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Implicit personality theories on the modifiability and stability of the action repertoire as a meaningful framework for individual motivation: a cross-cultural study

Albert Ziegler^{a*}, Marina Fidelman^a, Marold Reutlinger^a, Wilma Vialle^b and Heidrun Stoeger^c

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The attainment of exceptional accomplishments requires extremely long periods of time. It has yet to be explained, though, how individuals find the motivation for such protracted learning. Carol Dweck proposed that an incremental theory of an individual's abilities is an important factor in this process since it would account for the optimism needed to successfully tackle new steps in the learning process and would help an individual to cope with setbacks. This study seeks to refine Dweck's theory. Drawing on the Actiotope Model of Giftedness, we argue that an incremental theory of an individual's abilities should be divided into two theories: a modifiability theory of the mutability of an individual's deficits in the areas of knowledge and capability; and a stability theory of the stability of successful extensions of the action repertoire. A sample of 488 12- to 13-year-old students from Brazil, South Korea, Spain, and the United States participated in the cross-sectional study. Their IQ scores place them among the top 5% of the target population. A series of regression analyses using various indicators of motivational behavior as dependent variables shows that the theorized elaboration of Dweck's approach appears to be very useful.

Keywords: Actiotope Model of Giftedness; implicit personality theories; gifted students; cross-cultural study; motivation

Introduction

Eminence develops over long periods of time. Estimates suggest no less than 10,000 hours of intensive learning, or approximately 10 years, are required (Chase & Simon, 1973; Ericsson & Crutcher, 1990; Ericsson, Krampe, & Tesch-Römer, 1993). From a motivational standpoint, this raises certain questions which have yet to be answered satisfactorily.

The modifiability problem

The first problem is the huge number of individual learning episodes that an individual requires in order to develop the action repertoire of an expert. It has not yet been clarified, for instance, how many learning episodes mathematics experts will have completed once they have progressed from simple attempts at counting with

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their fingers to, finally, being capable of complex calculations in n-dimensional spaces. From their initial attempts at coaxing a tone from their instrument, virtuoso violinists have progressed through learning to breathtaking concert performances; and, similarly, learning enables soccer players to close the gap between their first awkward attempts at kicking a ball and elegantly kicking a goal. A point of departure in estimating the number of requisite learning episodes is the number of chunks that an expert must acquire. In their seminal work, Chase and Simon (1973) estimate this number to be approximately 100,000; indeed the actual number is likely to be considerably higher (Gobet, de Voogt, & Retschitzki, 2004; Gobet et al., 2001).

The long series of individual learning episodes follows a principle, which can be characterized as the *incremental principle*. Individuals must summon the will to continually extend the limits of their capability without concluding that the next learning step is unattainable. Such a conclusion can lead to what is known as the phenomenon of arrested development in which an individual stagnates at a particular ability level (Ericsson, 1998, 2006). The individual's conviction that following every successful learning episode there is a subsequent learning step to be surmounted, will be addressed in the following as the *modifiability problem*.

The stability problem

A second important problem results from these long periods of learning, which has relevance from a systemic perspective on exceptional performance. The long-term learning carried out by those who would go on to become experts is the type of permanent learning which takes place far beyond the point of equilibrium (Ziegler, 2005). Such individuals, therefore, require enormous resources for maintaining the conscious and goal-oriented expansion of their action repertoires. These resources include motivation, attention, financial resources, social assistance, and so on (Ericsson, Charness, Feltovich, & Hoffman, 2006; Feltovich, Prietula, & Ericsson, 2006). Should these resources become insufficient, the overall stability of the system would be endangered, and further learning may no longer be possible.

The individuals involved in the long-term learning process pose a further threat to the system's stability in their idiosyncratic changes over time. Increases in individuals' action repertoires necessitate various co-evolutions. For example, after every completed learning episode the goal system must undergo a new process of co-evolution and new, more challenging learning goals must be set. The learning environment (e.g., through the input of the teacher or the coach) is co-adapted to the newly established skill level and designs the subsequent learning situation to be more challenging in order to ensure the possibility of a further increase in performance. Such co-evolutions in the area of capability are only part of the picture; individuals experience numerous other changes, which are typical of their ontogeny (e.g., entering school, moving, puberty, adolescence, finding oneself, developing one's own capabilities in, for instance, cognitive, social, and motivational spheres, and so on). All of these changes and developments need to be coordinated and harmonized with the learning process. The expert's learning process is not without its setbacks. Careful work on individual weaknesses is often necessary. The surmounting of limits on one's performance can also turn out to be a difficult process, and the individual involved in such a learning process must be capable of dealing with negative emotions.

According to the Actiotope Model of Giftedness, the individual can be seen as a system that requires long periods of time in order to develop expertise. Thus, the question arises as to how the system can generate a level of stability sufficient for ensuring the viability of the learning process. Constant changes as well as setbacks and difficulties often pose a danger to the learning process, which can lead to its demise. We will address this as the *stability problem*.

Implicit personality theories

An individual who achieves performance excellence will have had to find various solutions to the modifiability problem and the stability problem. For example, it is well established that the individual's social environment plays a crucial role in this problem-solving (see, e.g., Gruber, Lehtinen, Palonen, & Degner, 2008). However, in this paper we examine another promising step towards understanding the nature of how individuals successfully tackle these problems, drawing on the work of Carol Dweck (1999, 2006). Dweck's research led her to conclude that individuals develop implicit personality theories in the course of their histories of learning, which are focused on both the stability and the malleability of their own abilities and their own intelligence. As she extended her approach to the learning of gifted students, her work offers possible solutions to the modifiability and stability problems (Dweck, 2009).

Dweck postulates that individuals subscribe to one of two beliefs; they either view individual abilities and intelligence as stable (entity theory), or they see them as malleable (incremental theory). She assumes that the incremental theory fosters adaptive learning behavior. Two observations speak in favor of this assumption. First, an incremental theory represents an important resource to maintain an optimistic view of what learning goals seem to be reachable. Second, an incremental theory protects individuals from learning pessimism since setbacks in the learning process always appear surmountable.

Dweck has extensively examined the validity of her theory. She has been able to demonstrate, for example, that incremental theory is correlated positively with self-esteem (Nussbaum & Dweck, 2008), self-regulated learning (Dweck & Master, 2008), goals (Dweck & Grant, 2008), and social competence (Molden & Dweck, 2006). Dweck's postulate – that belief in the modifiability of an individual's abilities decisively increases the stability of the learning process – appears particularly interesting when considered in the context of the stability problem. She demonstrates this empirically with, for example, the problem of falling grades (Blackwell, Trzesniewski, & Dweck, 2007). While many students react to this situation by giving up, those who adhere to an incremental theory of their abilities and their intelligence are more likely to react adaptively, such as increasing their amount of effort (Dweck & Leggett, 1988; Dweck & Master, 2009).

Dweck's approach is promising, yet it must be noted that, from a systemic standpoint, her work does not go far enough. A crucial deficit is the one-dimensional conceptualization of entity theory and incremental theory. Both theories represent the endpoints of beliefs developed across the dimensions of ability and intelligence. Both dimensions, however, are measured with a single scale (Dweck, 1999). In systemic models such as the Actiotope Model of Giftedness, the assumption is made that the stability and modifiability of a system represent system characteristics, which are to be conceptualized independently of one another (Ziegler, 2005).

Implicit personality theories of modifiability and stability in the Actiotope Model of Giftedness

In the Actiotope Model of Giftedness (e.g., Ziegler, 2005; Ziegler & Stoeger, 2008) it is postulated that each action taken is developed and examined in a subjective action space. In this process various goals need to be optimized, and this optimization process takes both the individuals' action repertoires and their environment into account.

Learning episodes lead to an expansion of the action repertoire: individuals become capable of doing things of which they had formerly not been capable. Two types of prerequisites are required for initiating an action sequence that leads to the expansion of the action repertoire. First, the individual needs to see that there is a good chance that the extension of the action repertoire will lead to the chosen goal. In other words, belief in modifiability is necessary, and this belief not only applies to the individual's own learning potential but also to the extendability of the entire Actiotope. Indeed each extension of the action repertoire corresponds to other changes, which need to be made through the process of co-evolution. Thus, each additional step in the learning process leads to new possible actions which, in turn, allow new goals to be reached. All the consequences arising from new possible actions need to be explored in the subjective action space as, for example, successful actions are now possible in settings in which the individual previously was less effective, and so on.

At the same time, however, the individual must also consider whether the extension of the action repertoire and the resulting co-evolutions threaten the stability of the Actiotope. Indeed, only when there is no perceived threat to stability, will the individual initiate new learning processes. Thus, and in contrast to Dweck's theory, the Actiotope Model of Giftedness postulates that beliefs about stability can also be functional. Three types of evidence speak in favor of this assumption:

- (1) It has been demonstrated for many self-theories that assumptions about the stability of the self can play a crucial role in maintaining a healthy view of the self.
- (2) A functional, learning-oriented subjective action space plays a key role in successful learning processes.
- (3) There are studies in which Dweck's one-dimensional conceptualization is compared directly with the independent conceptualization of implicit personality theories (as postulated in the Actiotope Model of Giftedness). This evidence is explored below.

Many research-based studies have shown that maintaining a stable, positive view of the self is an adaptive process (e.g., Baumeister, 1986; Harter, 1993; Swann, Chang-Schneider, & McClarty, 2008). Interestingly, this even constitutes an explicit component within many influential theories. This applies to, among other things, self-esteem (Brown, 1993; Harter, 1993; Leary, 1998), self-concept (Baumeister, 1986), self-regard (Rogers, 1977, 1980), self-definition (Wicklund & Gollwitzer, 1982), and even to impressions of the self in the eyes of the others (Goffman, 1959; Schlenker, 2003). There seems also to be a behavioral tendency to preserve the stability of one's own self-concept (see Swann, Rentfrow, & Guinn, 2003, for a review). People tend to actively seek verification of self-views that they consider to be important and central to the self (Chen, Chen, & Shaw, 2004; Swann et al., 2008).

Ziegler and Stoeger (2008) explore the claim – which is of central importance in the Actiotope Model of Giftedness – that a learning-oriented subjective action space is functional for successful learning processes. In one study, it was shown that high-achieving

pupils in the subject of mathematics could be differentiated from other pupils according to the learning orientation of their subjective action space. High achievement could be better predicted over a temporal distance of six months through the learning orientation of the subjective action space than through intelligence. This finding was replicated in a further study for the scholastic subject of biology. In a third study, it was found that a learning-oriented subjective action space is also beneficial for coming to terms with experiences of failure. Further, in all three studies, a learning-oriented subjective action space outperformed IQ as a predictor of achievements. Dweck's central premise (1999, 2006) is that an entity theory generally can be seen as maladaptive while an incremental theory can generally be seen as adaptive. Ziegler and Stoeger (2010; see also, Stoeger, Ziegler, Schimke, & Cozacu, 2006) hypothesized that an entity theory of one's own abilities does not generally lead to negative consequences. In contrast to Dweck, they assumed that an entity theory only produces negative consequences if a person shows ability deficits. It should produce positive consequences, however, if a person shows high abilities. For example, in two longitudinal studies with students from grades seven through ten, they found supportive evidence for the proposed distinction (Ziegler & Stoeger, 2010). In the first study, they compared the predictive power of Dweck's original scales with two new scales, which take into consideration different adaptations concerning stability beliefs and modifiability beliefs. The results demonstrated that only the new scales were effective for predicting adaptive achievement behavior in the scholastic subject of mathematics. In the second longitudinal study the predictive power of the new framework was confirmed in the scholastic subject of physics.

Aims of the present study

This empirical study focused on a comparison of the conceptualization of implicit personality theories as it is formulated in Dweck's work and as it is envisioned in the Actiotope Model of Giftedness. Dweck offers a one-dimensional perspective in which modifiability and stability represent two extremes within one dimension. Accordingly, an incremental theory should encourage adaptive behavior while an entity theory should encourage non-adaptive behavior. By contrast, in the Actiotope Model of Giftedness, the view is advanced that learning processes require both stability and modifiability. Expansions of the action repertoire only appear justified in the subjective action space when both the step in the learning process and the co-evolution are possible (modifiability belief). But the expansion of the action repertoire should not be allowed to threaten the stability of the Actiotope, since this would lead to the loss of this behavior opportunity (stability belief). Thus stability *and* modifiability need to be observed. The current research pursues two goals on the basis of these theoretical considerations.

Previous studies in which Dweck's one-dimensional conceptualization was compared with the independent conceptualization of convictions about modifiability and stability did not include gifted participants. This study will therefore examine students whose high IQ indicates an above-average academic action repertoire (cf. Stoeger & Ziegler, 2008). We expect that the systemic view of the implicit personality beliefs in regression models will explain more variance than the one-dimensional conceptualization.

Beliefs are culturally dependent notions. Indeed, there is also clear evidence of cultural differences in the implicit personality theories found in Dweck's framework (e.g., Hong, Chiu, Yeung, & Tong, 1999). Thus our empirical study examines whether modifiability beliefs and stability beliefs measured according to the Actiotope Model

of Giftedness are also influenced by culture. If the independent conceptualization of the beliefs in various cultures turn out to be productive then this would increase their credibility.

Countries can be differentiated according to various criteria on the basis of Hofstede's 4-D Model. Differences in the degree of collectivism and individuality now appear to be of fundamental importance. Our study thus examines gifted students in countries, which differ markedly from one another with respect to these dimensions. Empirical studies (Hofstede, 1986) show that the United States is strongly characterized by individualism and that South Korea, on the other hand, is strongly characterized by collectivism. The same study rates Spain among those nations characterized somewhat, but less strongly, by individualism and Brazil among those nations which are slightly collective in nature.

Method

Participants

The participants comprise a subsample of gifted students in a larger study. In sum, the data from 488 students from four countries are examined; their results in the Raven Test (Standard Progressive Matrices, SPM; Heller, Kratzmeier, & Lengfelder, 1998) lie above the 95th percentile. The average percentile rank of the entire sample was 97.14 ($SD = 2.38$). Among the 488 students, 121 were from Brazil (72 boys, 49 girls), 129 from South Korea (86 boys, 43 girls), 120 from Spain (60 boys, 60 girls), and 118 from the United States (61 boys, 57 girls). Their average age was similar in all four countries ($F(3,485) = 2.54$, $p > 0.05$; Brazil: $M = 12.87$, $S = .82$; South Korea: $M = 12.55$, $S = .62$; Spain: $M = 13.11$, $S = .62$; United States: $M = 13.36$, $S = .73$).

Measures

Cognitive abilities

The cognitive ability levels of the students were assessed with the assistance of the Raven Test (Standard Progressive Matrices, SPM; Heller, Kratzmeier, & Lengfelder, 1998). The questionnaire comprised several measuring instruments previously established in empirical research.

Unless specified otherwise, all items of the scales were presented along a six-point Likert-type scale, ranging from '1' (*I disagree completely*) to '6' (*I agree completely*).

Implicit personality theory (adapted from Dweck). The items suggested by Dweck, Chiu, and Hong (1995) for assessing implicit theories on talent for school were translated into German for use in this study. The three-item scale offers insight regarding the degree to which a student utilizes an entity or an incremental theory of his or her own talent in school, in other words, whether the pupil perceives his or her talents to be fixed characteristics or ones which can be further developed. A sample item from the scale is 'Everyone has a certain amount of ability for school and there is not much that can be done to really change that'. Greater agreement with the items indicates an incremental theory. The Cronbach's α of the scale reached .88.

Stability belief. In order to assess the stability beliefs, a six-item scale, published by Ziegler and Stoeger (2010), was applied. A sample item from the scale is 'After I have

learned something in school, I don't forget how to apply it'. A higher scale value indicates that the individuals believe they can preserve their academic action repertoire. The reliability (Cronbach's α) of the scale was .91.

Modifiability belief. In order to measure the modifiability, a six-item scale, developed by Ziegler and Stoeger (2010), was utilized. A sample item from the scale is 'In school, I can compensate for knowledge deficits by studying more'. A higher value on this scale indicates that the individuals believe they can expand their action repertoire. The reliability of the scale was .90.

Helplessness. The degree of helplessness was assessed with four items taken from the Helplessness Scale (HiS) advanced by Breitzkopf (1985). This scale appraises anxiety (sample item: 'I cannot think clearly in school') as well as the self-perceived non-contingency of one's own actions and the consequences of these actions (sample item: 'Even when I study a lot, I still won't be good in math'). The Cronbach's α of the scale was .92.

Interest. Interest was measured with a six-item scale developed by Ziegler, Dresel, and Schober (1998). This instrument is based on the person-object conception of interest (Krapp, 1998; Krapp & Prenzel, 1992). The importance of something is defined as a 'function of the characteristics of a task and as a function of the needs, goals and values of a person' (Hodapp & Mißler, 1996, p.146). Sample items include: 'Instruction in school is generally very useful' and 'What I learn at school is important to me'. The Cronbach's α was .78.

Failure response. Failure response was measured with the help of a five-item scale (Schober, 2002). The scale measures the degree to which a person reacts adaptively after failure, for example, by enhancing effort. A sample item is 'When I've made a mistake in math, I try with the aim of improving myself'. The Cronbach's α was .75.

Learning-goal orientation. In order to assess learning goals we used the six-item scale developed by Ziegler, Dresel, and Stoeger (2008). The scale measures the degree to which students learn because they want to learn and understand new things. All items begin with the phrase 'In school I want above all to...'. A sample item is 'In school I want above all to work through tricky exercises which can teach me something new'. Cronbach's α was 0.76.

Achievement. As the systems used to evaluate student performance vary from country to country, we asked participating teachers to translate the values used in their respective grading systems into a percentage scale. To this end they were presented with a line of 100 circles under which the percentages 0%, 25%, 50%, 75%, and 100% were written. The statement 'extremely low competencies' was paired with 0% and the statement 'extremely high competencies' with 100%. Above this line were the following instructions: 'How do you assess this pupil's achievement in school? Please mark the circle which best represents your opinion with a cross'.

Aspiration level. Students' aspiration level was measured with the question: 'With which grade would you be satisfied?' (cf. Ziegler & Stoeger, 2004).

Procedure

The students completed the IQ test and the questionnaires in balanced order. Both were administered during two successive normal classroom instruction periods. The sessions were conducted by a research assistant in the presence of the class teacher.

Results

First, descriptive statistics and an analysis of mean differences between the countries are reported followed by the intercorrelations among these variables. Finally, the results of a stepwise regression analysis will be described. As the sex of the participants turned out to be of no significance for the statistical analyses, the data for boys and girls are presented together.

Descriptive statistics

Means (*M*), standard deviations (*SD*), and the results of an analysis of variance with country as independent variables as well as of the *post hoc* Scheffé's test are presented in Table 1. In line with Dweck's own results (e.g., Dweck, 1999), approximately equal numbers of students in each country, with the exception of the United States, subscribe to an entity or an incremental theory. The results of the *post hoc* Scheffé's test show that the US students held an incremental view more strongly than did the students in the other countries.

In all the countries examined, students tended more to a modifiability belief (Ziegler & Stoeger, 2010). Nevertheless, distinct differences among the countries appeared, as the *Post hoc* Scheffé's test shows. The belief in modifiability was weakest in Spain and strongest in South Korea and the United States. The results for Brazil lay midway between these extremes. The results were quite different for the stability belief, though (Ziegler & Stoeger, 2010). The means lay only slightly above the midpoint of the scale; and there were no significant differences among the nations.

Data on six indicators of motivation were collected for all the countries. All of the comparisons of mean values were statistically significant. The United States fared best in this area and achieved the modal value six times. Yet, there is reason to be cautious when evaluating grades, since such grade statistics may equally reflect more lenient, or more strict, grading procedures. A more meaningful comparison existed between grades and aspiration level. But here, too, the grades of students from the United States most strongly surpass their aspirations. The evaluation of motivation in the three other national samples has proven difficult. For example, Brazilian students report the highest degree of helplessness; and their mean grades lie below the average grade for scholastic performance, which they consider to be only barely acceptable. However, the failure response of the Spanish students is the worst among all four countries. The Spanish students are the least likely to pursue learning goals. Our indicators of motivation appear to suggest the following order of national samples of gifted students with regard to motivation: gifted students in the United States achieve the highest values, followed by those in South Korea, and then, with roughly equal values, the gifted students in Spain and Brazil. As the aforementioned examples suggest, these results should be viewed with caution. Further, as our results are not based on representative national samples, the results cannot be applied to the

Table 1. Means, standard deviations, results of the ANOVAs, and results of post hoc tests (Scheffé).

	Brazil	South Korea	Spain	USA	F	p	1/2	1/3	1/4	2/3	2/4	3/4
IPT-Dweck	3.72 (1.21)	3.57 (1.63)	3.69 (0.83)	4.11 (1.22)	5.24	***			m		**	*
Modifiability belief	4.79 (0.73)	5.09 (0.59)	4.23 (0.73)	4.99 (0.67)	38.76	***	**	***		***		***
Stability belief	3.73 (0.92)	3.88 (0.98)	3.79 (0.59)	4.01 (0.81)	2.48	m			m			
Helplessness	2.61 (1.12)	2.42 (0.85)	2.33 (0.76)	2.12 (1.04)	5.59	***			***	m		
Interest	4.72 (1.10)	4.89 (0.76)	4.55 (0.78)	5.10 (0.84)	8.44	***			*	*		***
Failure response	4.43 (0.75)	4.67 (0.57)	4.16 (0.53)	4.48 (0.64)	14.18	***	*	**				***
Learning goals	5.09 (0.85)	5.13 (0.62)	4.92 (0.79)	5.21 (0.68)	3.19	*						*
Grades	64.70(22.37)	68.55 (18.97)	74.04(22.59)	89.14 (8.92)	37.69	***	**	**	***		***	***
Aspiration level	65.32(13.43)	68.87 (11.68)	72.04(20.37)	84.90 (6.55)	44.44	***	**	**	***		***	***

Table 2. Correlation matrix of all variables.

	2)	3)	4)	5)	6)	7)	8)	9)
1) IPT Dweck	.24***	.01	-.21***	.05	.14**	.09	.09	.08
2) Modifiability belief		.38***	-.51***	.48***	.56***	.46***	.33***	.36***
3) Stability belief			-.38***	.42***	.36***	.34***	.25***	.27***
4) Helplessness				-.43***	-.41***	-.33***	-.45***	-.33***
5) Interest					.46***	.59***	.30***	.32***
6) Failure response						.42***	.17***	.16***
7) Learning goal							.24***	.28***
8) Grades								.71***
9) Aspiration level								

Notes: * $p < .05$; ** $p < .01$, *** $p < 0.001$.

respective countries in general. They are important, nevertheless, for the evaluation of the remaining statistical analyses.

Table 2 contains the correlations among the various individual variables. The absolute value of the correlations calculated between each of the three measures and applied to assess implicit theories of personality well as the other variables representing adaptive achievement behavior ranged from .01 to .38. The intercorrelations among the motivational variables ranged from $-.17$ to $.71$. An examination of the multicollinearity of the three predictor variables (the three implicit personality theories) provided satisfactory results and fulfilled the guidelines for acceptable scores.

Regression analyses

In the next step, a series of stepwise regression analyses was calculated. The measures used to assess implicit theories of personality (the adapted scale from Dweck, stability beliefs, modifiability beliefs), as well as the interaction term of the modifiability and the stability beliefs, were set as predictors in the regression model. In order to determine the individual interaction term, the variables were centered on the group mean (that is, for each individual on his or her mean) and the scales were then multiplied with each other. The motivational variables presented above formed the criteria. The results of the regression analyses for all dependent variables are presented in Table 3.

A total of 24 regression analyses were conducted. The adapted version of Dweck's implicit personality theory scale was a significant predictor in only five instances. It prognosticated helplessness in South Korea and the United States as well as interest, grades, and aspiration in Brazil. The adjusted R^2 were quite small, the median only reached 2.2%.

Stability and modifiability beliefs as well as their interaction turned out to be better predictors. The variance explained by these three predictors is, for Brazil, South Korea, Spain, United States respectively, as follows: 32.8%, 47.5%, 22.4%, and 47.6% for helplessness; 39.0%, 28.8%, 27.4%, and 26.8% for interest; 33.9%, 25.8%, 28.1%, and 28.6% for failure response; 44.5%, 14.8%, 22.9%, and 12.1% for learning goals; 13.1%, 32.4%, 23.7%, and 12.6% for grades; 11.8%, 17.6%, 18.4%, and 15.2% for aspiration level. Although most R^2 are of moderate size, the explained variances,

Table 3. Results of the regression analyses.

	Brazil			Korea			Spain			USA								
	Helplessness									Interest								
	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p		
IPT Dweck					2.20	-.15	-2.38	*					1.90	-.17	-2.07	*		
Stability belief	3.90	.53	2.62	**	2.00	-.16	-2.25	*					2.80	-.19	-2.85	**		
Modifiability belief					45.50	-.60	-8.61	***	22.40	-.47	-5.84	***	44.80	-.55	-6.71	***		
Stability × Modifiability	28.90	1.03	5.01	***														
Adjusted R^2	32.80		49.70		22.40				49.50									
					Interest													
	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p		
IPT Dweck	2.60	-.18	-2.50	*														
Stability belief	28.70	2.26	5.43	***	2.50	2.67	3.76	***										
Modifiability belief	2.70	1.23	5.13	***	20.00	1.44	4.61	***	3.40	.26	2.54	*						
Stability × Modifiability	7.60	2.50	4.47	***	6.30	3.06	3.51	***	27.40	.53	6.78	***	23.40	.33	3.19	**		
Adjusted R^2	41.60		28.80		27.40				26.80									
	Brazil			Korea			Spain			USA								
	Failure response																	
	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p		
IPT Dweck																		
Stability belief	2.60	.20	2.36	*														
Modifiability belief	30.40	.46	5.40	***	25.80	.51	6.78	***	28.10	.54	6.90	***	23.40	.29	2.90	**		
Stability × Modifiability																		
Adjusted R^2	33.00				25.80				28.10				23.40					

Table 3. (Continued).

	Learning Goal											
	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p
IPT Dweck												
Stability belief	5.40	1.42	3.52	***								
Modifiability belief	3.80	1.03	4.51	***	14.80	.39	4.84	***				
Stability × Modifiability	35.30	1.49	2.78	**	22.90	0.49	6.03	***	12.10	.36	4.13	***
Adjusted R ²	44.50		14.80		22.90				12.10			
	Grades											
	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p
IPT Dweck	5.80	-.26	-2.97	**								
Stability belief												
Modifiability belief					32.40	.63	2.41	*	12.60	.37	4.22	***
Stability × Modifiability	13.10	.36	4.18	***	23.70	.49	5.95	***				
Adjusted R ²	18.90		32.40		23.70				12.60			
	Brazil											
	Korea											
	Spain											
	USA											
	ΔR^2	β	t	p	ΔR^2	β	t	p	ΔR^2	β	t	p
IPT Dweck	5.30	-.25	-2.85	**								
Stability belief												
Modifiability belief	11.80	.38	4.42	***	17.60	.43	5.34	***	18.40	.44	5.24	***
Stability × Modifiability									15.20	.40	4.67	***
Adjusted R ²	17.10								18.40			

Notes: Only those predictors with p < .05 were included in the regression model. Depicted in the table are the regression coefficients and significance levels for the final regression model (**p < .001, ***p < .01, *p < .05).

which are considerably higher than in Dweck's original scale, clearly show, however, that they play an important explanatory role.

It is interesting to note that stability belief did not serve as a significant predictor in Spain or the United States, that is, it was not relevant in the very societies characterized as being, respectively, the least and the most individualistic. But the interaction term of the modifiability belief and the stability belief reached statistical significance in the case of interest, failure response, learning goals, and grades (only Spain). Modifiability was even more frequently a significant predictor, that is, for helplessness, interest (only the United States), failure response, learning goals, grades (only the United States), and aspirations.

Stability beliefs predicted helplessness and interest in both modestly collectivist Brazil and strongly collectivist South Korea; in Brazil they also predicted failure response and learning goals. The interaction between stability belief and modifiability belief was a significant predictor of helplessness (only Brazil), interest, learning goals (only Brazil), and grades (only Brazil). Modifiability beliefs were a significant predictor of all motivational variables in South Korea. Modifiability beliefs were predictors of interest, failure response, learning goals, and aspirations in Brazil.

Discussion

The question of how gifted individuals manage to progress down a very long path of learning to a state of excellence formed the starting point for this study. A learning process, which may involve many years, requires that the learners find the motivation to continually extend the limits of their capabilities (*incremental principle*). From a systemic perspective, we are dealing with learning that takes place well beyond the point of equilibrium (Ziegler, 2005).

Dweck (1999) identifies two salient problems that arise along this path of learning: the maintenance of a favorable view of what learning goals seem to be reachable and the avoidance of an insidious learning pessimism. It follows that the situation must be avoided in which a setback causes an individual to feel that the next step in the learning process is not within reach. This would lead to the phenomenon of arrested development. She views an incremental theory as a key component in surmounting these problems: individuals should believe in the modifiability rather than the stability of their abilities and intelligence.

Dweck views the individual from the perspective of personality theory (Dweck, 1999, 2006). In the Actiotope Model of Giftedness (Ziegler, 2005), the individual is viewed rather from a systemic perspective. This leads to two major problems. The first is that after every successful learning episode the conviction must remain intact that the next step in the learning process can be successfully taken. This is defined as the modifiability problem. The stability problem refers to the perennial changes, setbacks, and difficulties, which jeopardize the learning process at any given moment. Indeed, parallel to gaining expertise in a particular area, individuals continue to experience normal ontogenetic developments related to their body, personality, and numerous individual capabilities. New environments, furthermore, frequently demand adaptation from the individual. An exploration of whether Dweck's beliefs can be further developed in accordance with the modifiability and stability problems therefore seems to be a meaningful undertaking. We hypothesized that an entity theory does not show negative effects when applied to positive aspects of one's own talent and one's own learning. The maladaptive consequences postulated by Dweck should be limited, in

our view, to cases in which the negative aspects of one's own talent and learning are considered to be stable entities. In short, we assume that both the belief in the stability of existing abilities, as well as the belief in the modifiability of ability deficits, are adaptive.

In line with these assumptions, Ziegler and Stoeger (2008, 2010) showed that a systemic approach permits better prognoses of the grades of average students than does, for example, the students' intelligence quotients. The work of Ziegler and Stoeger (2008, 2010) demonstrates, in particular, that modifiability and stability beliefs lead to prognoses, which are more accurate than those based on Dweck's incremental beliefs. In this study we sought, first, to replicate the results for gifted students and, second, to validate them across cultures.

In the empirical study, the newly devised implicit personality beliefs explained – by way of regression analyses – considerably more variance than did Dweck's original scale, which reached statistical significance in only five of 24 regression analyses and explained, in the median, only 2% of the variance. The general lack of correlations and, in some cases, very low degrees of correlation with motivation should not be interpreted, however, as a falsification of Dweck's model. Dweck has explained repeatedly that incremental beliefs are important particularly after setbacks (Dweck, 1999; Mueller & Dweck, 1998). We do not have information about the failures of gifted students as depicted in the four national samples. The assumptions of the Actiotope Model of Giftedness could naturally be applied to failure experiences, but the model does not take such experiences into special consideration.

The results of the regression analyses show the systemic expansion of Dweck's incremental theory to be productive. Considering the fact that motivation is a complex phenomenon, even the R^2 values achieved solely through the stability and modifiability beliefs and through their interactions are impressive.

However, the pattern of results for the new personality theories in the regression analyses is not stringent. The following trends can be observed: stability beliefs were not predictors of the motivation indicators in collectivist South Korea and in weakly collectivist Brazil. But interactions between the stability belief and the modifiability belief surfaced for these two countries. Accordingly, it is important that a student senses stability and modifiability with regard to his or her own learning experiences.

The results suggest, in sum, that the employment of the new differentiation between adaptive stability and modifiability beliefs in the area of gifted education should be explored. In carefully translating Dweck's results (Dweck, 1999, 2006), two goals in particular seem important: both the gifted student *and* the educator should advance these adaptive beliefs. Schober (2002), for example, has already published a successful training program for students. It is important to consider how the results of our study fit into the literature on motivation, especially since motivation is a function not merely of implicit theories (Heckhausen, 1980). And, indeed, the implicit theories were only partially examined in our empirical study. We only incorporated theories of stability and modifiability that apply to one's own learning and to the learning process, or apply to, expressed in the terms of the Actiotope Model of Giftedness, the expansion of one's own action repertoire. It is certain that further subjective beliefs will also be important. For example, self-referential beliefs need to be expanded through the integration of implicit theories of stability and modifiability of the environment in which actions are taken. It is well known, for example, that a key factor enabling some tennis players to win the highly renowned tennis tournament, the Wimbledon Championships, is the grass court; and, for some of these same players, the clay court of the

French Open may prove to be an insurmountable hurdle preventing them from winning (and vice versa). Thus, the tennis environment changes in important ways across major tennis tournaments.

In the future, the relationships between, on the one hand, adaptive stability and modifiability beliefs and, on the other, further important determinants of motivation will have to be examined along with other implicit theories. It is plausible, for instance, to assume that beliefs and the individual goal system correlate in manifold ways (Shah & Kruglanski, 2000; Shah, Kruglanski, & Friedman, 2003). It was Dweck, in particular, who frequently stressed this link in her early work. The connections between, on the one hand, stability and modifiability beliefs and, on the other, learning goals appear, in this respect, promising and should be given further attention. It seems possible that the new conceptual basis regarding beliefs will allow us to move beyond earlier work and identify closer and more stable correlations with other goal orientations and aspects of motivation as well.

Limitations

In closing we would like to address a few of the limitations associated with the present study. The first is that this research was conducted with questionnaires. In contrast, Dweck's assumptions are supported by a wide array of data sets, which were collected through a broad range of methods (Dweck, 1999, 2006). A second limitation is the focus on general school achievement. Although this might be justified in a preliminary cross-cultural study on this topic, in further empirical studies one should bear in mind that subject-related studies (focusing, for example, on mathematics or physics) would probably be more appropriate. Because of the domain-specificity of many achievements and of motivation, the explained variances might even increase. A third limitation is the cross-sectional design of our study. In order to investigate causal relationships, longitudinal designs will be needed in future studies. A final limitation worth mentioning is the non-representative country samples. The differences in motivational levels among the country samples may well be due to school or other effects.

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