Educators' Implicit Theories of Intelligence and Beliefs about the Identification of Gifted Students*

Teorías implícitas de los educadores sobre la inteligencia y creencias sobre la identificación de los estudiantes talentosos

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Abstract

This research study analyzed the structure of educators' implicit theories of intelligence (ITI) and explored the relationship between ITI and beliefs about the identification of gifted students. This study included a sample of 372 educators. School Teachers and professors from colleges of education favor practical, analytical, and creative attributes in their prototypes of an intelligence person. However, participants were fairly neutral about whether interpersonal and intrapersonal attributes characterized intelligent people. Educators that rated creativity as an important attribute of intelligence tend to favor multiple methods to identify gifted students. In contrast, educators who supported the use of IQ test as the primary basis of gifted identification tended to agree that analytical abilities were part of the structure of intelligence.

Key words authors
Implicit Theories of Intelligence, Confirmatory Factor Analysis, Teacher Beliefs, Gifted Identification, Intelligence, Creativity.
Key words plus
Factor Analysis, Intelligence, Gifted, Educators.

Resumen

Este estudio analizó la estructura de las teorías implícitas de los educadores sobre la inteligencia (ITI, por sus siglas en inglés) y exploró la relación entre las mismas y las creencias sobre la identificación de los estudiantes talentosos. El estudio incluyó una muestra de 372 educadores. Los profesores de colegio y universidad favorecen atributos prácticos, analíticos y creativos en sus prototipos de una persona inteligente. Sin embargo, los participantes mostraron bastante neutralidad a la hora de determinar si los atributos interpersonales o intrapersonales caracterizan a la gente inteligente. Los educadores que puntuaron la creatividad como atributo importante de la inteligencia tienden a favorecer múltiples métodos para identificar a los estudiantes talentosos. En contraste, los educadores que apoyaban el uso de pruebas de coeficiente intelectual como la base para la identificación del talento generalmente estuvieron de acuerdo con que las habilidades analíticas eran parte de la estructura de la inteligencia.

Palabras clave autores
Teorías implícitas de la inteligencia, análisis factorial confirmatorio, creencias de los profesores, identificación del talento, inteligencia, creatividad.
Palabras clave descriptores
Análisis factorial, inteligencia, superdotado, personal docente.

* Artículo de investigación.

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Introduction

Implicit theories are essentially definitions; ideas or theories that laypersons or scientists have about some phenomena (Sternberg & Davidson, 1986). Understanding people's implicit theories is important because these beliefs guide people's attitudes and behaviors. Social cognition theory suggests that beliefs determine their attitudes and their willingness to be engaged in certain behaviors (Pintrich & Schunk, 2002). Additionally, Teachers 'and Faculties' implicit theories determine many of their instructional decisions (Gómez-López, 2005).

Implicit theories of intelligence (ITI) are beliefs that people have about what intelligence is and how it is manifested in people's behavior. Prior research indicates that people possess implicit theories of intelligence, and they use these implicit theories to evaluate themselves and hypothetical others (Sternberg, 1985). In gifted education, implicit theories of intelligence are of particular interest because intelligence is interwoven into most definitions of giftedness.

There are several reasons it is important to understand ITI (Sternberg, 2000). First, these theories drive the way in which people perceive and evaluate both their own intelligence and that of others. Therefore, ITI may influence the identification and nomination of gifted students (Maker, 1996). Second, implicit theories give rise to explicit theories and can help researchers to refine and revise existing explicit theories. Finally, analyzing implicit theories of intelligence across cultures and ages can help to understand developmental and cultural differences in expectations about intellectual abilities (Sternberg, 2000).

To analyze ITI, researchers have developed a variety of classification schemes. Early works studied whether intelligence is a stable genetic trait or is modifiable by environmental factors (Lynott & Wolfolk, 1994). In this vein of research, some researchers (Blackwell, Trzesniewski & Dweck 2007; DaFonseca , Schiano-Lomoriello, Cury, Poinso, Rufo & Therme, 2007; Hong, Chi-yue & Dweck, 1999; Cabezas & Carpintero, 2006) have classified theories of intelligence as fixed (entity theories) or malleable (incremental theories).

There may exist certain prototypes of intelligence (Sternberg, Conway, Ketron & Bernstein, 1981; Cabezas & Carpintero, 2006). These prototypes are related to the characteristics that people assign to intelligence, intelligent behavior, or intelligent people. Sternberg et al. (1981) identified different constructs related to intelligence such as: verbal ability, social competence, verbal intelligence, problem solving ability, and practical intelligence. In addition, he found that these constructs vary among different populations. Using factor analysis, Lynott and Wolfolk (1994) found the following dimensions or attributes that people use to describe intelligent people: practical, academic, socially adaptive, and conceptual thinking.

Most of the research conducted on implicit theories examines the role of a student's beliefs about his or her own intelligence on achievement and motivation. Dweck's model of motivation states that there is a relation between the ITI of students and their self-motivational process, specifically in the kind of goals that students set for themselves (Blackwell, Trzesniewski & Dweck, 2007; Dweck, 2000; Carpintero, Cabezas, González & Fernández, 2003; Valenzuela, 2007). In addition, Ablard (2002) found that learning goals are stronger in students that have an incremental theory of intelligence. However, Strømsø and Bräten (2004) found that there were weak and non-statistically significant relations between intelligence beliefs and three measures of goal orientations (mastery goal, performance approach goals and performance avoidance goals). As these authors suggest, it is important to develop more field-oriented research to elucidate the nature of the relationship between implicit theories and goal orientations. Finally, research developed by (Hong et al., 1999) showed that ITI affect attributions and coping behaviors. Incremental theorists tend to associate attribute failure with effort, and they tend to engage in remedial actions more than entity theorists.

Although the previous results are applied to students' beliefs, it is posible that a similar process exists for teachers' beliefs about intelligence.

Some researchers suggest that teachers' behavior and attitudes are influenced by their beliefs about the nature of the intelligence (Deemer, 2004; Dupeyrat & Marine, 2005). Lynott and Wolfolk (1994) found a relationship between the implicit theories of the teacher (conceptual thinking-practical knowledge) and the teacher's educational goals. Further, Lee (1996) found that teachers with an entity implicit theory and teachers with an incremental theory treat their students differently. Entity teachers tended to focus more in the abilities of students, whereas incremental teachers tended to focus in strategy and effort in learning. Moreover, entity teachers viewed failures as obstacles to be overcome, in contrast with incremental teachers, who believed that failures were learning opportunities.

Based on the previous review, teachers' nomination and identification of gifted students may be mediated by teachers' implicit theories of intelligence. This study examined a national sample of classroom teachers and professors. The main purpose of this research was to analyze and to understand educators' implicit theories of intelligence (ITI) and to explore the relationship of ITI with their beliefs about identification of gifted populations, their beliefs about the malleability of intelligence, and their self-evaluations on the hypothesized attributes.

Method

Sampling framework

We included two groups of educators: teachers that work in schools and have direct contact with gifted students and professors from schools of education, who may provide education for current and future teachers. It was important to include faculty from school of education because their beliefs may play an important role in the development of their students' beliefs, and these students will ultimately be the teachers of gifted students. In addition, professors' beliefs could affect the choice of curricular content and competencies that they seek to develop in pre-service and in-service teachers with whom they have contact.

A nationally representative sample of 1000 K-12 educators and 1000 professors from schools of education around the country were invited to participate in the study. After procuring names and addresses from a marketing company, we mailed surveys and postage paid envelopes to these 2000 educators. A second mailing went out to non-respondents approximately 10 weeks after the initial mailing. 372 surveys were collected in this process. The response rate to the survey was approximately 25%. The sample consisted of 168 teachers and 204 professors from the mail portion of the study.

Instrumentation

The participants completed four instruments. The Implicit theory of Intelligence Survey (ITIS) (Garcia-Cepero & McCoach, 2006) was used to identify the structure of implicit theory of intelligence. The survey of implicit theories of intelligence, developed by Carol Dweck (Dweck, 2000) was used to identify and assess the degree to which participants considered intelligence fixed or malleable. An adapted and revised version of the survey on Assumptions Underlying the Identification of Gifted and Talented Students (Brown et al., 2005) was used to identify participants' beliefs about identification of gifted students. The last section included a small self-rating instrument that gathered information about participants' perceptions of their ability in selected areas (creativity, social conscience, analytical ability, practical ability, and interpersonal ability). The items from each instrument are included in the Appendix.

Analysis

Initially, a series of factor analyses were conducted to identify the measurement model for each of the surveys and scales. Confirmatory Factor Analysis (CFA) was used with the ITIS and Dweck's survey of Implicit Intelligence, because these instruments had previously undergone a validation process (Bryant & Yarnold, 2005). Therefore, we were able

to posit an a priori structure for these instruments. In contrast, because we had made substantial modifications and adaptations to the survey of beliefs about identification of gifted students, we conducted an Exploratory Factor Analysis (EFA) to identify the factorial structure of this instrument (Bryant & Yarnold, 2005). Once the best measurement model was identified for each survey, the reliability of each scale was calculated. After this, we conducted a series of descriptive analyses to identify the general ITI tendencies within the sample of teachers and professors.

To analyze the relationships among the scales and the differences among the teacher's and professor's responses, we used Structural Equation Modeling (SEM) techniques (Loehlin, 2004; MacCallum & Austin, 2000; McCoach, 2003).

The first survey identified the structure of the educators' implicit theory of intelligence (ITIS) using four different sub-scales: analytic, practical, creative, and inter-intra personal. Each sub-scale had a range from 1 to 7 where lower scores represented lower agreement to include items from that factor (analytic, practical, creative, and inter-intra personal) as part of the prototype of intelligence; higher scores represented high agreement to include items from that factor as part of the prototype of intelligence. The reliability estimates for each of the IT IS subscales were .87, .82, .84 and .96 respectively. Based on the CFA analysis, the measurement model exhibited less than adequate fit: $\chi 2$ (521, N= 369)= 1824.73 $\rho <$ .001; CFI= 0.851 ; TLI= 0.840; RMSEA= 0.082; 90% CI of RMSEA= 0.078 to 0.086; SRMR= 0.071. The model fit could be improved considerably if correlated errors were added to the measurement model (Tomarken & Waller, 2005). Table 1 depicts the reliability information for all the scales used in the current study.

The second survey, Dweck's survey of implicit theories of intelligence, (Dweck, 2000) measured the malleability (modifiability) of intelligence. The survey contained one 8-item scale that included questions about how malleable or fixed respondents believe the intelligence is. Four of the questions asked whether the respondent agreed that intelligence was fixed. The other four questions asked whether the respondent agreed that intelligence was malleable. This CFA analysis modeled two factors: a substantive factor, and a method factor, which accounted for the opposite (negative) wording of four of the items. To address this method effect, we used the CT-C(M-1) Model (Maydeu-Olivares & Coffman, 2006). Based in the CFA analysis, the measurement model seemed to exhibit reasonable fit (χ^2 (16, *N=371)*= 65.711 $\rho <$ 0.001; CFI= 0.98; TLI= 0.96; RMSEA= 0.092; 90% CI of RMSEA 0.069 to 0.115; SRMR= 0.033). The reliability estimates were .92 for the present sample. This response scale ranged from

Table 1
Surveys reliability for the sample of teachers and professors

Scale	Number of Items	Average inter-item correlation	SD of IIC	Cronbach's alpha
ITIS				
Inter-Intra-personal Scale	14	0.64	0.07	0.96
Practical Scale	6	0.44	0.12	0.82
Creative Scale	6	0.47	0.08	0.84
Analytic Scale	8	0.45	0.10	0.87
Dweck's				
Malleability Factor	8	0.59	0.12	0.92
Believes Identification				
Multiple Identification Method	5	0.50	0.08	0.83
IQ Based Method	5	0.38	0.10	0.76

Source: own work.

1 to 7. Higher scores on this scale indicated a tendency to believe that intelligence is malleable, and lower scores indicated a tendency to believe that intelligence is fixed.

The third survey measured participants' beliefs about identification of gifted students. This survey was based on the instrument developed by Brown et al. (2005), and it included two subscales. An EFA was conducted using principal axis factoring and oblimin rotation. A parallel analysis suggested a two factor extraction solution. Two meaningful factors were then extracted, and they explained 31% of the variance. The first factor measured the degree of agreement with using IQ as the primary form of identification. This subscale had an internal consistency Cronbach's alpha reliability estimate of 0.76 in the present sample. The second scale focused on the use of multiple criteria for identification as gifted, and had a Cronbach's alpha of 0.83. Each of the scales had 5 items. Six of the original items were eliminated because they had low loadings on both factors (questions 7, 10, 13, and 15) or because elimination of the item increased the Cronbach alpha reliability estimate (question 3). The scores of these sub-scales ranged from 1 to 7, where lower scores indicated that the respondent did not endorse the identification method (IQ base or Multiple criteria). In contrast, higher scores represented a tendency to endorse the identification method.

The self-evaluation section contained a 7-point Likert scale in which participants ranked themselves in the following five areas: interpersonal skills, analytic ability, social conscience, inter/intrapersonal ability, practical abilities, and creativity. For these analyses, the items of the self-assessment survey were collapsed around two factors using CFA. The first factor measured self–perceptions of cognitive skills such as analytic ability and creativity. The second factor measured a more affective dimension. This factor included social conscience, practical ability (common sense) and inter-intra personal ability. The two factor model exhibited reasonable fit: χ^2 $(24, N=371) = 41.98$ $p = 0.013$; CFI= 0.92; TLI= 0.93; RMSEA= 0.064; 90% CI of RMSEA 0.029 to 0.095; SRMR= 0.173.

Results

On average, the teachers and professors in the sample tended to favor analytic attributes in their prototypes of an intelligent person. In addition, there was a clear tendency to include practical and creative characteristics in their theories about the attributes of an intelligent person. However, on average, participants were fairly neutral about whether inter- and intrapersonal attributes characterized intelligent people. Table 2 depicts the sample means and standard deviations for these four scales, as well as the others scales included in the survey.

There was no general tendency for teachers and professors to consider intelligence as fixed or as malleable (mean=4.34). However, this scale had a fairly large standard deviation (SD=1.16),

Table 2
Mean and Standard Deviation of the scales

Scale		M	SD
Structure of implicit theory (ITIS)	Analytical	5.73	0.77
(1-7 Scale)	Creative	5.56	0.85
	Practical	5.27	0.79
	Inter/Intrapersonal	4.42	0.99
Modifiability of intelligence	Modifiability of intelligence	4.34	1.16
(1-7 Scale)			
Self perception	Interpersonal abilities	5.37	0.95
(1-7 Scale)	Analytical abilities	5.18	0.93
	Social conscience	5.58	0.91
	Practical abilities	5.52	0.92
	Creative abilities	5.01	1.13
Beliefs about identification	Multiple approach	6.26	0.70
(1-7 Scale)	IQ Based Identification	3.11	0.9 7

Source: own work.

indicating that there was considerable amount of variability among participants in terms of their beliefs about malleability of the intelligence.

In terms of people's perceptions of their own abilities, in general, people perceived themselves to be above average on most or all of the 5 traits. The means of all 5 self-perception factors were between 5 and 5.6 on a scale of 7, where 7 means they believe that they belong to the 1% top percent of the population in that attribute, a score of 6 indicates very high ability, a score of 5 indicates high ability, and a score of 4 means that they consider to themselves to have average ability.

Finally, there was a strong tendency among the educators to endorse the use of multiple criteria for identification of gifted populations (Mean=6.26 on a 7 point scale). On the contrary, there was a slight tendency to eschew the use of IQ as the basis of the identification process (Mean=3.11). There was more variability in people's attitudes about using IQ-based approaches (SD=.97) than there was in their attitudes toward using multiple criteria approaches (SD=.70).

To analyze the relations among the constructs, we used structural equation modeling techniques. Before creating the model that included all the scales, we tested each of the initial CFA measurement models separately to test for invariance among the two groups. Table 3 summarizes the unstandardized regression weights and standard errors for the items and table 4 depicts the pattern matrix for the survey of beliefs of identification of gifted students.

Table 3
Unstandardized regression weights for the instruments

	Estimate	S.E.	Est./S.E.
IT IS			
Inter-Intrapersonal factor			
understands his/her feelings	1.00	0.00	0.00
deals effectively with people	1.06	0.06	19.19
accepts others for who they are	1.01	0.05	18.90
maintains emotional control	1.02	0.05	19.67
Remains calm under pressure	1.00	0.05	18.60
is sensitive to other people's needs	1.00	0.07	15.26
Can see issues from other people's point of view	1.03	0.07	15.81
is a good judge of other people	0.97	0.07	14.78
Has a social conscience	1.05	0.06	18.79
earns the trust of others	1.04	0.06	17.14
Has high moral values	1.04	0.06	18.73
Acts responsibly	1.12	0.06	19.87
prioritizes the needs of the group above his/her needs	0.91	0.05	17.29
wants to improve society	0.98	0.06	16.98

	Estimate	S.E.	Est./S.E.
Analytic Factor			
reads with high comprehension	1.00	0.00	0.00
learns rapidly	1.05	0.09	11.66
reasons logically	1.17	0.10	12.13
Has a good memory	0.89	0.09	9.65
Makes accurate inferences	0.94	0.09	10.89
sees relationships among different concepts	0.69	0.07	9.45
processes information easily	1.05	0.09	11.47
is analytic	1.08	0.09	12.26
Practical Factor			
Solves real problems efficiently	1.00	0.00	0.00
is able to use what he/she knows to solve problems in real life	0.66	0.07	9.34
is capable of solving real world problems	0.66	0.07	8.88
is a good decision maker	1.08	0.08	13.13
easily adjusts to new situations	0.99	0.08	11.93
is able to shape his/her environment	0.89	0.08	11.39
Creativity Factor			
Displays creativity	1.00	0.00	0.00
is full of ideas and insights	0.95	0.09	11.21
is independent in thought and action	0.97	0.09	10.49
Comes up with unusual ways to solve problems	1.02	0.08	12.36
finds original relationships among concepts	0.93	0.08	11.17
is imaginative	1.07	0.08	12.83
Self-evaluation factors			
Self evaluation non-cognitive abilities			
Self- evaluation Interpersonal skills	1.00	0.00	0.00
Self- evaluation social conscience	1.15	0.14	8.11
Self- evaluation practical abilities/common sense	0.78	0.12	6.69
Self-evaluation cognitive abilities			
Self- evaluation analytical abilities	1.00	0.00	0.00
Self- evaluation creative skills	1.14	0.38	2.98

Source: own work.

Table 4
Pattern matrix of beliefs about identification for teacher and professors sample

	Multiple criteria	IQ Based
Identification should include options that allow students to express themselves in many ways (e.g., written, visual, oral, constructed, interpersonal).	0.80	
An effective plan for identification requires the use of several types of information about the student.	0.69	
At least part of the identification process should be individualized.	0.66	
Gifted and talented students may express their abilities in many ways.	0.65	
The identification process should include the assessment of nonintellectual factors such as creativity and leadership.	0.60	
Standardized intelligence tests are the most accurate instruments to identify gifted students.		0.77
Identification should be based primarily on an intelligence or achievement test.		0.70
All gifted students have high IQ.		0.65
All students with high IQ are gifted.		0.55
A precise cut-off score should be set for all tests used in identification.		0.45
Identification should be restricted to a fixed percentage of the total student population.		0.35

Note. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. **Pattern coefficients below 0.15 are suppressed.

Source: own work.

The models for Dweck's survey and the self-rating survey were totally invariant across the two groups. The model for the ITIS was a partially-invariant across the two groups. The standardized regression weights for all four factors were invariant across the two groups. However, for this model, the errors for the indicators of the inter-intrapersonal factor were significantly different across the two groups. Additionally, the mean for the inter-intrapersonal factor differed across the two groups. Finally, the correlation of the inter-intrapersonal factor with other factors in the model differed across the two groups. Figure 1 presents the full measurement model.

We conducted a series of multiple group SEM analysis to determine the invariance level of the model. It was possible to establish a partial invariance across the two groups. The loadings in the model were invariant. The errors and correlations were invariant in all factors except the inter-intrapersonal factor. The factor means were freely estimated across the two groups. Table 5 and 6 summarize the results of these analyses.

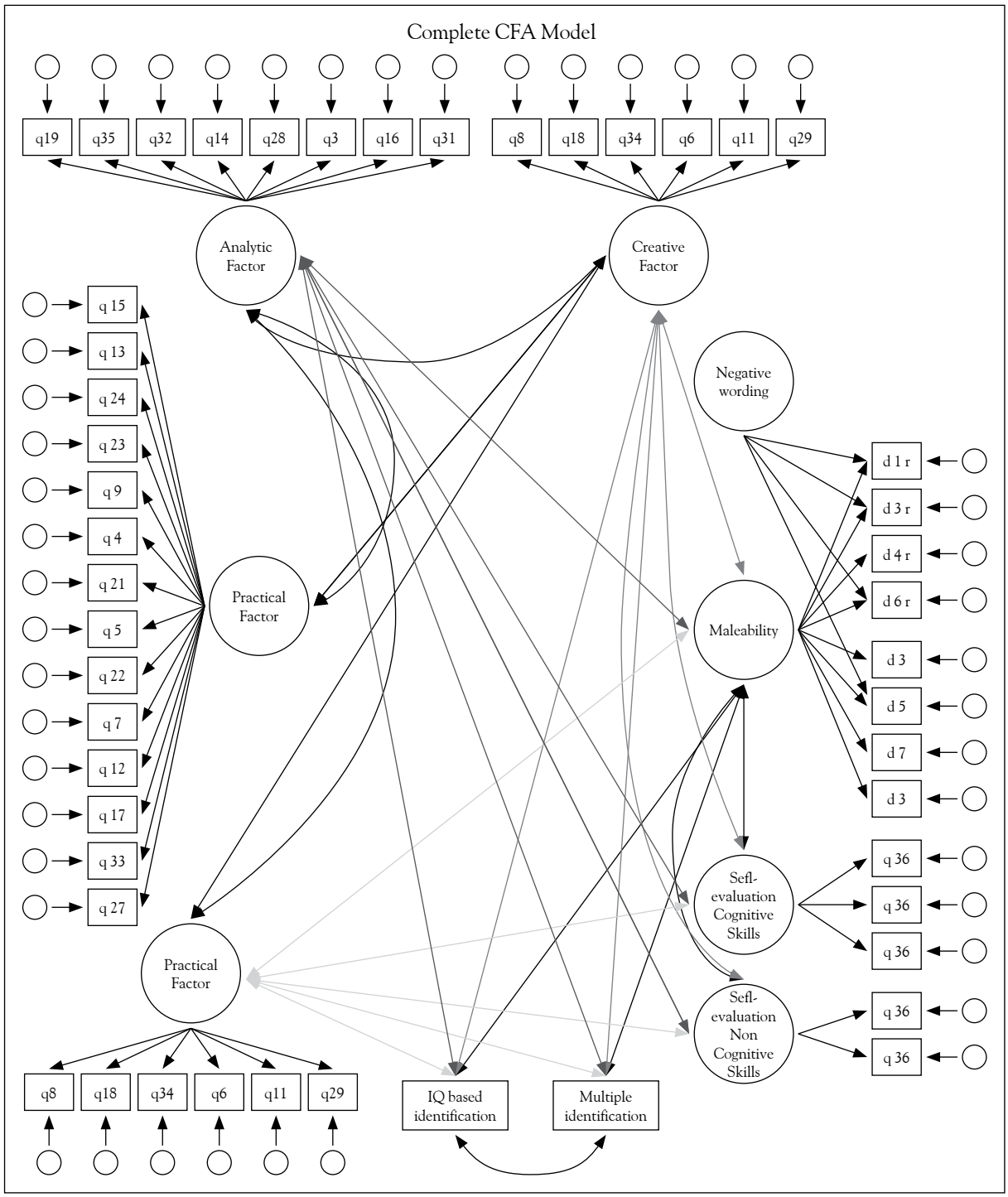

Figure 1
Measurement model of implicit theories of intelligence, beliefs about identification of gifted students and self-evaluation of abilities.

Source: own work.

Table 5
Goodness-of –fit Indices for Multiple group comparison

Model	χ^2 (df)	χ^2/df	$\Delta\chi^2$ (Δdf)	CFI	TLI	RMSEA (90% CI of RMSEA)	SRMR
Model 1	4353.62 (2217) *	1.96	---	0.82	0.81	0.072 (0.069-0.076)	0.07
Model 2	4391.63 (2260) *	1.94	38 (14)	0.82	0.81	0.072 (0.068-0.075)	0.07
Model 3	4442.43 (2297) *	1.93	50.8 (37)	0.82	0.81	0.071 (0.068-0.074)	0.08
Model 4	4477.645 (2329) *	1.92	34.2 (31)	0.82	0.82	0.071 (0.068-0.074)	0.08
Model 5	6079.86 (2337) *	2.6	1603.2 (9)*	0.69	0.69	0.093 (0.090-0.096)	1.35

Note. Model 1: Model with free estimates.
Model 2: Model with all loadings constrained.
Model 3: Model with all loadings constrained, and errors constrained in all factors except in Inter-Intra factor.
Model 4: Model with all loadings constrained, and correlation and errors constrained except in Inter-Intra factor.
Model 5: Model with all loadings constrained, and means correlation and errors constrained except in Inter-Intra factor.
$\rho \leq 0.001$.

Source: own work.

There were moderate to high correlations among the four factors on the ITIS, with correlation coefficients ranging from 0.39 to 0.86. Table 3 present the correlation indices among all the factors. The analytic factor and the creativity factor of the IT IS are highly correlated (r=0.84), as are the inter/intra-personal factor and the practical factor (r=0.81 for teachers and 0.86 for professors).

In terms of people's perceptions of their own abilities, there was a moderate correlation among the non cognitive and cognitive variables (r=0.59, $p<0.05$). Therefore, people that rated themselves high in terms of their cognitive abilities also tended to rate themselves as high in terms of their non-cognitive abilities.

Table 6
Unstandardized regression weights for the structural part of the model

	Estimate	SD	Estimate/ SD
Analytical factor with practical factor	0.44	0.06	7.64*
Analytical factor with creativity factor	0.50	0.06	8.05*
Analytical factor with inter-intrapersonal factor	0.32	0.06	5.77*
Multiple identification method with inter-intrapersonal factor	0.11	0.04	3.01*
Multiple identification method with practical factor	0.11	0.03	3.19*
Multiple identification method with creativity factor	0.16	0.03	4.68*
Multiple identification method with analytical factor	0.09	0.03	2.88*
Multiple identification method with malleability factor	0.04	0.03	1.39
IQ based identification method with inter-intrapersonal factor	0.06	0.05	1.27
IQ based identification method with practical factor	0.09	0.05	2.06*
IQ based identification method with creativity factor	0.03	0.04	0.70

	Estimate	SD	Estimate/ SD
IQ based identification method with analytical factor	0.11	0.04	2.61*
IQ based identification method with malleability factor	-0.16	0.05	-3.44*
Self-evaluation non cognitive abilities with inter-intrapersonal factor	0.07	0.04	2.00
Self-evaluation non cognitive abilities with practical factor	0.12	0.03	3.37*
Self-evaluation non cognitive abilities with creativity factor	0.09	0.03	2.58*
Self-evaluation non cognitive abilities with analytical factor	0.07	0.03	2.29*
Self-evaluation non cognitive abilities with malleability factor	0.06	0.03	1.84
Self-evaluation non cognitive abilities with multiple identification method	0.15	0.03	5.02*
Self-evaluation non cognitive abilities with IQ based identification method	-0.07	0.04	-1.95
Self-evaluation cognitive abilities with inter-intrapersonal factor	0.07	0.04	1.80
Self-evaluation cognitive abilities with practical factor	0.10	0.05	2.15*
Self-evaluation cognitive abilities with creativity factor	0.15	0.05	2.88*
Self-evaluation cognitive abilities with analytical factor	0.11	0.06	1.99
Self-evaluation cognitive abilities with malleability factor	0.03	0.04	0.80
Self-evaluation cognitive abilities with multiple identification method	0.09	0.03	3.05*
Self-evaluation cognitive abilities with IQ based identification method	0.00	0.05	-0.03
Self-evaluation cognitive abilities with self-evaluation non cognitive abilities	0.21	0.04	4.74*
Multiple identification method with IQ based identification method	-0.22	0.04	-5.89*

$\rho < 0.05$.

Source: own work.

Table 7
Estimated correlation matrix among factors

	1	2	3	4	5	6	7	8	9
1. Inter-Intrapersonal Factor	-								
2. Practical Factor	0.81* (0.86) *	-							
3. Creative Factor	0.44* (0.48) *	0.72*	-						
4. Analytic Factor	0.39* (0.45) *	0.75*	0.84*	-					
5. Self-eval. NON cognitive ability	0.13 (0.13)	0.25*	0.18*	0.16*	-				
6. Self-evaluation cognitive ability	0.14 (0.14)	0.24*	0.36*	0.29*	0.59*	-			
7. Malleability Factor	0.25* (0.33) *	0.23*	0.07	0.03	0.12	0.07	-		
8. Multiple Identification Method	0.16* (0.17) *	0.19*	0.29*	0.17*	0.38*	0.24*	0.08	-	
9. IQ Based Method	0.07 (0.07)	0.12*	0.04	0.15*	-0.13	-0.004	-0.2*	-0.32*	-

Note. The numbers in parenthesis are the estimated correlation for professors when it differs from the estimation of teachers
$\rho < 0.05$.

Source: own work.

The survey about beliefs about identification of gifted students contained two factors: a factor measuring teachers' agreement with IQ testing to determine giftedness and a factor measuring teachers' attitudes toward the use of multiple criteria. The relationship between these factors was small to moderate and negative ($r = -0.32$, $p<0.05$). The magnitude of this correlation was somewhat smaller than we had anticipated.

When we correlated the factors that measured the structure of implicit theories with malleability of intelligence, we found small or non-statistically significant relationships among some of the scales. There were small positive correlations between the malleability factor and both the intra-interpersonal factor ($r=0.25$, $p<0.05$ for teachers, 0.33, $p<0.05$ for professors) and the practical factor ($r=0.23$, $p<0.05$). The malleability factor was completely uncorrelated with the creativity factor ($r=0.07$, NS) and the analytic factor ($r=0.03$, NS). This suggests that people's implicit theories about the nature or structure of intelligence are essentially unrelated to their beliefs about the malleability of intelligence.

Also, the correlations among the self evaluation scales and the structure of implicit theories scales were generally quite low. There was one exception: self perception of cognitive ability was modestly correlated with both the analytical scale ($r=0.29$, $p<0.05$) and the creative scale ($r=0.36$, $p<0.05$). In addition, there was no statistically significant relationship between the inter-intrapersonal factor and either of the self-evaluation factors. These results suggest that people's implicit theories of intelligence are only weakly related to their perceptions of their own intelligence.

An examination of the relationship of the malleability factor and the factors measuring the identification of gifted populations revealed generally low correlations. Educators who were supportive of IQ based approaches to identifying students as gifted were slightly less likely to also endorse items related to the malleability of intelligence ($r=-0.20$, $p<0.05$) In contrast, the multiple approaches for identification factor did not correlate with Dweck's scale at all ($r=0.08$, NS).

In general, the factors measuring the identification of gifted populations and the ITIS factors had non-statistically significant or low correlation estimates. One exception was the correlation between the creativity factor on the ITIS and multiple identification method, which were somewhat positively related to each other ($r=0.29$, $p<0.05$). In other words, people who viewed creativity as an attribute of intelligence tended to support a multiple approach to identification of gifted populations. The correlation between the analytical factor and the IQ based identification factor was quite low ($r=0.15$, $p<0.05$). Further, the correlation between the multiple identification methods factor and the analytical factor ($r=0.17$) was also quite low. Therefore, viewing analytical ability as an attribute of intelligence was fairly unrelated to both a respondent's views about using IQ testing as the primary means of gifted identification as well as his or her views about using multiple criteria to identify students as gifted. In general, the correlations among the ITIS and the identification factors were lower than anticipated.

As was reported before, the results of the multiple groups SEM indicated that the model where the factors' means were constrained to be equal provided worse fit than the unconstrained model. Table 8 summarizes the means for the factors. Professors tended to have either similar or slightly higher scores on the factor means.

Discussion

This analysis suggests that teachers and professors in college of education have similar structures in terms of their beliefs about intelligence and also about gifted identification procedures.

Teachers' and professors' prototypes of intelligence do include a variety factors such as analytic ability, creativity and practical ability. While some teachers and professors consider that inter-intrapersonal abilities are part of their prototype of intelligence, this is the least endorsed attribute of intelligence.

Table 8
Comparison of estimated factor means

	Teachers	Professors
1. Inter-Intrapersonal Factor	0.00	0.05
2. Practical Factor	0.00	0.15
3. Creative Factor	0.00	0.14
4. Analytic Factor	0.00	0.03
5. Self-evaluation NON cognitive ability	0.00	0.16
6. Self-evaluation cognitive ability	0.00	0.18
7. Malleability Factor	0.00	0.04
8. Multiple Identification Method	6.23	6.28
9. IQ Based Method	3.21	3.04

Source: own work.

The relationship between the structure (prototypes) of intelligence and the belief that intelligence is malleable is unclear. However, there is some evidence to suggest that teachers and professors who endorse practical abilities and inter-intrapersonal skills as attributes of intelligence are also more likely to view intelligence as malleable. Future research should examine how modifiability whether educators view modifiability as differing across each of the attributes of intelligence. This could be achieved through ratings of malleability on each factors of the ITIS survey.

We expected to see a strong relationship between the structure of intelligence and educators' beliefs about gifted identification. Our results suggest that there is a weak relationship between those two types of beliefs. Educators who rate creativity as an attribute of intelligence tended to favor multiple methods to identify gifted students. This sounds reasonable since traditional standardized tests are generally unsuccessful at measuring creativity (Sternberg, 2003). In addition, educators who support the use of IQs test as the primary base of gifted identification tended to agree that analytical abilities are part of the structure of intelligence; however, this relationship was very weak. More research should be conducted to reveal if there is a relationship among belief about intelligence and the identification of gifted populations. However, the current study suggests that these relationships may be weaker than expected.

It is still is not clear if there is any relationship between ITI and self-evaluations of the abilities included in the prototype of intelligence. The results of this study are not clear in this regard. In one hand, we found a moderately strong correlation between self-evaluation of cognitive abilities and non-cognitive abilities. On the other hand, we found lower correlations between self-evaluation of non cognitive abilities and the same factors of the ITIS. Finally, we have only just begun the journey toward understanding how implicit theories influence educational practices. It is important to go beyond the realm of the beliefs and attitudes to address the real issue of teacher performance. Therefore, more research should be done to address if certain types of beliefs determine aspects of teacher behavior such as educators planning, teaching, and assessment strategies.

To conclude, it is important to state that generalizations based in the results obtained in this study should be made cautiously. In spite that the target sample was representative, we only obtained a 25% response rate. Since the survey was anonymous, it was not possible to ensure the representativeness of the final sample. However, given the very low response rate, it is safe to assume that responders were systematically different from the original sample. In addition, the sample of pre-service teachers was not representative at all. We chose to use a convenient sample because the difficulty of obtaining a mailing list of pre-service teachers. However, future research should examine the ITI of randomly sampled college students.

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Appendix

Items used in the analysis

ITIS Items (Garcia-Cepero & McCoach, 2006)
Emotional Intelligence: (Inter-Intrapersonal factor)
Understands his/her feelings
Deals effectively with people
Accepts others for who they are
Maintains emotional control
Remains calm under pressure
Is sensitive to other people's needs
Can see issues from other people's point of view
Is a good judge of other people
Has a social conscience
Earns the trust of others
Has high moral values
Acts responsibly
Prioritizes the needs of the group above his/her needs
Wants to improve society
Analytic Intelligence: (Analytic Factor)
Reads with high comprehension
Learns rapidly
Reasons logically
Has a good memory
Makes accurate inferences
Sees relationships among different concepts
Processes information easily
Is analytic
Practical Intelligence: (Practical Factor)
Solves real problems efficiently
Is able to use what he/she knows to solve problems in real life
Is capable of solving real world problems
Is a good decision maker
Easily adjusts to new situations
Is able to shape his/her environment
Creative Intelligence: (Creativity Factor)
Displays creativity
Is full of ideas and insights
Is independent in thought and action
Comes up with unusual ways to solve problems
Finds original relationships among concepts
Is imaginative

Theories of Intelligence Scale – Dweck
Everyone has certain amount of intelligence and we can't really do much to change it.
People's intelligence is something about they that they can't change very much.
No matter who someone is, he/she can significantly change his/her intelligence level.
To be honest, people can't really change how intelligent they are.
People can always substantially change how intelligent they are.
Someone can learn new things, but he/she can't really change his/her basic intelligence.
No matter how much intelligence people have, everyone can always change it quite a bit.
Everyone can change even their basic intelligence level considerably.

Beliefs about identification of gifted students' Survey (Based on Brown, et al. 2005)
Multiple Approach Identification
An effective plan for identification requires the use of several types of information of the student.
Identification should include options that allow students to express themselves in many ways .
The identification process should include the assessment of nonintellectual factors such as creativity and leadership.
At least part of the identification process should be individualized
Gifted and talented students may express their abilities in many ways.
IQ based Identification
All students with high IQ are gifted
Identification should be based primarily on an intelligence or achievement test.
All gifted students have high IQ's
Standardized Intelligent test are the most accurate instrument to identify gifted students
A precise cut-off score should be set for all tests used in identification.