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AUTHOR Cheng, Zi-Juan; Hau, Kit-Tai; Wen, Jian-Bing; Kong, Chit-Kwong

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ABSTRACT

Using structural equation modeling (SEM), researchers examined whether there was a general dominating factor that governed students' implicit theories of intelligence, morality, personality, creativity, and social intelligence. The possible age-related changes of students' implicit theories were also studied. In all, 1,650 elementary and junior high school students (grades 5 to 10) in a large Chinese city participated in the study. A set of questions about the personal attributes being studied was developed, and SEM was used to compare various competitive first- and second-order factor models. Results show a general and dominating implicit theory affecting students' beliefs about the individual personal attributes. In addition, students' entity theories seemed to be stronger as they grew older. However, whether these trends result from natural cognitive maturity or socialization remains to be explored. (Contains 18 references.) (SLD)

Chinese Students' Implicit Theories of Intelligence and Other Personal Attributes: Cross-Domain Generality and Age-Related Differences

Zi-Juan CHENG, Northeast Normal University, The People's Republic of China

Kit-Tai HAU, The Chinese University of Hong Kong, Hong Kong

Jian-Bing WEN, The Chinese University of Hong Kong, Hong Kong

Chit-Kwong KONG, Yenching College, Hong Kong

Note: Paper presented at American Educational Research Association Annual Meeting, April 24-28, New Orleans. Address all correspondence to Professor Kit-Tai Hau, Faculty of Education, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong.

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Previous research (e.g., Dweck, Chiu & Hong, 1995a) suggested that students' implicit theories of human attributes (e.g., whether intelligence and personality are changeable) might affect their perception of and reaction to human actions and achievement outcomes. Researchers have been particularly interested on the malleability dimension of whether an attribute is fixed and trait-like (e.g., "Is intelligence changeable?"). In this study we investigated the generality of such perspective across different attributes. Specifically, using structural equation modeling (SEM), we examined whether there was a general dominating factor which governed students' implicit theories in intelligence, morality, personality, creativity, and social intelligence (e.g., Do people believing intelligence can be changed also think that personality is malleable?). The possible age-related changes of students' implicit theories were also examined with 1650 elementary and secondary school students from a large city in mainland China.

Entity and Incremental Implicit Theories

In recent motivational research, there is a shift to analyze how people construe and interpret the situation (see review Weiner, 1990). In addition to the studies on attribution, self-efficacy and others, research has demonstrated that our belief of whether intelligence is malleable will affect our achievement behavior. It has also been argued that this theory of intelligence can be related to the general perspectives of human attributes (Dweck et al., 1995a). Research evidences show that these beliefs will affect people's judgments and reactions. "People believe that attributes (such as intelligence or moral character) are

fixed, trait-like entities (an entity theory) ... tend to understand outcomes and actions in terms of these fixed traits (I failed the test because I am dumb);... people believe that attributes are more dynamic, malleable, and developable (an incremental theory) ...tend to understand outcomes and actions in terms of more specific behavioral or psychological mediators (I failed the test because of my effort or strategy) (Dweck et al., 1995a, p.267). So, a person holding an entity theory of morality may interpret misbehavior through analyses of the actor's moral trait/character, whereas the incrementalist will explore circumstantial and situational factors. It has also been shown that the differential preference of traits versus specific mediators will predict people's adaptive behavior in face of failure. People with incremental theories will try harder and are less prone to helplessness despite the difficulties encountered. In the review, Dweck et al. (1995b) believes their concentration on malleability (changeability) is important and there is currently no other perspective that has the same level of cognitive and motivation impact.

Issues in the Present Study

Cross-Domain Generality. Dweck et al. (1995a) postulated, though with marginal empirical evidence, that "people need not have one sweeping theory that cuts across all human attributes" (p.269). So, a person may believe intelligence to be fixed whereas morality is malleable. An exploratory factor analyses of items on three domains (intelligence, morality, and general world) revealed three factors and suggested independent theories on different attributes (Dweck et al., 1995a). The present study replicated and extended that study in that (i) a methodologically stronger and more appropriate method (confirmatory factor analysis) would be used, (ii) 5 rather than 3 personal attributes were used so that a second-order factor could be used to examine the cross-domain generality (note: second-order factor for 3 attributes is mathematically

identical to correlated first-order factors), and (iii) positively as well as negatively worded items would be used (cf. only positive items used in Dweck et al.'s study).

Age-Related Changes. Due to either cognitive maturity or experience, older children or adults may have a different conception on the malleability or changeability of intelligence. On one hand as shown by the series of studies by Nicholls (1989), children's conception of ability and effort changes developmentally. While younger children may not be able to differentiate effort from ability, older ones believe ability as a capacity limiting the performance of effort. Such trend has also been demonstrated in other empirical studies which showed older children believed more in that intelligence was stable than younger ones did (Ablard & Mills 1996; Yussen & Kane, 1985). On the other hand, it is also possible that due to socialization, particularly in the Chinese culture where effort is strongly emphasized (Hau & Salili, 1991, 1996), older children may believe more in the malleability of intelligence. Thus, their incremental theory of intelligence may increase with age. In this study, the age-related changes of the implicit theories of various personal attributes will be examined.

Positive versus Negative Poles. Among the various commentaries on Dweck et al.'s (1995a, see the whole special issue) theoretical model, a common concern has been on the content of the three items being used (Anderson, 1995; Peterson, 1995; Schunk, 1995; Sorrentino, 1995; Weiner, 1995). The problem, as exemplified by Weiner's (1995) remark has been that "only entity items, and not incremental items, are included in the scale..."(p.319). The question is whether the endorsement of incremental items implies the rejection of entity ones. Dweck et al. (1995b) did not rule out such possibility. They agreed that " this possibility – that many people actually hold both theories, albeit to differing degrees – raises many other intriguing [research] possibilities" (p.323). In the present study, an equal number of items were constructed to measure the incremental and

entity view respectively. We postulated that these two sets of items should be negatively related.

Number of items. The three items used by Dweck et al. (1995a) were "You have a certain amount of intelligence and you really can't do much to change it", "Your intelligence is something about you that you can't change very much", and "You can learn new things, but you can't really change your basic intelligence". The challenge is that the items are very similar and "the wording of the items overlaps greatly." (Weiner, 1995, p.319; see also Sorrentino, 1995). In this study, 8 items (4 positive, 4 negative) were used, which substantially provided a wider range of descriptors on the implicit constructs.

Method

Subjects. Totally 1650 senior elementary and junior high school (Grades 5 to 10) Chinese students in a metropolitan city in Northeast China took part in the studies. They came from families of average city standard. Generally, it is believed that Chinese students have stronger learning goal (cf. performance goal) and attributed their examination performance more to effort rather than to ability (e.g., Hau & Salili, 1991, 1996). Age-related changes were compared among senior elementary (N=509), junior high (N=567) and senior high (N=574) school students.

Instrument. A set of 40 questions on 5 important personal attributes (personality, intelligence, morality, creativity, emotional intelligence) on 9-point scale ("strongly agree" to "strongly disagree") was constructed following the description of entity and incremental theories in Dweck (1986). Each attribute was measured by 4 incremental and 4 entity theory items. For example, for personality, the items were "personality is generally relatively fixed", "personality is usually cultivated by the environment", "personality is not something learnt", and "personality cannot be changed even with great effort". The 4 entity and 4 incremental items were matched in content but rephrased in a

natural way. The item wording and content were constructed basing on a pilot in-depth interview with students. The order of the items was random.

Results and Discussion

SEM was used to compare various competitive first- and second-order factor models (LISREL, Joreskog & Sorbom, 1993). The baseline model is a 5 Personal Attribute X 4 Wording Content MTMM model with uniqueness of items having identical wording being further correlated (Marsh, 1989). The model fitted nicely, $\chi 2(654)=1031$, RMSEA=.031, NNFI=.93, CFI=.94 (Marsh, Balla & Hau, 1996). This model was compared with a second-order model which assumed a cross-domain generality factor transcending through 5 personal attributes. Results showed that this second-order factor could account reasonably well the relations among the 5 personal attributes, $\chi 2(659)=1082$, RMSEA=.033, NNFI=.92, CFI=.93, which supported a general and dominating implicit theory that governed students' belief in the major personal attributes. That is, students believing personality is changeable also thinks that morality is malleable. Perhaps one message to educators is that an educational intervention programs such as effort attribution retraining (Forsterling, 1985) has to tackle holistically students' attitudes or beliefs to various personal attributes. It is more effective to educate our students that their effort and hard work can help not only their ability (or intelligence), but their other personal attributes as well.

Before comparing the latent mean structure of the implicit theories across the three age groups, their factorial invariance was established first (Joreskog & Sorbom, 1993). Additional constraints were imposed so that the factor loadings, variances and covariances were sequentially forced to be equal across the three age groups. Results supported the invariance of factorial structure across the three groups; $\Delta\chi 2(160)=298$, Δ

RMSEA=.001, ΔNNFI=.00, ΔCFI=.01; $\Delta\chi 2(266)=304$, ΔRMSEA=.001, ΔNNFI=.00, ΔCFI=.01; $\Delta\chi 2(192)=371$, ΔRMSEA=.001, ΔNNFI=.00, ΔCFI=.01 when constraining the loadings, variances, and covariances respectively. Subsequently the factor latent means were compared. Results showed that in the personality, intelligence and creativity attributes, generally senior (sen) and junior (jun) high school students believed more in the entity implicit theories than elementary (ele) school students did; personality, $M_{sen} = .14$, $M_{jun} = .04$, $M_{ele} = .00$; intelligence $M_{sen} = 1.00$, $M_{jun} = .54$, $M_{ele} = .00$; creativity, $M_{sen} = .17$, $M_{jun} = .08$, $M_{ele} = .00$; whereas no significant difference was found in the emotional intelligence and morality domains. The results were in congruence with previous studies which showed adults or older children believing more in entity (vs. incremental) theories (Ablard & Mills 1996; Yussen & Kane, 1985).

In sum, the present study showed a general and dominating implicit theory affecting students' respective beliefs on individual personal attributes. Furthermore, students' entity theory seems to be stronger as they grow older. However, whether these trends are due to natural cognitive maturity or socialization still has to be explored in future research.

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Table 1
Goodness of Fit of Various Competitive Confirmatory Factor Analytical Models

Models	5 personal attributes df	χ2	RMSEA	NNFI	RNI	5 domains in Intelligence χ2	RMSEA	NNFI	RNI
No correlated uniqueness									
M1 5 correlated factors, entity+incremental items in same factor	1165	5558	.067	.46	.49	6131	.071	.54	.56
M2 10 correlated factors, entity and incremental items in separate factors	1130	5000	.064	.51	.55	5344	.067	.60	.63
M3 same as M1, but one 2nd-order factor above the 5 1st-order factors	1170	5614	.067	.46	.48	6166	.071	.54	.56
M4 same as M2, one 2nd-order factor above the 10 1st-order factors	1165	6058	.071	.40	.43	6171	.071	.54	.56
M5 same as M4, but entity and incremental factors of matching domain to be correlated	1160	5593	.067	.46	.49	6076	.071	.54	.57
M6 similar to M2, 2 correlated 2nd-order factors, 1 for 5, 1st-order entity factors, another for 5 1st-order incremental factors	1139	3248	.047	.74	.76	3765	.052	.75	.77
With within-factor correlated uniqueness									
M7 same as M1, with within-factor correlated uniqueness (CU) (i.e., entity and incremental items of matching item stem within same attribute/domain have freely estimated correlated uniqueness)	1140	3779	.052	.67	.69	4795	.062	.65	.68
M8 same as M2, with within-factor CU	1105	2988	.045	.76	.78	3637	.052	.75	.78
M9 same as M3, with within-factor CU	1145	3843	.053	.67	.69	4833	.062	.65	.68
M10 same as M4, with within-factor CU	1140	3699	.052	.68	.70	4451	.059	.69	.71
M11 same as M5, with within-factor CU	1135	3627	.051	.69	.71	4372	.058	.69	.72
With correlated uniqueness within and across factors									
M12 same as M7, entity and incremental items of matching item stem across attribute/domain have freely estimated correlated uniqueness)	940	1852	.034	.86	.89	2138	.039	.86	.89
M13 same as M8, with across-factor CU	905	1537	.029	.90	.93	1511	.028	.93	.95
M14 same as M9, with across-factor CU	945	1888	.034	.86	.89	2159	.039	.86	.89
M15 same as M10, with across-factor CU	940	1954	.036	.85	.88	1986	.036	.88	.91
M16 same as M11, with across-factor CU	935	1816	.033	.87	.90	1932	.036	.88	.91
M17 same as M6, with across-factor CU	939	1806	.033	.87	.90	1662	.030	.92	.94
MTMM Models									
M18 5 attribute X 5 item content MTMM model; 5 correlated factors for each attribute/domain; items of matching item stem grouped as 5 correlated factors	1105	3428	.050	.70	.73	3383	.050	.78	.80
M19 5 attribute X 10 item content MTMM model; similar to M18 except the incremental and entity item content are grouped separately into 10 correlated factors	1070	2782	.044	.77	.80	2517	.040	.85	.87
M20 10 attribute X 5 item content MTMM, similar to M18	1070	3048	.047	.74	.77	2926	.045	.81	.84
M21 10 attribute X 10 item content MTMM, similar to M18	1035	2708	.044	.77	.81	2493	.041	.85	.87

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