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Relation Among Meta-Cogntition Level, Decision Making, Problem Solving and Locus of Control in a Turkish Adolescent Population

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Abstract

Whereas human beings are only seem to" have" cognitive processes they have knowledge about the process itself as well. This process, which is known as metacognition should be taken as a system responsible for the proper functioning of whole memory system via its executive role in information processing. Although some differences on naming and definition of the term metacognition in literature an agreement among researchers seem to occur on the fact that metacognition has two general aspects; monitoring and control. When taken from a developmental perspective an increment takes start in information processing capacity and functionality of cognitive functions directly related with executive functions including non-verbal reasoning, decision making, problem solving, abstracting, using the acquired information and producing new information of adolescents by the age 11 which is the onset of the formal operational stage. Thus level of metacognitive development might be an indicator and predictor of the general developmental status of executive functions such as decision making in adolescents. In this research we tried to investigate the relation among the metacognition level, decision, problem solving and locus of control.

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*Keywords:*Metacognition, Decision Making, Problem Solving, Locus of Control

1. Introduction

Information as it is processed through cognitive processes such as problem solving, imagination, reasoning, abstracting and judging is represented in human thought with its final version (Solso, Maclin and Maclin, 2009). From this point of view people not only have cognitive processes but also do have knowledge about knowledge itself (Garner and Alexander, 1989). With this aspect "metacognition" comes into prominence as an fundamental

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and executive feature of human mind (Yzerbyt, Lorries and Dardenne, 1998). In Flavell's theory, in general, cognition and metacognition differ on content and function but retain the same qualitative features. Metacognition is defined as thinking about thinking or a psychological phenomenon including someones feelings and motives about him/herself and about others (Flavell, 1979). According to Vos (2001), function of cognition is about problem solving and carrying out cognitive attempts in general. On the other hand metacognition is about making regulations related with necessary cognitive steps.

Whereas some differences among researchers can be seen on naming and defining "metacognition" as a concept (executive cognition, executive control, self-regulation, meta-knowledge, cognitive awareness etc) a consensus seem to occur among them recently that metacognition has two general aspects: A cognitive domain including knowledge someone has about reading, memory and learning . Second aspect is a monitoring function including planning, monitoring and evaluation providing control of cognitive processes (Flavell, 1979; Brown, 1987; Lucengeli and Cornoldi, 1997; Schraw and Dennison, 1994; Schraw, 1998; Stenberg, 1998; Yzerbyt, Loris and Dardenne, 1998). Metacognition, as a concept including both monitoring and regulating processes together, was asserted firstly in the 1976 study of Flavell, in which these processes were defined as metacognitive strategies (activities). The term metacognitive strategy refers to the regulated processes that are used in order to monitor metacognitive progress, achievement of cognitive goals and to execute control on cognitive activities. For a person with metacognitive skills and awareness these metacognitive processes are means of checking his/her learning progress, planning and exerting changes on ongoing cognitive activities, monitoring and comparing cognitive outputs with internal and external criteria.

Adolescence is a critical period in human life in the sense that an era of prominent qualitative changes in cognitive processes and abilities takes start. By the onset of formal operational stage an accelerated development in executive functions related to metacognitive skills including, as well as decision making and problem solving, non-verbal reasoning, abstracting, using gained knowledge and understanding begin to erupt in sense of both information processing speed and capacity (Ormond, Mann and Luszcz, 1987; Stewart et al, 2007). These increased capacity and efficiency of the cognitive infrastructure during adolescence give rise to a higher level of cognition: Metacognition. In another words developmental level of metacognition can be taken as a prominent indicator of general integration level of high-order or executive functions.

Adolescence also is a critical developmental period that an increase in educational, family and social demands is also prominent in addition to the increase in cognitive and metacognitive skills. Young individual has to face with making serious decisions that have long-lasting consequences, domains necessitating problem-solving skills, problematic social interactions with family and peers needed to be resolved etc. Findings in literature indicate that metacognitive level of an adolescent might be an indicator of his or her success in dealing with these problematic environmental features. So it is important to understand the relation among metacognitive level and related, socially necessary skills in terms of adaptation, such as decision making, problem solving and locus of control. Rather than working on those skills separately focusing on helping adolescents with developing their metacognitive abilities as a whole might be much more efficient during their both formal and informal education in order to raise self-competent and cognitively effective individuals.

In this study we aimed to investigate whether adolescent with different levels of metacognition, as measured by metacognitive awareness inventory, also differ in their cognitive abilities like decision making, problem solving and their locus of control as well. Relation among these has not been investigated before in context of Turkish adolescents. Thus it is important to investigate this possible relationship since level of metacognitive development, on its own, is an indicator of integration of the developing cognitive subsystems asserted above. Thus, it is plausible to expect that participants with the highest metacognitive development level will also display higher scores in other test domains like decision making and problem solving as well.

2. Materials and Method

A total of 105 adolescents ages ranging between16-18 (X=17.08) chosen from a pool of 250 participants took place in this study. They were given B-Form of the Metacognitive Awareness inventory (Howard, Miller and Murphy), Adolescent Decision Making Questionnaire (Mann, Harmoni and Beswick,1989), Problem Solving

Inventory (Heppner and Petersen, 1982) and Internal-External Locus of Control Scale (Nowicki-Strickland, 1982). A socio-demographic question form including questions about parents educational status and family income was also given. Through this question form participants are divided into three levels on basis of their socioeconomic status (High, middle and low).

Data derived from Metacognitive Awareness Inventory, Problem Solving Inventory and Internal-External Locus of Control Scales was evaluated through overall test score however scores from Adolescent Decision Making Questionnaire were evaluated on the basis of subscales. In fact, Adolescent Decision Making Questionnaire has two sections and five subscales in total. The two sections of the questionnaire are "Decisional Self-Esteem" and "Decisional Coping Patterns". The first section has only one subscale called "Self Confidence" whereas the latter section has four subscales which are "Vigilance", "Evasiveness", "Panic" and "Complacency".

2.1 Procedure

In the first phase of the study participants in the larger data pool were given Metacognitive Awareness Inventory (MAI), which is an 18 itemed Likert-type inventory with a score range of 18-90. In the second phase of the study 105 of the participants were divided into three groups with respect to their MAI scores: Average of the minimum and maximum scores that can be taken from the inventory was calculated (36) and then this score was added to the minimum score (54) so as to use as a cut point for allocation of the participants into the groups. Finally three groups were structured with one group that has a mean score under the cut point level and two groups with mean scores above the cut point level. Afterwards all participants in either group were given Adolescent Decision Making Questionnaire (ADMQ), Problem Solving Inventory (PSI) and Internal-External Locus of Control Scale (LOCS).

Statistical analysis of the data was run via SPSS16.0. A one-way ANOVA was followed by Tukey HSD test for post-hoc comparisons. A correlation analysis was run for detecting the relation among family SES and other parameters.

3. Results

One-Way ANOVA revealed significant between groups differences. Tukey HSD was then exerted for post-hoc analysis. ANOVA and Tukey HSD results are presented in the tables below (Table-1 and Table-2). In the tables ADMQ-SE refers to decisional self esteem subcale of ADMQ, ADMQ-VG refers to vigilance subscale, ADMQ - PNC refers to panic subscale, ADMQ-CO refers to cope-off subscale, PSI refers to problem solving inventory and LOC refers to locus of control scale.

Table-1 ANOVA results

		Sum of Squares	df	Mean Square	F	Sig.
ADMQ-SE	Between Groups	1142,248	2	571,124	238,748	,000
	Within Groups	244,000	102	2,392		
	Total	1386,248	104			
ADMQ-VG	Between Groups	867,600	2	433,800	151,207	,000
	Within Groups	292,629	102	2,869		

	Total	1160,229	104			
ADMQ-PNC	Between Groups	86,990	2	43,495	2,795	,066
	Within Groups	1587,543	102	15,564		
	Total	1674,533	104			
ADMQ-CO	Between Groups	79,105	2	39,552	1,017	,365
	Within Groups	3966,857	102	38,891		
	Total	4045,962	104			
PSE	Between Groups	30119,314	2	15059,657	87,746	,000
	Within Groups	17506,114	102	171,629		
	Total	47625,429	104			
LOC	Between Groups	45601,733	2	22800,867	200,447	,000
	Within Groups	11602,514	102	113,750		
	Total	57204,248	104			

Table-2 Tukey HSD comparisons

Dependent Variable	(I) MCAL	(J) MCAL	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
ADMQSE	1	2	,68571	,36972	,157	-,1936	1,5651
		3	7,31429*	,36972	,000	6,4349	8,1936
	2	1	-,68571	,36972	,157	-1,5651	,1936
		3	6,62857*	,36972	,000	5,7492	7,5079
	3	1	-7,31429*	,36972	,000	-8,1936	-6,4349
		2	-6,62857*	,36972	,000	-7,5079	-5,7492
ADMQVG	1	2	1,71429*	,40489	,000	,7513	2,6773
		3	6,77143*	,40489	,000	5,8084	7,7344
	2	1	-1,71429*	,40489	,000	-2,6773	-,7513
		3	5,05714*	,40489	,000	4,0941	6,0201
	3	1	-6,77143*	,40489	,000	-7,7344	-5,8084
		2	-5,05714*	,40489	,000	-6,0201	-4,0941
PSE	1	2	3,08571	3,13167	,588	-4,3627	10,5341
		3	37,37143*	3,13167	,000	29,9230	44,8198
	2	1	-3,08571	3,13167	,588	-10,5341	4,3627
		3	34,28571*	3,13167	,000	26,8373	41,7341
	3	1	-37,37143*	3,13167	,000	-44,8198	-29,9230
		2	-34,28571*	3,13167	,000	-41,7341	-26,8373
LOC	1	2	5,11429	2,54951	,116	-,9495	11,1781
		3	46,54286*	2,54951	,000	40,4791	52,6066
	2	1	-5,11429	2,54951	,116	-11,1781	,9495
		3	41,42857*	2,54951	,000	35,3648	47,4924
	3	1	-46,54286*	2,54951	,000	-52,6066	-40,4791
		2	-41,42857*	2,54951	,000	-47,4924	-35,3648

* The mean difference is significant at the 0.05 level.

Tukey HSD was followed by Pearson Correlation for detecting the relationship among family SES level and related parameters taken under consideration in this research. Results of the correlation analysis is presented below in Table-3.

Table-3 Results of correlation analysis

		FSES	MCALVL	ADMQSE	ADMQVG	PSE	LOC
FSES	Pearson Correlation	1	,401**	,423**	,408**	,325**	,509**
	Sig. (2-tailed)		,000	,000	,000	,001	,000
	N	105	105	105	105	105	105
MCALVL	Pearson Correlation	,401**	1	,762**	,776**	,706**	,716**
	Sig. (2-tailed)	,000		,000	,000	,000	,000
	N	105	105	105	105	105	105
ADMQSE	Pearson Correlation	,423**	,762**	1	,821**	,716**	,863**
	Sig. (2-tailed)	,000	,000		,000	,000	,000
	N	105	105	105	105	105	105
ADMQVG	Pearson Correlation	,408**	,776**	,821**	1	,684**	,844**
	Sig. (2-tailed)	,000	,000	,000		,000	,000
	N	105	105	105	105	105	105
PSE	Pearson Correlation	,325**	,706**	,716**	,684**	1	,753**
	Sig. (2-tailed)	,001	,000	,000	,000		,000
	N	105	105	105	105	105	105
LOC	Pearson Correlation	,509**	,716**	,863**	,844**	,753**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	
	N	105	105	105	105	105	105

**Correlation is significant at the 0.01 level (2-tailed).

4. Discussion

Our results indicate that metacognitive developmental level as measured by MAI is a prominent indicator of decision making and problem solving performances of adolescents. In addition, group with the highest MAI scores had the highest LOCS scores which is an indicator of increased internal locus of control with increased metacognitive development. Results from correlation analysis, on the other hand, indicate importance of family SES level in terms of metacognitive development, decision making and problem solving. There is a positive correlation with family SES level and all other parameters which is a finding that is in line with literature. In general, direction of our results pertains to the fact that higher level of metacognitive development is strongly connected with some other executive functions-related cognitive capacities that are subject to accelerated development through adolescence period including decision making, problem solving and locus of control. In addition to this, the second direction that our results indicate, family environment seem to facilitate, or in some cases obstacle, this critical developmental process.

As asserted above adolescence is a critical developmental period that an increase in educational, family and social demands is also prominent in addition to the increase in cognitive and metacognitive skills (Garner and Alexander, 1989; Brown and Mann, 199). Young individual has to face with making serious decisions that have long-lasting consequences, domains necesssisating problem-solving skills, problematic social interactions with family and peers needed to be resolved etc. (Mann et al, 1989; Lucangeli and Cornoldi, 1997) Findings in literature indicate that meta-cognitive level of an adolescent might be an indicator of his or her success in dealing with these problematic environmental features. So it is important to understand the relation among metacognitive level and related, and socially necessary skills in terms of adaptation, such as decision making, problem solving and locus of control (Kitcner, 1983; Schraw, 1998; Sternberg, 1998). Rather than working on those skills separately focusing on helping adolescents with developing their meta-cognitive abilities as a whole might be much more efficient during their both formal and informal education in order to raise self-competent and cognitively effective individuals. Our results give further support to this assumption that meta-cognitive developmental level of an adolescent might provide his/her teacher for instance with an important donate about his/her general level of cognitive development and competence (Schraw, 1998; Sternberg, 1998). In light of our findings it can be expressed that an adolescent with a high MAI score seem to have more tendency to rely on him/herself while making a decision or solving a problem with a higher tendency to internal locus of control which, also in general, indicates higher level of self-esteem on its own. Thus, meta-cognitive level is among prominent determinants of how successful an adolescent will cope with routine academic and social problems that he/she will have to face with through adolescence period.

SES level of family seem as an important determinant of meta-cognitive development (Wang, 1993). With increased opportunity of education for the adolescent and having educated parents, as well as living in an environment rich of stimuli, probably nourishes the meta-cognitive development of children (Wang, 1993; Thompson and Williams, 2006). Various studies in literature give support to this fact. Also, our findings indicate that children of educated parents with high or middle income seem to have higher meta-cognitive abilities along with higher scores related with decision making and problem solving. Although not specifically inquired in this study it is probable that adolescents from low SES families have little time and opportunity to share with their parents and/or other family members essential for fostering their meta-cognitive development when compared to higher SES families (Brown and Mann, 1990; Schraw, 1998; Neville et al, 2013). Though, this probability should urge us for at least developing educational programs for families under such risk focusing on teaching how to spend quality time with their children.

Given the fact that meta-cognition is a process which is at top of all executive cognitive processes that are crucial for us to adapt to social and physical environment effectively it gains importance to determine to what extent meta-cognitive development reflects developmental and integration status of related cognitive subsystems. Thus, another important issue is to define and constitute the most suitable conditions, as well as, family and social environments fostering and promoting meta-cognitive development. New interdisciplinary studies on this topic are needed to have these goals achieved. Whereas this study is one of the first in the literature that tried to investigate the relation among meta-cognitive level and related cognitive functions that are prone to a monumental advancement through adolescence period in a Turkish adolescent population yet it has some constraints that have to be overcome in future studies. For instance, a larger sample should be used for improving representativeness of the study. In addition, variables like gender and family structure (including parental attitudes etc) should also be taken to consideration.

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