

Cognitive Modifiability and Ego Identity among Adolescents

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Received: May 15, 2014, Accepted: June 19, 2014, Published: June 28, 2014

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Abstract

This study examines differential relations of ego identity (EI) with cognitive ability, and cognitive modifiability among adolescents. A sample of 238 adolescents aged 16-18 was administered three dynamic assessment measures (Set-Variations II, Complex Figure, and the Organizer from the Learning Propensity Assessment Device) and the Adolescent Ego Identity Scale (AEIS). Canonical correlation analysis revealed positive correlation of AEIS factors with cognitive ability ($R_c=.40$, $p<.05$) and cognitive modifiability ($R_c=.39$, $p<.05$). Hierarchical regression analysis revealed that cognitive modifiability contributed significantly (5%) to prediction of total EI score of the AEIS, beyond the contribution of cognitive ability (8%). The findings are discussed in relation to the common factors affecting cognitive modifiability and ego identity among adolescents. The findings indicate that adolescents with a higher cognitive ability and cognitive modifiability possess abstract resources to deal with normative identity crises and therefore can cope better with conflicts and reach better EI formation. Cognitive modifiability added significantly to the understanding of the mechanism of EI formation. This might add a novel perspective for psychotherapy as clinicians might use a mediated learning approach in enhancing adolescents' modifiability, both cognitive and emotional as a venue for emotional changes and psychological resiliency.

Keywords: Ego identity; Cognitive modifiability; Cognitive ability; Mediated learning; Adolescents

Cognitive Modifiability and Ego Identity among Adolescents

Numerous researches have claimed that individuals begin to conceptualize their own thoughts and of others upon attainment of formal operational thought at adolescence [1-4]. This claim suggests that events within the course of cognitive development may also contribute to the onset and resolution of adolescent identity formation [5-7]. Various attempts have been made to explore the relations between cognitive development and Ego Identity (EI). Most research was related to Marcia's [8] four identity statuses [9-11]. The research findings so far portray an ambiguous picture about the relation between EI and cognitive ability. In this paper we will focus on two cognitive aspects: cognitive ability and cognitive modifiability [12] in relation to EI development. The main question of this paper is to what degree cognitive modifiability (see definition below) is conceptually related to EI development more than to the traditional concept of cognitive ability. In the following we will introduce the concepts of cognitive modifiability and EI as well as the relation between them.

Cognitive modifiability

Cognitive modifiability is defined as "the individuals' propensity to learn from new experiences and learning opportunities and to change one's own cognitive structures" [13]. In other words cognitive modifiability is the ability to benefit from a learning experience and subsequently to change one's cognitive performance in similar or more advanced learning situations [12]. Cognitive ability on the other hand is refers to static manifested cognitive skills as shown in standardized cognitive tests.

According to Feuerstein et al. [12] cognitive modifiability is based on the premise that an individual's cognition can change structurally. Although this change may occur through direct learning the main venue for change is through Mediated Learning Experience (MLE). MLE describes a special quality of interaction between a learner and a person and is considered as the proximal factor that explains cognitive modifiability. MLE interactions are defined as "an interactional process in which parents, or substitute adults interpose themselves between a set of stimuli and the human organism and modify the stimuli for the developing child" [13]. The MLE processes are gradually internalized by the child and become an integrated mechanism of change within the child. An integrative component of the MLE approach is related to the conceptualization of the developing individual as an open system that is modified by mediating agents, much like Vygotsky's [14,15] concept of the zone of proximal development. This component has led to both theoretical elaboration of Dynamic Assessment (DA) of learning potential and development of an applicative system of measuring cognitive modifiability. The term DA refers to an assessment of thinking, perception, learning, and problem solving by an active teaching process aimed at modifying cognitive functioning [16,17]. This process is aimed at modifying an individual's cognitive functioning, and observing subsequent changes in learning and problem-solving patterns within a testing situation. DA differs from conventional static tests in regard to its goals, processes, instruments, interpersonal relationships, and interpretation of results [13-16,18-30]. The conceptualization behind using change criteria is that measures of modifiability are more closely related to mediational processes by which an individual is taught how to process information, than they are to static measures of intelligence.

According to DA approach testing should measure not only what specific information the learner has acquired (traditionally, this has been the sole aim of testing), but should also assess the learner's ability to modify previous concepts and learn new ones. The DA approach was used extensively in research and proposed as a more efficient and

accurate approach for identifying individual's cognitive capacities [16,31-33].

One of the major assumptions of this paper is that focusing on cognitive modifiability appears to be a contributing factor in capturing the dynamic nature of EI formation; a assumptions that is developed later.

Typological versus continuous approaches to EI

The typological approach to EI was developed by Marcia [7,8] and used later extensively by many researchers [9,34-36]. According to the typological approach adolescents are conceived as belonging to one of four statuses: diffusion, foreclosure, moratorium, or achievement. This typology is based on a two-criterion matrix: exploration and commitment, the combination of both creates four identity statuses. Adolescents with identity achievement status are those who experienced a phase of exploration and reached commitment. Adolescents in the moratorium status are in the midst of exploration phase, not yet committed but expected to be at the end of their identity search process. Adolescents in the foreclosure status are those who reached commitment prematurely without going through the exploration phase. Lastly, adolescents with identity diffusion are those who did not go through exploration phase and did not reach commitment.

Cognitive factors and identity formation

The relation between EI and various cognitive and academic factors (e.g., cognitive style, cognitive complexity, cognitive structure, academic achievements, concept learning) has been investigated over the last four decades [37].

The relation between learning concepts and the identity statuses was investigated first by Marcia [8]. The findings showed that adolescents with identity achievement accomplished a task of learning concepts better than adolescents with other identity statuses. However, these findings were not reproduced in other studies [38]. In another study Marcia and Friedman [39] found that female college students with identity achievement, and students of both genders with foreclosed identities, tended to choose more difficult research topics than those with diffused and moratorium identity statuses. Contrary to these findings Waterman and Waterman [40] reported that foreclosed individuals avoided demanding or ego threatening tasks. Hopkins [41] found that women with identity achievement and moratorium showed higher levels of ego development and a more mature cognitive style than identity diffused and foreclosed individuals. Evidently, the field has not yet settled to a coherent consensus, and future research was advised to use multiple methodologies in order to reach more integrative consequences [42].

Some investigators focused on the relation between EI and cognitive styles such as cognitive complexity [43]. Here too, researchers had difficulty finding constant, linear correlation between variables. In fact, a non-linear correlation was found between level of cognitive complexity and level of identity formation [44]. Those with diffused identities were found to be cognitively very complex, those with foreclosure were found to be cognitively very simple, and those with integrated identity were found to be average in regard to cognitive complexity [44-46].

Other researchers focused on the relation between EI and Piaget's [4,47] concept of cognitive structure. Cognitive Structure refers to

structurally defined stages of cognitive development indicating that cognitive growth occurs through a process of assimilation, absorption of experiences, and accommodation to existing cognitive structure. This growth involves transition through stages of cognitive development, beginning with the sensory-motor stage, through the pre-operational and the concrete-operational stages, and ending with the formal-operational stage. It was suggested that achievement of formal operation is a prerequisite, or a process simultaneous to that of identity formation. Few investigators reported positive correlation between advancement to higher stages within Piaget's concept of cognitive development, and the achievement of an advanced personal identity [1,48-50]. Other researchers had difficulty in finding the asserted correlation [51-54], or found only a weak correlation between the two [10,55-57].

Consequently, both Marcia [10] and Muuss [11] concluded that, counter to researchers' expectations, the reported findings concerning the relation between intellectual functioning, cognitive abilities, and scholastic achievements to EI formation, are mostly ambivalent, and do not indicate a consistent or systematic pattern.

Criticism on Marcia's typological paradigm

Although Marcia's [8] typological paradigm and measure were the first comprehensive approach to assess progress toward identity achievement, and has been used in more than 300 studies [34], they were also criticized, on both theoretical and operational grounds [58-60].

From conceptual point of view critics assert that a typological model, with only four EI types, is too simple to be realistic, as not every adolescent can be categorized into one "pure" type. The concern is that adolescents, who fail to be classified into one specific type, are lost, or forced into an unsuitable category. In fact, both Berzonsky and Neimeyer [58], and Jones and Hartmann [60], found that only about 30% of respondents could be classified into one "pure" status type. Another conceptual criticism concerns the compatibility of the typology with Erikson's original theoretical EI framework. Côté and Levine [59] argue that Marcia's identity status paradigm does not follow a developmental continuum, which is a necessary criterion in Erikson's epigenetic framework. Rather, the adolescent must continually revert to a state of moratorium, if exploration and progress in identity development are to occur. Côté and Levine [59] "challenge[d] the assumption that (Marcia's) identity status paradigm is an appropriate conceptualization and operationalization of Erikson's theory of EI formation". These researchers asserted that Erikson did not support the notion that identity achievement is an end product that can be clearly identified. Erikson [5] emphasized the evolving nature of identity, focusing on the process through which individuals become more differentiated in their view of self. Despite this criticism, Cote and Levine [59] agreed that Marcia's identity status paradigm "appears to address at least one essential concern expressed in Erikson's work, namely, the formation of commitments during the process of EI formation".

Operationally, Marcia's [8] Identity Status Interview has been criticized because it requires considerable cost for transcribing and the establishment of inter-rater reliability during coding [61]. Also, a rater's bias was recognized as a potential problem [62].

The continuous approach to EI

Advantages of the typological paradigm are not to be disregarded. Yet, the preceding criticism led to attempts for a more flexible, multi-dimensional model [7,63-65]. For example, Tzuriel [66] offered a bipolar continuous approach, and developed the Adolescent Ego Identity Scale [28,66]. The AEIS is based on the conception of EI as a global Gestalt-like construct, although it is composed of basic identity factors [63,67,68]. An important advantage of this approach is that it allows quantification of the concept of EI along different dimensions, as well as differential comparison of individuals and groups according to their profiles [28,44,66,69].

Tzuriel [28] found seven principal factors of EI: (a) Commitment and purposefulness represents an individual's perception of him/herself as having defined goals for the future, and a clear idea of professional direction and outlook, (b) Solidity and continuity is expressed by adolescent's perception of him/herself as a balanced and stable person, possessing a sense of continuity in spite of coerced changes over time, (c) Social recognition represents an adolescent's perception of him/her characteristics, skills, and talents as contributing to other people, and being appreciated by them, (d) Meaningfulness versus alienation stands for an adolescent's sense that his/her personal being is meaningful, (e) Physical identity refers to adolescent's motivation to preserve, or to change, his/her external appearance, (f) Genuinity refers to adolescent's sense that his/her expression of emotions and/or actual behavior, indeed reflect his/her feelings, as opposed to a sense of feigning and pretense, (g) Perception of self-control reflects adolescent's perception of him/herself as possessing self-control, even in pressured situations and circumstances of partial helplessness.

The common ground between processes enhancing cognitive modifiability and ego identity

Mediation within DA is expressed when the examiner interposes him/herself between the examinee and the task, and modifies both the task (e.g., adjusting its frequency, order, complexity, and context) and the examinee (e.g., by stimulating curiosity, teaching concepts and problem solving strategies). Modifiability is not limited only to cognitive aspects but is revealed as well in personality and emotional domains. An individual who is open to benefit from mediation within the DA procedure is probably open for changes in the process of identity formation. Mediation strategies according to the MLE theory include reciprocating to mediational efforts, accepting mediator's efforts to create meanings, constructing rules and principles, and internalizing feelings of competence and self-regulation strategies conveyed by the mediator. Those aspects of accessibility to mediation enhance not only the development of cognitive modifiability as specified in the MLE theory but to our view also contribute in creating a solid ego identity. Although Feuerstein et al. [12] refer mainly to the cognitive aspects of the mediation process; it is reasonable to assume that an individual who is open to cognitive changes is also open for change in other life contexts that are crucial for EI construction. In other words, the individual's responses to mediation expressed by cognitive modifiability are closely related to the individual's attributes required during EI formation. Adolescents possessing the ability to modify their cognitive functioning through mediation are most likely to be those who are able also to cope successively with conflicts of adolescence by changing, modifying, and integrating their identity, and ultimately reaching EI crystallization.

In the present study a sample of adolescents was administered three DA measures which include pre- and post-teaching tests. The pre-teaching phase of the DA measures yields cognitive ability indices whereas the pre- to post-teaching improvements yield cognitive modifiability indices. Following the cognitive assessment all participants were administered the Adolescent Ego Identity Scale (AEIS).

Hypotheses

Significant positive correlations will be found between AEIS factors and cognitive ability as well as with cognitive modifiability.

EI overall score will be significantly predicted by DA post-teaching scores beyond the prediction of the DA pre-teaching scores. It should be noted that the residual variance of the post-teaching scores left after prediction of EI by pre-teaching scores, represents the cognitive modifiability of the individual.

Method

Subjects

The sample included 238 adolescents (118 boys and 120 girls) aged 16-18 years. Subjects were randomly selected from 10 schools in the central part of Israel; they all were in 11th (n=128) and 12th (n=110) grade. The age distribution was: 16 (n=61), 17 (n=137), and 18 (n=42). Ninety-one percent of the adolescents were born in Israel; the rest were immigrants who immigrated at least ten years prior to the start of the study. Socioeconomic status of participants was heterogeneous as reflected also by the parent's educational level: 31% of the parents had professional or academic education, 29% had high-school education, and 40% had partial high-school education.

Measures

The Adolescent EI Scale is a self-report inventory based on Erikson's theory [5,28,66]. It contains 38 items, divided into seven scales: commitment and purposefulness, solidity and continuity, social recognition, meaningfulness -alienation, physical identity, genuinity, and perception of self-control. A general EI score, composed of all 38 items, is also calculated. Subjects are asked to indicate how each item characterizes them, on a five-level Likert-type scale ranging from "completely disagree" (1) to "completely agree" (5). The EI scales are based on Erikson's theory and several studies [28,66,68-70]. The AEIS validity and reliability was established in a series of studies [28,66,69,71]. In the first study carried out on a large sample of Israeli adolescents (n=1207), factor analysis revealed three main factors: commitment and purposefulness, solidity and continuity, and social recognition. These factors explained 15.6%, 16.9% and 10.6% of the variance, respectively. Cronbach-alpha reliability for the general scale was .77 [66]. In a second study [28], carried out on a sample of Israeli Jewish and Arab students (n=1329) seven factors have emerged; the first three were similar to the factors found earlier. The other four factors were meaningfulness -alienation, physical identity, genuinity, and perception of self-control. Cronbach-alpha reliability coefficients for the EI scales ranged between .70 and .84. The Cronbach-alpha reliability of the total EI scale based on the current sample is .86. Most EI scales were found to be significantly correlated with suicidal tendencies [69,71,72], communication style and fear of personal death [73], previous development stages and varying degrees of psychopathology [74], gaps between moral judgment and moral

behavior [75], and symptoms of loneliness and family dysfunction [76].

Cognitive tests

For the purpose of the current study we chose three type of DA measures, each sampling a different cognitive domain and cognitive modality. SV II is an abstract test requiring a visual modality, the Complex Figure Test requires planning and organization, and memory in a visual motor modality, and the Organizer test requires hypothetical thinking and use of strategies in a verbal-abstract modality.

Set variation-II (SV-II)

The SV-II [22] is a DA measure of cognitive modifiability. It is based on the C, D, and E Series of the Raven's [77] Standard Progressive Matrices (RSPM); however, the SV-II test is more complex, requiring higher-level abstraction than RSPM does. Subjects are asked to abstract the rule or principle governing the problem, and select the proper solution from among eight alternatives. The SV-II includes five sets of tasks (A-E), each containing an example item (explained to the subjects) followed by a set of items arranged in order of increasing difficulty. In order to solve the problems subjects have to apply general rules and principles demonstrated earlier in the example. The test is administered as a group DA procedure, with three phases: pre-teaching (45 minutes), teaching (60 minutes), and post-teaching (45 minutes). From the pool of items we selected 10 items for the teaching phase and 12 items for each of the pre- and post-teaching tests. For the teaching phase we selected the first 2 items of series A-E (10 items). For the pre- and post-teaching tests we selected 12 items for each test. The pre-teaching test was composed of items with even numbers (starting from the fourth item of each series), and the post-teaching test was composed of items with odd numbers (starting from the third item of each series). Thus, each of the pre- and post-teaching phases includes 12 problems of similar difficulty. Each correctly solved problem is scored with 1 point and a total of 12 points for the whole test. In the teaching phase, the examiner teaches (mediates) 10 problems (2 problems from each of the 5 prototype problems of the SV-II). The teaching phase is aimed at focusing, prompting, teaching rules and strategies, controlling impulsivity, overcoming blocking, motivating, and teaching specific concepts and terms necessary for solving the problems.

Satisfactory validity and reliability scores were reported in several studies. The reliabilities, based on group administration for the pre- and post-teaching phases, were .82 and .84, respectively [22,78,79]. In the current study, reliabilities were .79 and .81, respectively.

The complex figure test

The Complex Figure test was originally developed by Rey [80] but was elaborated as a DA measure and is used extensively in clinical and educational settings [22]. The Complex Figure test is composed of five phases: (a) Copy-I. The child is asked to copy the figure on a blank page. This phase might take between 2 and 5 minutes. No help is given in this phase except encouragement to perform the task in case the subject is inhibited from starting the task. (b) Memory-I. The subject is required to draw the figure from memory. The child does not know in advance of that requirement and no help is given except encouragement to start performance when the subject shows signs of inhibition. (c) Teaching (mediation). The subject is taught efficient strategies of drawing. The strategies include gathering the information

systematically, planning the construction of the figure (i.e., drawing first the major lines and then secondary lines, going in clockwise order), and paying attention to precision, proportions, and the quality of lines. (d) Copy-II and (e) Memory-II. These phases are similar to the Copy-I and Memory-I, respectively. Comparison of copy and memory phases before and after teaching provides information about the cognitive modifiability of the subject's performance in terms of accuracy, precision, and organization of the figure.

The Complex Figure test has 18 components, each one given 1 point for accuracy and 1 for location, for a possible total score of 36. A third, qualitative, score, ranging from 1 (low) to 7 (high), is given for organization. Level of organization is based on the order of drawing (from main features to details) and level of cohesion of the figure. The total raw score was converted to percentage score.

Cronbach-alpha reliabilities were reported by Tzuriel and Samuels [81] on a sample of young adolescents using a combined score of accuracy + location. The reliabilities were .89 and .92, for pre- and post-teaching scores, respectively. Cronbach-alpha reliability for Organization rating was .89. In the current study we carried out inter-rater reliability on 25% percent of the subjects. The reliability ranged between .87 and .92. The reliability of the test was studied also on a sample of 15 kindergartners and first graders using a simplified version [82,83]. The test was rated independently by two raters who were well trained in rating the test. For the sake of clarity the Accuracy and Location scores were summed up, as both scores revealed a similar pattern for the majority of children. Because the Accuracy and Location scores are on a different scale (18 in each) than the Organization score (7) the final average score was converted to percents. The inter-rater reliability coefficients computed by Pearson correlation for Accuracy + Location scores were as follows: Copy-I .99, Memory-I .98, Copy-II .98, Memory II .97. The parallel reliability coefficients for Organization scores were Copy-I .90, Memory-I .95, Copy-II .48, Memory II .78.

The Complex Figure test was validated with different groups of preschool children with learning disabilities, academically high-risk disadvantaged children, and children who were born as very low birth weight [84]. The test was found effective in predicting treatment effects of the Bright Start program aimed at developing deficient cognitive functions and learning skills of preschool children with learning difficulties [13,83].

The organizer test

The Organizer test is composed of two parallel tests (pre- and post-teaching), each of 20 items, plus 5 teaching items. It is administered in a group DA procedure. Each item includes a series of statements, each provides partial information on how to organize and place items, in positions relative to one another. The subject is challenged to deduce placement of all items, by combining pieces of information. Items vary in complexity (3 to 8 statements) and level of inference (e.g., harder tasks include negative statements, and require deletion of objects) [22]. An example of a problem is shown in Figure 1.

Pre- and post-teaching phases are of similar difficulty. In the teaching phase, the examiner teaches (mediates) five prototype problems, emphasizing strategies and rules required to solve these tasks. The Organizer test requires high level of abstract representation and hypothetical-inferential thinking. Tzuriel and Alfassi [78] reported Cronbach-alpha reliabilities of .82 and .87, for pre- and post-teaching phases respectively.

15. Place the six in the appropriate bottles.

A. In bottles 1, 2, 4, 5 and 6 are Beer, Oil, Soda, Vinegar and Wine.

B. In bottles 1, 2, 3, 5 and 6 are Beer, Juice, Oil, Soda and Wine.

C. The Wine and Oil are in bottles 1 and 6.

D. The Beer is beside the Oil, but not beside the Vinegar.

The solution is:

Figure 1: The Organizer Test: An Example of a Problem

Procedure

Participants in each class were randomly divided into two groups of 10-12 each. Each group was led by a qualified and trained examiner; all had Master degree in clinical psychology or clinical social work. All examiners had passed a two-day training program constructed specifically for the current study.

The cognitive measures were administered twice: before and after a teaching phase within group DA procedure given for about one and a half hour. Following the DA procedure the AEIS scale was administered in groups. In order to reduce possible undesirable social effects, tests and questionnaires were anonymous. Each participant received a code number and was informed that results are confidential and are to be used only for research purposes.

Results

The means and standard deviations of the cognitive tests, before and after the teaching phase, are presented in Table 1. As seen in Table 1, all post-teaching scores were significantly higher than the pre-teaching scores. Two cognitive indices were constructed, an index of cognitive ability and an index of cognitive modifiability. The index of cognitive ability was based on two factor analyses of the three cognitive ability scores: Organizer, SV II, and Complex Figure tests.

Cognitive Measures		Pre	Post	
SV II	M	5.51	7.16	F (1,237) = 77.55***
	SD	2.82	3.92	
Complex Figure	M	6.24	7.54	F (1,196) = 193.41***
	SD	2.48	1.77	
Organizer	M	6.17	7.92	F (1,200) = 142.58***
	SD	2.12	1.77	

Table 1: Means and Standard Deviations of Cognitive Ability Measures (SV II, Complex Figure, Organizer Test) Before and After the Intervention, *** p<.001

Two principal factor analyses with varimax orthogonal rotation were carried out on each of the pre- and post-intervention scores. In each analysis, the findings showed only one factor with loadings

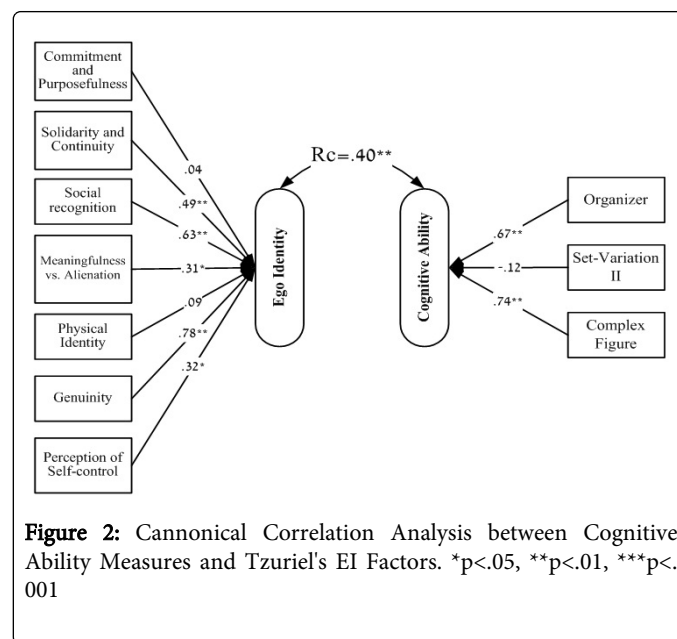
ranging between .73 and .81. The factors for the pre- and post-intervention tests explained 58.4% and 57.5% of the variance, respectively. The composite cognitive ability score was computed by multiplying the test scores by the factors score.

An index of cognitive modifiability was developed for each of the DA measures. The index is based on the residual post-teaching score after controlling for the variance contributed by the pre-teaching score. The statistical procedure is based on a regression analysis in which an extracted residual post-teaching score was computed after controlling for pre-teaching effects. This procedure has been suggested by several investigators to avoid ceiling effects of pre-teaching on post-teaching scores [16,85,86]. A composite cognitive modifiability index was then calculated based on the three DA measures.

Canonical correlation of EI components (AEIS) with cognitive ability and cognitive modifiability measures

In order to examine hypothesis 1 two canonical correlations were carried out. The EI components were analyzed first with the cognitive ability variables (Figure 2) and then with the cognitive modifiability indices (Figure 3). As can be seen in Figure 2, a significant correlation (Rc=.40, p<.01) was found between the cluster of cognitive ability measures and the cluster of EI factors, F (21, 457)=2.31, Wilks'=.75, p<.01. High coefficients were specifically indicated by the Complex Figure (β=.74) and the Organizer tests (β=.67) on the one hand, and by the EI factors of Genuinity (β=.78) and Social Recognition (β=.63), on the other. Other statistically significant EI factors were: Solidity and Continuity (β=.49), Meaningfulness-Alienation (β=.31), and Self-Control (β=.32).

As can be seen Figure 3, a significant correlation (Rc=.39, p<.05) was also found between the cognitive modifiability cluster and EI cluster, F (21, 442)=1.97, Wilks'=.77, p<.01. The correlation coefficients indicate an exceptionally high relation between cognitive modifiability Complex Figure (β=.89) on one hand and Commitment and Purposefulness component (β=.82) on the other.



It is interesting to note that SVs II did not emerge as a significant variable in relation to cognitive ability (Figure 2) whereas the

Organizer Test did not emerge as a significant variable in relation to cognitive modifiability (Figure 3).

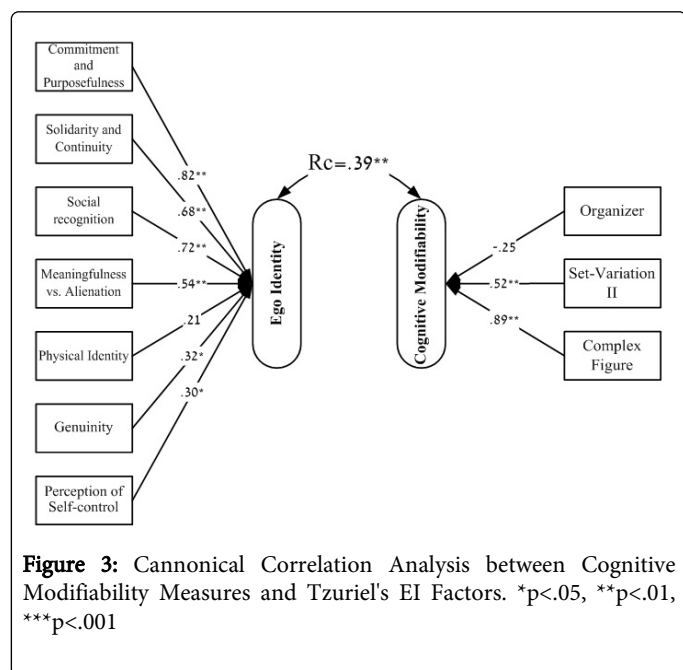


Figure 3: Canonical Correlation Analysis between Cognitive Modifiability Measures and Tzuriel's EI Factors. * $p < .05$, ** $p < .01$, *** $p < .001$

Prediction of EI Total (AEIS) by Cognitive Modifiability Indices

According to hypothesis 2, EI will be significantly predicted by cognitive modifiability measures. This prediction was examined by hierarchical regression analyses where the criterion variable was total AEIS score and the predicting variables were the specific cognitive measures of the Complex Figure, SV II and Organizer scores. The regression analysis was composed of two steps: in the first step we introduced the pre-teaching measures, and in the second step the post-teaching measures (Table 2).

Predictor	β	T	R2	$\Delta R2$	F (3, 164)
Step 1			.08**	.08**	4.21**
Set Variation-II Pre	-.13	-1.46	.00		
Organizer Pre	.28	3.24**	.07		
Complex Figure Pre	.03	0.28	.01		
Step 2			.13**	.05**	5.75**
Set Variation-II Pre	-.19	-1.68	.01		
Organizer Pre	-.13	-1.49	.01		
Complex Figure Pre	.26	2.99**	.03		
Complex Figure Post	.33	3.11**	.08		

Table 2: Prediction of Tzuriel's Total EI Score by Cognitive Ability and Cognitive Modifiability Measures, ** $p < .01$

As can be seen in Table 2, the three pre-teaching measures of cognitive ability (Step 1) explained 8% of variance in EI. The post-teaching variables, representing cognitive modifiability (Step 2), added

5% to the prediction. In Step 2 we present both the pre- and post-intervention variables. The total contribution to the variance of cognitive variables to the EI is 13%. It is interesting to note that Complex Figure, both pre- and post-teaching scores significantly predicted the AEIS total score only in the second step.

Discussion

The primary goal of the present study was to investigate whether adolescents' ego identity development is related to cognitive ability and cognitive modifiability, as measured within the DA procedure.

Our main expectation was that the mediated learning experience, which characterizes cognitive modifiability, has much in common with EI formation. Both processes, we believe, share underlying roots which promote or inhibit their overall progression. A close look at both theoretical constructs reveals that they require from the developing individual (a) an attachment to a meaningful figure, (b) authentic experience of reality, (c) a sense of continuity of experience, (d) reasonable risk-taking, (e) commitment to transcendent ideas, (f) conscious efforts for change, and (g) mental flexibility. Since consolidation of EI requires processes corresponding to those required for cognitive modifiability, we assume a positive correlation between the two.

The findings indicate that ego identity overall score (AEIS) was positively correlated with cognitive ability ($R_c = .40$, $p < .05$) and cognitive modifiability ($R_c = .39$, $p < .05$), thus confirming the first hypothesis. The AEIS scales that contributed to the overall correlation show that Genuinity was the highest contributing factor to cognitive ability ($\beta = .78$) whereas Commitment and Purposefulness factor was the highest contributing factor ($\beta = .82$) to cognitive modifiability. It seems that adolescents who have relatively higher level of commitment and purposefulness feel secure and open enough to accept mediation within the DA procedure and thus benefit more from teaching and consequently demonstrate higher level of cognitive modifiability. The ego identity factor of Genuinity, on the other hand, might reflect a straightforward "daring" approach to life problems including accurate perception of cognitive tasks; hence the higher performance of solving cognitive problems such as those represented by the Complex Figure and Organizer tests. While this intriguing explanation is a post-hoc explanation it is plausible to assume that personality factors play an important role in determining cognitive functioning. Comparison of the two canonical correlations shows that a different combination of cognitive variables (two out of three) has emerged with significant coefficients in each analysis. The combination of Complex Figure and Organizer tests for cognitive ability and the combination of Complex Figure and SVs II for cognitive modifiability is related to the co-variation among the three cognitive variables which is not the focus of our study. The different combination justifies our decision to select cognitive tests that sample different cognitive domains. Further research however is required to establish these differential relations based on a clear conceptualization of the specific cognitive domain as related to EI formation.

The findings of the regression analysis show (Table 2) that the variance of the post-teaching variables contributed significantly to the overall ego identity score (5%) beyond the variance contributed by the pre-teaching variables (8%); thus confirming hypothesis 2 (the overall contribution was 13%). These findings indicate the cognitive modifiability, represented by the post-teaching scores, is a significant factor explaining EI development. It should be noted that while the

overall predicted percentage of 13% is not very impressive, nevertheless it indicates that cognitive factors are intimately related to EI formation. Furthermore it shows that addition of a cognitive modifiability variable adds significantly and highlights understanding of EI formation.

The findings of the canonical and the regression analyses clearly indicate that the cognitive factors are intimately related to EI development and thus support earlier findings about the role of cognitive abilities and EI development [9,11,35]. It seems that adolescents with a higher cognitive ability possess abstract resources to deal with normative identity crises and therefore can cope better with conflicts and reach better solutions. The addition of cognitive modifiability in our study added significantly to the understanding of the mechanism of EI formation. This finding might add a novel perspective for psychotherapy. Clinicians might use a mediated learning approach in enhancing adolescents' modifiability, both cognitive and emotional as a venue for emotional changes and psychological resiliency. Support may be found in a study by Tzurriel and Shomron [87] who reported a significant relationship between cognitive modifiability and psychological resilience among children with learning disability. It seems that cognitive modifiability requires a certain level of flexibility, openness to new information, and "knowing how" to benefit from mediation provided. These characteristics are exactly the same features that help adolescents to construct their EI amidst contrasting demands and the need to resolve conflicting expectations and desires.

Conclusion

In the present paper we demonstrated how DA contributes significantly to prediction of ego identity above and beyond standardized static tests of cognitive ability. Concerning the continuous approach, cognitive modifiability contributed beyond cognitive ability to EI formation. Specifically, cognitive modifiability indices showed highest correlation with the Commitment and Purposefulness factor, suggesting that intellectual flexibility is required in promoting adolescents ability to commit to personal purposes and goals, as part of their EI formation. Apparently, it is openness to new ways of thinking that may help adolescents crystallize their identity, and more specifically their ability to be more accountable in accomplishing successfully duties and tasks. From a practical point of view, educators may use the notion that encouraging adolescents to consider innovative ideas and to strive for greater agility in their problem-solving (while maintaining critical thinking), may help their progress in multiple important ways: besides the near-term benefit of gaining problem-solving skills and higher test-scores, this strategy is expected to offer the long-lasting benefit of becoming able to commit authentically to explicit goals, as an essential part of EI formation [88]. A significant advantage of the continuous method is its ability to express time-varying cognitive modes for different levels of identity-formation. In this sense, one may appreciate the unique success (though limited) of continuous approach to EI in explaining part of the variance in relation to cognitive modifiability concept.

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