THE PREDICTIVE ROLE OF GRIT ON METACOGNITION IN TURKISH UNIVERSITY STUDENTS

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Abstract: The purpose of this study is to examine the relationship between metacognition and grit. Participants were 352 university students who were enrolled in Sakarya University, in Turkey. In this study, the Metacognitive Awareness Inventory and the Grit Scale were used. The relationship between metacognition and grit were examined using correlation analysis and multiple regression analysis. In correlation analysis, grit was found positively related to metacognition. According to results the two-dimensions of grit (consistency of interest and perseverance of effort) predicted metacognition positively. Results were discussed in the light of literature.

Key words: metacognition, grit, multiple regression analysis

Metacognition was first introduced by John Flavell in the beginning of 1970s, who stated that metacognition is composed of both watching and organizing elements. Flavell (1979) defined metacognition as the knowledge and cognition of the cognitive phenomenon; and with this definition many researchers (Braten, 1991, 1992; Weinert, 1987; Wellman, 1985) started to examine metacognition, considering it a multi-dimensional concept. Based on this, many researchers defined metacognition in various ways. For example, Brown (1978) defined metacognition as the recognition and organization of thinking processes in which students use their problem solving skills in planned learning processes. Marzano (1988) defined this construct as being aware of our thinking while performing certain duties and then using this awareness to control what we have done. Pintrich and Groot (1990) suggested that metacognition consists of strategies for planning, examining/controlling and describ-

ing one's own cognitive processes. There is no complete consensus among researchers concerning the main properties of metacognition. Some researchers argued that metacognition expressed conscious knowledge and intentional actions, while others suggested that metacognition could be defined in terms of non-verbal and automatic processes (Akın, Abacı, 2011). However, in general, researchers (Brown, 1987; Flavell, 1979, 1987; Forrest-Pressley, Waller, 1984; Metcalfe, Shimmura, 1994; Schraw 1994) considered metacognition as a two-dimensional concept: knowledge about cognition (metacognitive knowledge) and regulation of cognition (metacognitive regulation). Metacognitive knowledge, which can be described as the knowledge, awareness, and deeper understanding of one's own cognitive processes and products, is expanded by reflection on learning experiences. In addition, it can be used in the planning of progressive learning tasks (Desoete, 2008). This knowl-

edge influences strategy use, which in turn affects the metacognitive experience (Mevarech, 1999; Schraw, Dennison, 1994). It includes three different kinds of metacognitive awareness: declarative, procedural, and conditional knowledge. Declarative knowledge can be defined as knowing "about" things. Procedural knowledge refers to knowing "how" to do things. Knowledge of the "why" and "when" aspects of cognition is considered conditional knowledge (Brown, 1987; Schraw, Dennison, 1994).

Regulation of cognition can be conceptualized as encompassing a set of activities that help students control their learning (Gavelek, Raphael, 1985; Gourgey, 1998; Hartman, 1998). Although a number of regulatory skills have been defined in the literature, three basic skills are included: planning, monitoring, and evaluation (Jacobs, Paris, 1987). Planning involves the selection of appropriate strategies and the allocation of resources that affect performance. Monitoring refers to one's online awareness of comprehension and task performance. The appraisal of the products and efficiency of one's learning is called evaluation (Schraw, Moshman, 1998). Metacognition has been studied by many researchers (Akın, Abacı, 2011; Arslan, Çardak, 2012; Brown, 1978, 1987; Garofalo, Lester, 1985; Schoenfeld, 1985, 1987; Wellman, 1985) since the beginning of the 1970s and the importance of metacognition in the learning processes is extensively accepted (Anderson, Walker, 1991; Gourgey, 1998; Pintrich, De Groot, 1990; Schraw, Moshman, 1995). Metacognition in terms of the learning processes includes using and controlling high-level thinking skills consciously (Cornoldi, Lucangeli, 1996). Studies on metacognition were carried out under the light of the idea that a functional cogni-

tive system does not only learn and transact, it also knows how to do it and how to do it better (Lucangeli, Cornoldi, 1997). Metacognition plays an important role in communication, reading comprehension, learning a language, social cognition, attention, self-control, memory, writing, and solving problems (Flavell, 1979). In addition, metacognition is used to define knowledge, concerning learning processes, of how individuals perceive, remember, think, and take action. While discussing the role of metacognition in relation to the education process, Hartman (1998) emphasized that this concept was important especially in the education process because it directly affected many factors such as the individual's gaining, comprehending, remembering, and applying knowledge. According to the studies (Hartman, 2001; Zimmerman, Schunk, 2001), students who use metacognition effectively are more likely to volunteer for educational activity, they are intrinsically self-motivated and use more goal setting, planning, and self-monitoring strategies.

Grit

The importance of intellectual (such as intelligence, long-term memory, abstract thinking) and non-intellectual (personal traits, motivation, self-control) factors has been widely accepted in educational research (Duckworth, Seligman, 2005; Duckworth et al., 2007). Being one of the non-intellectual factors, grit was defined by Duckworth (2007) as behaving passionately and assiduously to reach long-term targets and it is indicated to be a main personal trait which distinguishes between people who have the same level of intelligence but who cannot succeed equally. Individuals

with higher levels of grit are assiduous in overcoming obstacles and despite of failures, difficulties and lack of progress, they try for years and maintain their interests (Duckworth et al., 2007). Studies (Dubey, 1982; Duckworth et al., 2007; Duckworth, Quinn, 2009) have consistently proved that there is a strong and positive relation between grit and academic success. In research on the relation between grit and productivity, it was concluded that gritty students were more successful in academic life than those who were less gritty (Dubey, 1982). When students make an effort to specialize in a new area of knowledge or strategies to solve problems, they encounter short-term difficulty or experience demoralization. Those who cannot push on despite of difficulties or demoralization may generally become unsuccessful (Ayres, Cooley, Dunn, 1990; Torgesen, Licht, 1983). Individuals who achieve things in their jobs are generally perseverant and achievement is more about being patient when compared to being talented (Duckworth et al., 2007).

Grit was an effective personal trait in succeeding and there was a positive relationship with responsibility under the Big Five personality model, which includes factors important in succeeding (Duckworth et al., 2007; Duckworth, Quin, 2009). When addressed especially in terms of personality traits under the Big Five personality model – openness, conscientiousness, extraversion, agreeableness, and neuroticism – in non-intellectual factors (Goldberg, 1990; Judge et al., 1999; Komarrajau, Kau, Schmeck, 2009) grit was stated to predict success. Significant relations were found between properties of the Big Five personality model and school life success (Barrick, Mount, 1991; Hough et al., 1990; Judge et al., 1999) and academic success (Akın, 2013). In addition, a positive significant relationship was found between responsibility, openness and harmony under the Big Five personality model and academic performance (Conard, 2006). Especially due to the properties accommodated by responsibility, which is included in the Big Five personality model, it was stated that grit had a significantly more positive relationship with academic success than other properties (Noftle, Robins, 2007).

THE PRESENT STUDY

Students of all ages need to control their learning through productive motivational beliefs and use of the cognitive learning process. Studies have indicated that two of the most important internal motivational factors that correlate with academic success are metacognition and grit (Sisney et al., 2000). Metacognition is important in learning and is a strong predictor of academic success (Dunning et al., 2003; Kruger, Dunning, 1999). Grit has been demonstrated to be a significant predictor of academic success in many research studies (Duckworth et al., 2007). In fact, students may be especially relevant for complex problem solving, which requires metacognition and grit in the face of challenge (Duckworth, Quinn, 2009). Despite these findings, as far as we know, no study has investigated the relationship between metacognition and grit. Thus, the purpose of this research is to examine the relationship between metacognition and grit. Based on the interpretation of previous research (Duckworth et al., 2007; Dweck et al., 2011; Henry, Smith, 1994; Noftle, Robins, 2007), it is expected that grit would be associated positively with metacognition.

METHOD

Participants

Participants were 352 university students who were enrolled in various undergraduate programs at the Sakarya University, Turkey. Of the participants, 101 were first-year students, 85 were second-year students, 79 were third-year students, and 87 were fourth-year students. One hundred and forty five of the participants (42%) were males and two hundred and seven (58%) were females. A large majority of the students (94%) were between 18 and 25 years of age (20.5 ± 1.32).

Measures

The Metacognitive Awareness Inventory (Akın, Abacı, Cetin, 2007) is a 52-item self-report scale using a five-point Likert scale (1 = never to 5 = always). This scale has two sub-scales: knowledge of cognition (seventeen items, e.g., "I understand my intellectual strengths and weaknesses") and regulation of cognition (thirty five items, e.g., "I ask myself questions about the material before I begin"). Results of exploratory factor analysis have demonstrated that the items loaded on eight factors. These eight factors were; declarative knowledge, procedural knowledge, conditional knowledge, planning, monitoring, information management, debugging, and evaluation. Factor loadings ranged from .49 to .72 for declarative knowledge, .36 to .63 for procedural knowledge, .35 to .74 for conditional knowledge, .38 to .65 for planning, .32 to .83 for monitoring, .35 to .70 for evaluation, .32 to .55 for debugging, and .32 to .75 for information management. The internal consistencies of the

Metacognitive Awareness Inventory, were found to be .95 for the entire scale and for subscales they ranged between .93 and .98. Findings also demonstrated that the corrected item-total correlation ranged from .35 to .65. For each factor and each item, the differences between mean scores of upper 27% and lover 27% groups are significant. Test-retest reliability coefficient of Metacognitive Awareness Inventory over three-week period was .95.

Grit Scale. The Revised Turkish Version of the Grit Scale (Akın et al., 2011). This scale has 8 items and two subscales; consistency of interest (four items) and perseverance of effort (four items). Each item was rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Results of language equivalency showed that the correlations between Turkish and English forms were moderate (.81 for consistency of interest and .62 for perseverance of effort). The results of confirmatory factor analysis indicated that the model was well fit and the Chi-Square value ($\chi^2 = 41.72$, N = 310, p = 0.003), calculated for the adaptation of the model, was found to be significant. The goodness of fit index values of the model were RMSEA = .059, CFI = .93, IFI = .93, GFI = .97, AGFI = .94, SRMR = .061. The internal consistency coefficients of two subscales were .63 for consistency of interest and .60 for perseverance of effort. The test-retest reliability coefficients were .76 for consistency of interest and .79 for perseverance of effort. The corrected item-total correlations of the scale ranged from .31 to .46.

Procedure

Convenience sampling was used in the selection of participants. Convenience sam-

pling is a non-probability sampling technique in which participants are selected because of their convenient accessibility and proximity to the researcher (Bryman, 2004). For this reason, the results of this study did not make inferences from the population, which led to a decrease in external validity.

Participants voluntarily participated and were free to fill out the questionnaires without pressure. Completion of the questionnaires was anonymous and there was a guarantee of confidentiality. The instruments were administered to the students in groups in the classrooms. The measures were counterbalanced in administration. Prior to administration of measures, all participants were told about purposes of the study.

In this research, Pearson's correlation coefficient and multiple regression analysis were utilized to determine the relationships between metacognition and grit. These analyses were carried out via LISREL 8.54 (Jöreskog, Sorbom, 1996) and SPSS 11.5.

RESULTS

Descriptive Data and Inter-correlations

Table 1 shows the means, descriptive statistics, inter-correlations, and internal consistency coefficients of the variables used.

When Table 1 is examined, it is seen that there are significant correlations between metacognition and grit. Metacognition related positively to grit. Two-dimensions of grit; consistency of interest ($r = .79$, $p < .001$) and perseverance of effort ($r = .78$, $p < .001$) were found positively associated with metacognition.

Multiple Regression Analysis

Before applying regression, assumptions of multiple regression were checked. The data were examined for normality by the Kolmogorov-Smirnov test. The Kolmogorov-Smirnov test indicated normality of distributions of test scores for all tests in the current study. Outliers are cases that have data values that are very different from the data values for the majority of cases in the data set. Outliers were investigated using the Mahalanobis distance. A case is an outlier if the probability associated with its D2 is .001 or less (Tabachnick, Fidell, 2007). Based on this criterion, five data were labeled as outliers and they were deleted. Multicollinearity was checked by the variance inflation factors (VIF). All the VIF values were less than 10 (Tabachnick, Fidell, 2007), which indicated that there was no multi-collinearity.

Table 1. Descriptive statistics and inter-correlations of the variables

Variables	1	2	3
Metacognition	1.00		
Consistency of interest	.79**	1.00	
Perseverance of effort	.78**	.77**	1.00
Mean	63.03	11.43	22.74
Standard deviation	8.71	3.74	4.26
Cronbach's α	.93	.91	.87

**$p < .01$

Table 2. Summary of stepwise multiple regression analysis for variable predicting metacognition

Variables	B	Standard Error of B	β	t
Step 1				
Consistency of Interest	1.82	.08	.78	22.20[*]
Step 2				
Consistency of Interest	1.05	.11	.45	9.05[*]
Perseverance of Effort	.87	.10	.43	8.59

[*]p < .05

A stepwise multiple regression analysis was applied to determine which dimensions of grit were the best predictors of metacognition. Table 2 shows the results of multiple regression analysis where the independent variables are dimensions of grit and the dependent variable is metacognition.

Consistency of interest entered the equation first, accounting for 62% of the variance in predicting positive metacognition. Perseverance of effort entered on the second step accounting for an additional 8% of variance. The last regression models involved consistency of interest and perseverance of effort as predictors of metacognition and accounted for 70% of the variance. The standardized beta coefficients indicated the relative influence of the variables in the last model with consistency of interest ($\beta = .45$, p < .05) and perseverance of effort ($\beta = .43$, p < .05) all significantly influencing positive metacognition.

DISCUSSION

The purpose of the present study was to determine the relationships between metacognition and grit. It was also expected that consistency of interest and perseverance of effort would be related positively to meta-cognition. The results of correlation and regression analyses confirm the hypothesis and the importance of grit, for better understanding of metacognition. This finding also shows grit as an important determinant of metacognition.

The positive correlation between metacognition and grit is in line with the previous studies, which demonstrate that individual differences, including not only gross deficits in the knowledge of cognition or the regulation of cognition but also differences in other cognitive capabilities such as grit, working memory (Griffin, Wiley, Thiede, 2008; Metcalfe, 2009), and attention are all likely to be crucial in metacognition. In some recent studies (Meijer, Van Hout-Wolters, 2006; Nietfeld, Cao, Osborne, 2005; Pintrich, 2002; Veenman, Spaans, 2005; Vrugt, Oort, 2008; Young, Fry, 2008) a relationship between students' metacognitive characteristics and academic performance was also found.

Moreover, academic success requires not only an initial surge of momentum in a focused direction but also the ability to maintain that momentum regardless of what gets in the way. As a result, students with academic grit would continue working hard for a good grade in a challenging class even after failing several tests, and they would con-

tinue looking for new ways to understand difficult material instead of giving up (Dweck, Walton, Cohen, 2011; Farrington et al., 2012). The feeling of difficulty (Efklides, 2001) is also crucial for the awareness of problems, regulation of effort, recognition of need for help, or use of strategies and, therefore, bridges metacognition with grit. Academic grit represents a desirable quality of academic behavior that seems essential for both short-term and long-term educational achievement and degree attainment.

Specifically, metacognition in educational processes comprises knowledge of cognition and regulation of cognition, beliefs, theories retrieved from memory regarding cognitive functions (e.g., grit, memory, attention, etc.), tasks, persons (including one's self), strategies, and goals (Efklides, 2001; Flavell, 1979; Metcalfe, 2001).

It is extremely important to explain the limitations of this research. First of all, because this research suggests a significant link between metacognition and grit, findings from the research are of explanatory characteristics. Therefore, if it is not tested on another sample, it is wise to avoid taking the findings as definite. Secondly, that the samples presented here are limited to university students restricts the generalizability of the findings. For that reason, it is also important to investigate the variables studied in this research on other samples. Future research on the relationship between these constructs focusing on demographic variables like gender, age, ethnicity and socio-economic status would increase the generalizability of the findings. The results also support the applications of educational programs aiming to improve metacognitive skills by providing evidence for desirable affective outcomes such as grit. In conclusion, the current find-ings increase our understanding of the relationship between metacognition and grit.

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PREDIKTÍVNA ÚLOHA VYTRVALOSTI NA METAKOGNÍCIE U TURECKÝCH VYSOKOŠKOLÁKOV

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Súhrn: Zámerom štúdie je skúmať vzťah medzi metakogníciami a vytrvalosťou. Respondentmi bolo 352 študentov univerzity v Sakarii, Turecko. Použili sme Metacognitive Awareness Inventory (Dotazník metakognitívneho vedomia) a Grit Scale (Škála vytrvalosti). Vzťah medzi metakogníciami a vytrvalosťou sme skúmali pomocou korelačnej analýzy a viacnásobnej regresnej analýzy. Korelačná analýza ukázala, že vytrvalosť pozitívne korelovala s metakogníciami. Podľa výsledkov, dve dimenzie vytrvalosti (trvalosť záujmu a udržanie úsilia) pozitívne predikovali metakognície. Výsledky sme diskutovali s ohľadom na relevantnú literatúru.