Relationships between Education Faculty and Engineering Faculty Students' Critical Thinking and Metacognitive Self-regulation Strategies and Their Approach to Learning[1]

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ABSTRACT

The purpose of the current study is to determine the relationships between the extent to which students of education and engineering faculties use critical thinking and metacognitive self-regulation strategies and the level of their possessing deep approach to learning. The study was designed in line with the survey model. The sample of the study comprises 468 students attending the Education and Engineering faculties of Muğla Sıtkı Koçman University, Turkey. The data of the study were collected through the administration of the *Learning Motivating Strategies Scale* and the *Approaches to Learning Scale* to the sample. In the analysis of the collected data, descriptive statistics, *t*-test and multiple regression analysis were employed. The basic findings of the study are: (1) Students make use of critical thinking and metacognitive self-regulation strategies and the deep approach to learning to a great extent; (2) The extent to which students utilize critical thinking and metacognitive self-regulation strategies and deep approach to learning increases as their grade level increases; (3) The extent to which students utilize critical thinking and metacognitive strategies significantly predicts their deep learning orientation.

Key Words: Learning strategies, critical thinking, metacognitive self-regulation, approaches to learning, deep approach to learning

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INTRODUCTION

It is stated that the way for individuals to be able to engage in learning activities, even in environments where there is no teacher at the time they need and to realize effective learning is by organizing their own learning. The need for individuals to organize their own learning has brought about the concept of self-regulated learning, one of the metacognitive strategies (Altun, 2005). One of the most important goals of education is to train individuals who can take responsibility for their own learning, control their own learning processes and actively participate in these processes, who are confident in their own abilities and who use these abilities in a positive way. In achieving this goal, the self-regulation ability of the individual, which they transfer to the process of learning their mental abilities and skills, is of great importance (Gömleksiz, & Demiralp, 2012). Self-regulated learning involves the learner's purposeful endeavors to manage and direct complex learning activities (Du Bois & Staley, 1997). Zimmerman (2000) defines this endeavor as individual's determining their learning goal and regulating their knowledge, emotions and behaviors in order to achieve this goal, and emphasizes that individuals having high self-regulating skill constantly demonstrate this effort.

Self-regulation skill utilizes three constructs related to learning; cognitive, motivational and metacognitive processes (Trautwein, & Köller, 2003; Hong, Peng, & Rowell, 2009; Ramdass, & Zimmerman, 2011). According to Çiltaş (2011), self-regulation involves cognitive strategies used by students in order to learn, remember and understand the material, effort management and control in performing in-class academic tasks and metacognitive strategies used by students to plan, monitor and revise their cognition. Among these three variables, while cognition is the most influential factor on achievement, what makes it more important is that it provides coordination between metacognition and other variables (Zimmerman, & Moylan, 2009). In order to have self-regulation skill, it is necessary for students to consistently monitor and control their ongoing cognitive processes at the metacognitive level (Aşık, & Sevimli, 2015). Lucangeli and Cornoldi (1997) state that metacognition is between cognition and emotion, and plays a fundamental role in the self-regulation necessary to achieve success in learning (Alkan, & Erdem, 2012).

The concept of metacognition was first coined by Flavell (1979). Flavell defined metacognition as the individual's knowledge about his/her own cognitive processes and the ability to utilize this knowledge in regulating these cognitive processes and constructed the concept as metacognitive knowledge and metacognitive experience. According to Flavell, metacognitive knowledge is the individual's knowledge about the work they will undertake and the strategy they will use. Metacognitive experience, on the other hand, is made up of planning, monitoring and evaluation processes. Individuals having metacognitive skills not only become aware of their own learning processes, but also evaluate these processes and make changes in the learning process for effective learning. These skills enable individuals to be more effective in the learning process and take responsibility for their own learning (Yürük, 2014).

When the learner possesses metacognitive skills and utilizes them, the quality of learning increases. The level of metacognitive skills possessed is parallel to the quality of learning (Woolfolk, 1993). In the literature, there are studies showing the positive correlation between the use of metacognitive learning strategies and achievement (Vanderstoep, Pintrich, & Fagerlin, 1996; Altun, 2005; Coutinho, 2007; Turan & Demirel, 2010; Bağçeci, Döş, & Sarıca,

2011). It is widely accepted that metacognition is an important tool for learner success in higher education and for higher level learning to occur (De Backer, Van Keer, & Valcke, 2012). The impact of metacognitive strategies on achievement and their being learnable lead us to believe that they can play an important role in teacher education. Studies focusing on the relationships between strategies and self-efficacy beliefs (Tunca, & Alkın-Şahin, 2014), metacognitive awareness level, problem-solving skills and attitudes towards technology (Bakioğlu, Küçükaydın, & Karamustafaoğlu, 2015), self-control skills and metacognitive awareness (Ulaş, Epçaçan, Sökmen, & Yasul, 2015), self-efficacy perception and meta-cognitive awareness (Küçük Kılıç, & Öncü, 2014; Kılınç, & Uygun, 2015), metacognition, epistemological beliefs and attitudes towards technology (Karakuyu, & Karakuyu, 2015), metacognitive strategies and epistemological beliefs (Belet, & Güven, 2011), metacognition and problem-solving (Baş, Sağırlı, & Bekdemir, 2016; Sparkman, & Harris, 2009), level of metacognitive skills and variables such as grade level, gender, choice of profession (Tüysüz, Karakuyu, & Bilgin, 2008; Özsoy, & Günindi, 2011; Alkan, & Erdem, 2012; Baysal, Ayvaz, Çekirdekçi, & Malbeleği, 2013; Saracaloğlu, & Çengel, 2013; Tuncer, & Kaysi, 2013) can be given as examples in this context. In the literature, it is stated that having metacognitive skills helps individuals to avoid experiencing problems in their professional lives and supports teachers in conducting activities that can enhance students' metacognitive skills (Alkan, & Erdem, 2012).

Another variable that is as effective as metacognitive self-regulation strategies on the quality of an individual's learning is the possession of critical thinking skills. When students exercise critical thinking, they need to use metacognitive skills such as monitoring their own thinking processes, checking whether or not they are progressing towards a proper goal, and deciding on the use of time and effort (Magno, 2010). Kuhn and Dean (2004) state that the concept of critical thinking has many different definitions, yet the commonality is that it is a part of cognition referring to an individual's awareness of their own thinking process and their own and others' ways of reflecting on thinking. Kökdemir (2000) argues that the process of critical thinking includes metacognition and other skills such as recognizing the differences between proven facts and claims, testing the reliability of information sources, distinguishing irrelevant information from evidence, recognizing inconsistent judgments, prejudices and cognitive fallacies, asking effective questions, using verbal and written language effectively and being aware of one's own thoughts (Kökdemir, 2003). In the experimental study by Akyüz, Samsa-Yetik, and Keser (2015), it was concluded that metacognitive guidance positively affects critical thinking disposition. Uzuntiryaki-Kondakçı and Çapa-Aydın (2013) concluded that metacognitive self-regulation directly predicts critical thinking to a great extent. In Semerci and Elaldı's (2014) study, a low but positive relationship was found between metacognitive beliefs and critical thinking dispositions. When the research on pre-service teachers and critical thinking in the literature is reviewed, it is seen that they mostly focus on the investigation of critical thinking as disposition (Türnüklü, & Yeşildere, 2005; Güven, & Kürüm, 2008; Ekinci, & Aybek, 2010; Çetinkaya, 2011; Gök, & Erdoğan, 2011; Emir, 2012; Kartal, 2012), critical thinking dispositions and deep approach to learning (Beşoluk, & Önder, 2010), critical thinking attitudes (Şen, 2009; Karasakaloğlu, Saracaloğlu, & Yılmaz-Özelçi, 2012) and the power of executing critical thinking (Kaya, 1997; Kürüm, 2002; Tok, & Sevinç, 2010). These studies revealed that though in general students' critical thinking levels are at a medium level, there are some variations.

Given the delineations mentioned, it can be assumed that the preferred learning strategies can have significant effects on the quality of learning. In this connotation it can be

argued that the positive features attributed to critical thinking and metacognitive self-regulation skills may influence the way in which the learner handles learning and their intention to learn. The competence of learners to use these skills can therefore influence their preference for approach to learning.

The concept of approach to learning stems from studies pioneered by Marton and Säljö (1976a, 1976b). The approach to learning described as an interaction between the learner and the learning task (Ramsden, 2000) is the way adopted by an individual to deal with learning depending on his/her intention (Ekinci, 2008). Approaches to learning have been structured in three dimensions as a result of different studies performed in parallel to each other. The consistency of these results have also been evaluated. These three learning orientations have been tried to be explained on the basis of recite-repeat, achievement and comprehension, and are known as deep, surface and strategic approaches to learning (Marton, & Säljö, 1976a, 1976b; Entwistle, & Ramsden, 1983; Biggs, 1987).

Individuals with a surface approach to learning deal with learning with the intention of meeting minimum requirements with very minimal effort. Students adopting this approach tend to use low cognitive level activities (Biggs, 1999). It is stated that students who prefer the surface approach to learning only intend to meet the task requirements, they memorize the information required by the assessment, fail to distinguish the principles from the samples, and evaluate the learning task as an external force (Ramsden, 2000).

Individuals with a strategic learning approach are learning to take high marks (acting strategically) by using ways and means leading to success rather than those resulting in learning. Entwistle (1987) argues that students who prefer this approach may employ strategies such as arranging time in such a way as to get the highest grade, investing effort to what is most effective in achieving this goal, providing materials and conditions suitable for the study, making use of former exam questions in order to come up with predictions about possible upcoming exam questions and being alert towards clues of how the teacher assigns grades (Richardson, 1994).

In the deep approach to learning, what is of greatest significance is meaningful learning. The individual is intrinsically motivated and has a sense of curiosity. Students who prefer the deep approach to learning have features such as pursuing the goal of learning, being interested in the structure of the learning task and different opinions, establishing links between theoretical ideas and everyday life, transforming the content they are dealing with into a harmonious whole and then constructing and utilizing evidence (McCune, & Entwistle, 2000; Ramsden, 2000). When dealing with a topic, it is important to look for meaning rather than surface or strategic approaches. Studies on approaches to learning have revealed that there are relationships between the preference for learning approaches, the grades of students and the quality of learning products (Entwistle, Meyer, & Tait, 1991; Trigwell & Prosser, 1991; Marton, & Säljö, 1997).

Learning approaches are not fixed characteristics of individuals. Entwistle and Entwistle (1991) point out that the student's intention is the main factor determining the choice of learning approach. The main point to be taken into account here is that this intention may differ by the influence of some variables (Ekinci, 2008). Though the greatest influence is exercised on learning approaches by the learning environment-related variables as perceived by the learner, individual competencies also play a role. Chin and Brown (2000) contend that

there is a clear relationship between in-depth learning and metacognitive activities. The deep approach to learning requires employing metacognitive skills such as self-assessment, self-questioning, identifying mistakes, and taking into account the limitations of options and ideas (Marshall, & Case, 2005).

When the studies conducted on pre-service teachers are reviewed, it is seen that there are studies focusing on the relationships between learning approaches and gender, grade level and achievement (Selçuk, Çalışkan, & Erol, 2007; Ozan, Köse, & Gündoğdu, 2012; Özgür, & Tosun, 2012; Ozan, & Çiftçi, 2013; Yağcı, 2015), learning approaches and study skills (Senemoğlu, 2011; Çolak, 2016), learning approaches and teacher self-efficacy belief (Ekinci, 2015), approaches to studying and general tendency to postpone (Akar, 2016), learning approaches, learning styles and critical thinking tendency (Beşoluk, & Önder, 2010), epistemological beliefs and learning approaches (Şahin-Taşkın, 2012), mental models for science learning, self-efficacy beliefs and learning approaches (Feyzioğlu, Feyzioğlu, & Küçükçıngı, 2014), approaches to studying and self-regulated learning skills (Karaduman, Güder, Özsoy-Güneş, & Kırbaşlar, 2014). No study has been found in the literature addressing the relationship between critical thinking and self-regulation strategies and approaches to learning. Thus, it can be said that investigation of these relationships within the context of the deep approach to learning, one of the learning approaches, is deemed important.

Purpose of the Study

The purpose of the current study is to investigate the extent to which students from the education and engineering faculties utilize critical thinking and metacognitive self-regulation learning strategies and their level of possessing the deep approach to learning. To this end, answers to the following questions were sought:

1. What is the extent to which the students utilize critical thinking and metacognitive self-regulation learning strategies and their level of possessing the deep approach to learning?
2. Does the extent to which the students utilize critical thinking and metacognitive self-regulation learning strategies and their level of possessing the deep approach to learning vary significantly depending on the variables of faculty and grade level?
3. How much does the extent to which the students utilize critical thinking and metacognitive self-regulation learning strategies predict their level of possessing the deep approach to learning?

METHOD

This study was designed in the survey model.

Population and Sample

The population of the study is comprised of a total of 1,187 students, of whom 1,009 are first and fourth year students from the Education Faculty of Muğla Sıtkı Koçman University, Turkey, and 178 are first and fourth year students from the same university's Engineering Faculty during the spring semester of the 2015-2016 academic year. Students of programs with second-shift education and programs with no fourth year students were excluded from the study.

The sample size that can represent the population with a 95% reliability level was calculated to be 290. All students found in the classrooms on the day of application were included in the study. Where a grade had more than one class group, the application was conducted in only one of the classes. A total of 468 students constituted the sample of the study, who were reached during the application and accurately completed the data collection tools. Of the participating students, 263 (46.20%) are females and 205 (43.80%) are males; 358 (76.5%) are from the education faculty and 110 (23.5%) from the engineering faculty; 272 (58.1%) are first-year students and 196 (41.9%) are fourth-year students.

Data Collection

The data of the current study were collected by administering the data collection tools to students from the faculties of education and engineering in a classroom environment during the spring semester of the 2015-2016 academic year. In the study, as the data collection tools, the Critical Thinking and Metacognitive Self-Regulation subscales of the Learning Motivating Strategies Scale developed by Pintrich, Smith, Garcia, and McKeachie (1993) and adapted to Turkish by Karadeniz, Büyüköztürk, Akgün, Çakmak, and Demirel (2008), and the In-depth Learning subscale of the Learning Approaches Scale developed by Ekinci (2008) were employed.

The Learning Motivating Strategies Scale consists of two main dimensions that are *motivation* (31 items) and *learning strategies* (50 items). The motivation dimension of the scale is made up of six subscales, which are; *intrinsic orientation*, *extrinsic orientation*, *task value*, *locus of control*, *self-efficacy perception*, and *exam anxiety*. The learning strategies dimension of the scale consists of nine subscales, which are; *repetition*, *arrangement*, *elaboration*, *critical thinking*, *metacognitive self-regulation*, *help seeking*, *effort management*, *peer cooperation*, and *time and work environment*. The critical thinking subscale used in the current study is comprised of five items and the self-regulation subscale has 11 items. The scale are comprised of seven-point, Likert-type items ("1-Absolutely false for me" through to "7-Absolutely true for me").

A sample item from the metacognitive self-regulation subscale is "*While reading sources related to the course, I ask questions to help me focus on the topic,"* and a sample item for the critical thinking subscale is "*I see the subjects of the course as a starting point and I try to develop my own opinions about these subjects* Bakioğlu, Küçükaydın, and Karamustafaoğlu Pintrich et al. (1993) stated that the scale can be used as a whole or depending on the purpose, the desired dimension can be selected and applied for different disciplines.

The construct validity of the scale was tested with Confirmatory Factor Analysis (CFA). The goodness-of-fit indices determined by means of this analysis for the learning strategies subscale are as follows: χ^2/sd=3.42, RMR=.17, SRMR=.044, GFI=.89, AGFI=.87, RMSEA=.047, CFI=.89, NNFI=.88. The factor loadings of the scale were found to range from .24 to .79. Thus, it was concluded that the scale has construct validity. The Cronbach's Alpha internal consistency coefficient calculated for this dimension of the scale is .74 (Karadeniz et al., 2008). The Cronbach's Alpha internal consistency coefficients recalculated for the critical thinking and metacognitive self-regulation subscales are .83 and .82, respectively.

The Approaches to Learning Scale (Ekinci, 2008) addresses the deep, surface and strategic approaches to learning. There are a total of 54 items in the scale, with 18 items in each of the three subscales. The scale consists of five-point, Likert-type items ("1-It does not reflect me at all" through to "5-It completely reflects me"). The construct validity of the scale was

tested through Explanatory Factor Analysis (EFA). The total variance explained by the three dimensions of the scale together is 30.98%. The factor loadings for the in-depth learning sub-dimension of the scale were found to range from .51 to .65. "*What I have learned is more important than the grade*" and "*Though not required by the course, I sometimes search for topics related to my field of study"* can be given as sample items for the in-depth learning sub-dimension. The Cronbach's Alpha internal consistency coefficient calculated for this dimension to determine the reliability of the scale is .89 (Ekinci, 2008). Within the context of the current study, the Cronbach's Alpha internal consistency coefficient recalculated for this dimension was found to be .90. Each dimension of the scale can be used independent of each other.

Data Analysis

In the analysis of the collected data, descriptive statistics, for paired comparisons *t*-test and multiple regression analysis to determine the extent to which the learning strategies (critical thinking and metacognitive self-regulation) predict the level of students' possessing the deep approach to learning were employed.

Prior to the regression analysis, the assumptions of the analysis were tested. In this regard, extreme value analysis was performed, and z scores ($z<3$) were calculated in the determination of the extreme values. The normality of the distribution was tested with Kurtosis and Skewness coefficients and were found to be in the range of ±1. The Skewness coefficients in all the variables were between -.084 and -.29 and the Kurtosis coefficients between -.18 and -.62. On the basis of these results, the distribution was accepted to be normal. Another problem for the regression analysis is multiple correlations between the predicting variables. In the determination of whether or not there are multiple correlations between the variables, the variance inflation factor (VIF) analysis and the non-standardized regression coefficients (B) were capitalized on. If the VIF value is greater than 10 (Myers, 1990) or if the B value is greater than 2, it points to a multiple correlation problem (Çokluk, 2010). In the current study, the highest VIF value was found to be 1.69 and the highest B value was found to be .28. Thus, there no multiple correlation problem was identified.

Evaluation criterion was constructed by calculating interval values for the means obtained from the scales. While the mean intervals calculated in this context for the critical thinking and metacognitive self-regulation subscales are interpreted as follows; 1.00-1.85 "very low," 1.86-3.57 "low," 3.58-4.43 "medium," 4.44-6.15 "high," 6.16-7.00 "very high," they are interpreted for the learning approaches subscale as follows; 1.00-1.79 "very low," 1.80-2.59 "low," 2.60-3.39 "medium," 3.40-4.19 "high," and 4.20-5.00 "very high." Correlation coefficients are evaluated as follows; .00-.29 "low correlation," .30-.69 "medium correlation," and .70-1.00 "high correlation" (Büyüköztürk, 2014). The findings are discussed on the basis of the literature.

FINDINGS

The first sub-problem of the current research is related to the determination of the extent to which students utilize critical thinking and metacognitive self-regulation strategies, and their level of possessing deep approach to learning. When critical thinking and metacognitive self-regulation mean scores of the students from the faculties of education and engineering were examined, it was concluded that these strategies are utilized by the students to a great extent. Similarly, when the students' mean scores related to the level of possessing

deep approach to learning were examined, it was found that their level is also high (see Table 1).

Table 1. *Extent that students utilize critical thinking and metacognitive self-regulation strategies, and level of possessing deep approach to learning (n=468)*

Dimensions	*Education Faculty*		*Engineering Faculty*		*Evaluation*
	$\overline{x}$	*SD*	$\overline{x}$	*SD*	
Critical thinking	4.85	1.06	5.04	.98	High
Metacognitive self-regulation	4.90	.85	4.91	.77	High
Deep approach to learning	4.02	.60	3.93	.62	High

The second sub-problem of the study relates to whether or not the extent to which students utilize critical thinking and metacognitive self-regulation learning strategies and their level of possessing deep approach to learning varies significantly depending on variables of faculty and grade level.

The extent to which the students utilize critical thinking [$t_{(466)}$= 1.625, p>.05] and metacognitive self-regulation [$t_{(466)}$= .104, p>.05] strategies and their level of possessing deep approach to learning [$t_{(466)}$= 1.355, p>.05] do not vary significantly by the faculty variable (see Table 2).

Table 2. *Comparisons based on the faculty variable*

Dimensions	*Faculty*	*n*	$\overline{x}$	*SD*	*df*	*t*	*p*
Critical thinking	Education	358	4.85	1.06	466	1.625	.105
	Engineering	110	5.04	.98			
Metacognitive self-regulation	Education	358	4.90	.85	466	.104	.917
	Engineering	110	4.91	.77			
Deep approach to learning	Education	358	4.02	.60	466	1.355	.176
	Engineering	110	3.93	.62			

The extent to which the students utilize critical thinking [$t_{(466)}$= 5.051, p>.05] and metacognitive self-regulation [$t_{(466)}$= 4.727, p>.05] strategies and their level of possessing deep approach to learning [$t_{(466)}$= 4.231, p>.05] vary significantly depending on the grade level variable. In all the three dimensions, the fourth-year students have higher mean scores than the first-year students (Table 3).

Table 3. *Comparisons based on the grade level variable*

Dimensions	*Grade level*	*n*	$\overline{x}$	*SD*	*df*	*t*	*p*
Critical thinking	1	272	4.70	1.02	466	5.051	.000
	4	196	5.18	1.01			
Metacognitive self-regulation	1	272	4.75	.81	466	4.727	.000
	4	196	5.11	.80			
Deep approach to learning	1	272	3.90	.58	466	4.231	.000
	4	196	4.13	.60			

The third sub-problem of the study relates to the extent to which students utilizing critical thinking and metacognitive self-regulation strategies predict their level of possessing deep approach to learning (Table 4).

Table 4. *Regression analysis: Prediction of deep learning approach to learning*

Independent variables	*B*	*Standard error*	*β*	*t*	*p*	*Zero-order (r)*	*Partial (r)*	*VIF*
Constant	1.456	.116		12.51	.00			
Critical thinking	.280	.024	.48	11.77	.00	.69	.48	1.69
Metacognitive self-regulation	.239	.030	.32	8.01	.00	.64	.36	1.69
R=.74 R^2=.54 $F_{(2-465)}$= 273.908. p=.00								

It is seen that critical thinking and metacognitive self-regulation strategies are significant predictors of the level of possessing deep approach to learning (*R=.74, R^2=.54*, p<.01). Critical thinking and metacognitive self-regulation strategies together explain 54% of the students' level of possessing deep approach to learning. According to the standardized regression coefficient (β), the predicting variables' order of importance in terms of predicting students' levels of possessing deep approach to learning is critical thinking and metacognitive self-regulation strategies. When *t*-test results concerning the significance of the regression coefficients were examined, it was found that both critical thinking and metacognitive self-regulation strategies are significant predictors of the level of possessing deep approach to learning. When the partial correlation coefficients were examined, a positive and medium correlation between the students' level of possessing deep approach to learning and their critical thinking (r=.48) and metacognitive self-regulation (r=.36) strategies was found.

RESULTS, DISCUSSIONS, AND SUGGESTIONS

The current study aims to investigate the relationships between the extent to which education and engineering faculty students utilize critical thinking and metacognitive self-regulation strategies and their level of possessing deep approach to learning. This section presents discussions based on the results of the study.

Both the extent to which students from the faculties of education and engineering utilize critical thinking and metacognitive self-regulation strategies and their level of possessing deep approach to learning are high. When the results are evaluated in terms of critical thinking strategies, they can be interpreted as the students' having skills attributed to critical thinking such as analyzing discussions, claims or evidence (Ennis, 1985; Facione, 1990; Halpern, 1998), making inferences through induction or deduction by using reasoning (Ennis, 1985; Facione, 1990), decision-making, problem-solving and evaluating (Ennis, 1985; Lipman, 1988; Facione, 1990; Tindal, & Nolet, 1995; Halpern, 1998; Case, 2005), asking questions to understand a problem, giving answers, defining concepts, determining premises (Ennis, 1985), and offering interpretations and explanations (Facione, 1990). It is considered desirable for university students to possess these skills in order to better facilitate their higher education learning experience.

The fact that students utilize metacognitive self-regulation strategies to a high degree can be interpreted as their having the desired skills such as being aware of their own cognitive processes, making use of this awareness in the arrangement of cognitive processes (Flavell, 1979), learner's organizing their own learning effectively, taking responsibility of their own learning, controlling their own learning processes, actively participating in learning processes, trusting their own skills and making proper use of these skills. Possession of these skills is claimed to be conducive to the occurrence of quality learning (Woolfolk, 1993; Coutinho, 2007; De Backer et al., 2012). These skills also seem to be of great importance in university education where individual learning and responsibility are vital.

With regard to students' deep approach to learning, on average it can be interpreted that the student's high level indicates them having a high level of meaningful learning orientation. Thus, it can be concluded that in general, students do not engage in their studies due to concerns of passing the class or having high grades; rather, their engagement is due to concerns of realizing deep learning. The way individual's handle learning affects their approach, awareness of what they know, and the quality of learning the strategies employed, and hence their personal competences. Thus, the results obtained for the students of both faculties indicate a positive situation. Due to the positive characteristics attributed to the competences required by the three concepts addressed in the current study, it can be argued that the learner characteristics coincide with the human profile aimed to be created through higher education. Operationalization of these three concepts by higher education institutions can contribute to the training of individuals who can research, inquire, and construct the content as a meaningful whole and therefore solve problems.

Though no study has been found in the literature simultaneously investigating students' critical thinking and metacognitive self-regulation strategies and deep approach to learning, some studies were noted explored these concepts together with other variables. For instance, with regards to critical thinking skills of university students, in the study conducted by Kaya (1997), it was found that critical thinking power of engineering faculty students was medium and higher than that of the science and social studies students. Kürüm (2002) reported the critical thinking skill of education faculty students as medium. In a research measuring critical thinking tendencies, it has been found that students of the natural sciences (math, chemistry, physics and biology) have a low level of critical thinking disposition (Tümkaya, 2011), education faculty students have critical thinking disposition higher than medium (Kartal, 2012), and a low level of critical thinking disposition (Ay, Padem, & Eriş, 2010).

In the studies by Baş et al. (2016), Baysal et al. (2013), and Alkan and Erdem (2012), students' metacognitive awareness levels were found to be high. Because the dimensions of the studies and the means of measurement related to critical thinking and self-regulation skills vary, research results are also diverse. When studies focusing on the learning approaches of education faculty students are examined, it is seen that besides the deep approach to learning, the surface and strategic approaches to learning have been investigated and it has been revealed that university students prefer deep approach to learning more than the others (Selçuk et al., 2007; Ekinci, 2008; Senemoğlu, 2011; Ozan et al., 2012; Özgür, & Tosun, 2012; Ozan, & Çiftçi, 2013; Karaduman et al., 2014; Olpak, & Korucu, 2014; Yağcı, 2015), which concurs with the findings of the current study.

Another finding of the study is that the extent to which the students utilize critical thinking and metacognitive self-regulation strategies and their level of possessing deep

approach to learning do not vary significantly by their faculty. The education and engineering faculties have very different characteristics in terms of their relevant disciplines, student characteristics, qualifications of their graduates, and the sectors where they work etc. In spite of these differences, the similarity between these two groups of students in terms of the extent to which they utilize critical thinking and metacognitive self-regulation strategies and their level of possessing the deep approach to learning may be due to the similarity of the teaching and learning processes they undergo.

The extent to which the students utilize critical thinking and metacognitive self-regulation strategies and their level of possessing the deep approach to learning vary significantly depending on the grade level variable, in favor of those studying in their fourth year. This indicates that with increasing grade level, the extent to which both the education faculty and engineering faculty students utilize critical thinking and metacognitive self-regulation strategies and their preference for the deep approach to learning also increases. In the literature, it is also argued that there are many factors affecting the extent to which students utilize critical thinking and metacognitive self-regulation strategies and the deep approach to learning in educational environments; and that in this area the quality of learning environments has an important role to play in this regard and that these skills can be developed (Zimmerman, 1995; Ley, & Young, 2001; Eshel, & Kohavi, 2003; Martinez, 2006; Kökdemir, 2012). In this connection, higher scores taken by fourth-year students in the study may be interpreted as their undergraduate education having developed them in terms of utilizing critical thinking and metacognitive self-regulation strategies and the deep approach to learning. However, when the relevant studies in the literature are examined, no real consistency on this matter can be seen. For example, in some studies conducted on the metacognitive skills of education faculty students (Tüysüz et al., 2008; Memnun, & Akkaya, 2009; Özsoy, & Günindi, 2011; Baysal et al., 2013), it was found that with increasing grade level, metacognitive awareness also increases (Sağırlı, Çiltaş, Azapağası, & Zehir, 2010; Tuncer, & Kaysi, 2013; Tunca, & Alkın-Şahin 2014; Kılınç, & Uygun, 2015). It has also been reported that grade level does not have any significant affect. In light of the results of the many studies in the literature, it can be maintained that similar inconsistency can be seen with regards to university students' critical thinking skills. For instance, in the studies of Aybek (2006) and also Can and Kaymakçı (2015), while it was found that the fourth-year students' critical thinking tendency and critical thinking level are higher than those of the lower grades, Akar (2016), Gülveren (2007), Kürüm (2002) and Sağırlı et al. (2010) all reported that with increasing grade level, critical thinking skill deteriorates. Ekinci and Aybek (2010), in their study on education faculty students, and in Tümkaya's (2011) study on science faculty students (math, chemistry, physics and biology), all found that grade level does not significantly affect critical thinking tendency. Beşoluk and Önder (2010) conducted a study with the participation of education faculty students and master's students and found that the students' critical thinking tendencies are higher in favor of the master's students.

Another dimension of the current study is concerned with the use of the deep approach to learning and in this regard, while there are some studies in the literature stating that scores taken for the use of the deep approach to learning vary significantly in favor of higher grades (Selçuk et al., 2007; Senemoğlu, 2011; Çolak 2016), there are some other studies that report no significant difference (Ozan et al., 2012; Özgür, & Tosun, 2012; Ozan, & Çiftçi, 2013; Yağcı, 2015).

The third sub-problem of the study aims to determine whether or not critical thinking and metacognitive self-regulation strategies predict the level of possessing the deep approach to learning. The results of the current research demonstrate that the extent to which the students utilize critical thinking and metacognitive self-regulation strategies is a significant predictor of their level of possessing the deep approach to learning. Critical thinking and metacognitive self-regulation strategies together explain 54% of the students' level of possessing the deep approach to learning. This result shows that besides the effect of other variables such as teaching and learning environment, individual competences (critical thinking and metacognitive self-regulation strategies) also affect students' level of possessing the deep approach to learning. Chin and Brown (2000) state that there is a clear relationship between metacognitive activities and deep learning and that the deep approach to learning requires employing metacognitive skills such as self-assessment, self-questioning, identifying mistakes, and taking into account the limitations of options and ideas (Marshall & Case, 2005).

Though no study has been found in the literature simultaneously investigating these three concepts related to students' learning processes, there are some studies exploring the relationships with two of these concepts or some other similar concepts with learning approaches. There are studies remarking that there are positive and significant correlations between the deep approach to learning and self-regulatory learning skills (Beishuizen, Stoutjesdijk, & Van Putten, 1994; Lonka, & Lindblom-Ylänne, 1996; Heikkilä, & Lonka, 2006; Karaduman et al., 2014). Beşoluk and Önder, (2010) reported a medium and positive correlation between students' critical thinking tendencies and the deep approach to learning and Bakioğlu et al. (2015) and Baş et al. (2016) reported a medium and positive correlation between pre-service teachers' metacognitive awareness levels and problem-solving skills. Pre-service teachers' epistemological beliefs and their beliefs in the importance of effort for learning have been found to be a significant predictor of their adopting the deep approach to learning (Şahin-Taşkın, 2012). The common conclusion to be drawn from these studies is that learning strategies including higher cognitive skills are effective on the pursuit of meaning.

As a conclusion, the main findings of the current study investigating the relationships between the extent to which the students from the faculties of education and engineering utilize critical thinking and metacognitive self-regulation strategies and their level of possessing the deep approach to learning can be summarized as follows: (1) The students utilize critical thinking and metacognitive self-regulation strategies and the deep approach to learning to a large extend. (2) The extent to which the students utilize critical thinking skills and metacognitive self-regulation strategies and the deep approach to learning increases parallel to the grade level. (3) The extent to which the students utilize critical thinking and metacognitive self-awareness strategies is an important predictor of their level of possessing the deep approach to learning.

In light of these findings, development of learning and teaching conception placing emphasis on the inculcation of higher cognitive skills rather than teaching of the content in higher education can be suggested as one of the primary steps to be taken.

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