grades had a significant effect on the causality beliefs trajectory which seems to be quite independent of these factors. Thus, apparently, the trajectories of these beliefs are more dependent on cognitive and sociocognitive development. The only exception was for luck which was negatively predicted by changes in student's level of academic achievement. This means that, as academic level increases, students tend to discredit luck as cause for school success.

The perceived importance of ability and teacher's help were predicted by student's initial engagement such that students who reported higher initial levels of engagement reported lower initial levels of ability and teacher's help beliefs, but less steep linear declines in those beliefs over time.

The best models for the trajectories of the different causes showed significant differences at the initial level, but not in the slope tendencies of the development trajectories. This means that the initial differences remain constant and that the students maintain the same position in the group throughout their schooling.

In sum, we found that our results, although being generically similar to the results from other contexts, represent some specificity, possibly connected with the characteristics of the Portuguese educational system and with the number of observations and the extension of the long period involved in following the same students.

Globally, the results support the notion that attributional style is mostly universal and little dependent on factors such as gender or school performance. This reinforces the need to create an early focused and systematic intervention to redirect debilitating attribution. By better understanding the students' attributional processes, we will be able to plan intervention programs to avoid the development of attribution processes that could undermine student's learning progress.

A limitation of this study was the small sample size. However, a particular strength of the study is that it stretched out during a very long period with a longitudinal design and an elaborated methodology. Finally, the fact that findings from this study largely supported previous cross-sectional findings on the development of causality beliefs reduces the cautions imposed by the sample size to the interpretation and generalization of results.

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Isabel Maria Roque dos Santos. Faculty of Psychology and Education Science of the University of Porto. Institutional address: Rua Alfredo Allen, 4200-135 Porto. Home address: Rua Adelino Arantes, 17 – 4º Esq.,4700-357 Braga. Tel. +351967562271; Email: pdpsi09036@fpce.up.pt; Web Site: http://www.fpce.up.pt

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Marina Gomes Serra de Lemos. Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto. R. Alfredo Allen, 4200-135 Porto. Telephone: 226079700; Telefax: 226079726; Email: marina@fpce.up.pt

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Maria Teresa Martins Gonçalves. Polytechnic Institute of Viana do Castelo – School of Education, Av. Capitão Gaspar de Castro - Apartado 513 | 4901-908 Viana do Castelo. Tel. +351 258 806 200; Fax. +351 258 806 209; Web Site: http://www.ese.ipvc.pt

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