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# The effect of metacognitive awareness on academic success

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**ABSTRACT**

In fact, there are several variables affecting an individual's academic achievement. However, in this study, it was aimed to investigate possible effects of metacognitive awareness level on academic achievement. The population of the research included 314 pre-service teachers studying at the faculty of education. A descriptive survey method was employed for the study. It was found that the pre-service teachers, participating in the research had a high level of metacognitive awareness. The pre-service teachers' levels of metacognitive awareness did not differ by gender. It was concluded that academic achievement influenced their levels of metacognitive awareness positively. It was also found that the pre-service teachers were capable of making predictions, planning, monitoring and evaluating about their own cognitive activities. In addition, it was revealed that the subjects knew which learning methods were effective and which were not, and that they had the skills of planning, using and monitoring an approach that they expected to be successful for a task they encountered. In the context of these findings, some implications on the development of pre-service teachers' metacognitive awareness were discussed.

**Keywords:** Metacognitive awareness, academic success, pre-service teachers, education, teacher training.

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## INTRODUCTION

The main purpose of the scientific studies in universities is to use the information in the desired application areas. The areas of practice in education extend from primary school to higher education. However, no studies on cognitive awareness levels of the students at our university have been found in the literature. Determination of cognitive awareness of pre-service teachers studying at higher education institutions with regards to their majors and to the teaching profession can help them analyze themselves better in a professional manner and may affect their job satisfaction. Accordingly, attitude of teachers with a high level of cognitive awareness can influence their students positively. Studies to be carried out to improve students' levels of cognitive awareness will considerably affect their levels of achievement.

Individuals, from birth to death, make an effort to understand and make sense of themselves, their environment, their education, all in all-the world. They activate the cognitive processes while making sense of these. For an individual, learning starts right from the moment he/she first interacts with the external world. What helps him/her participate in this interactional setting is the skill of cognitive awareness. According to Onan (2013), cognition is the process/processes for an organism to get information about its surrounding environment and to use this information in understanding the world and in bringing solutions to the problems. As understood from the definition, the human is in a struggle of understanding, interpreting and decoding the information about the world he is in. The cognitive processes are of quite importance for individuals in

making use of themselves and their environment. First, individuals learn the information they encounter, and then encode, detail and organize them by employing the cognitive processes. According to Sapancı (2010), the cognitive processes also have an effect on coding of information, transferring to the long-term memory and calling back. Metacognition is, on the other hand, the individuals'skills of monitoring and organizing own cognitive processes and strategies, as well as the information obtained.

One of the pioneers of the term 'metacognitive' was Flavell. This concept was introduced by Flavell as a type of upper memory and knowledge of processes of shaping intelligence, storing inputs, researching intelligence, tracking intelligence, and retrieving with this storage (Demircioğlu, 2008). Flavell (1979) claimed that metacognitive awareness is cognition about cognition. Cognitive awareness, according to Senemoglu (2010), is being able to ask and answer some questions about our own cognitive processby ourselves. Being able to ask and answer questions on his/her own depicts the individual's understanding of his/her own cognitive system. There have been several definitions related to cognitive awareness.

While Demirel (2020) explains the metacognitive as the individual communicating with himself/herself about the cognitive strategy and the requirements of the task before, during and after a learning task; Yurdakul (2004) defines it as observing the order, structure and all features of the cognitive stages of individuals and becomes aware of these stages and control them; and Sahranç (2019) states it as the student's evaluation of his/her own thinking process. Papleontiou-louca (2003) suggested that if cognitive awareness involves knowing, perceiving, comprehending and remembering, then it contains an individual's understanding and remembering about his own perception. In addition, Moore described cognitive awareness as "the knowledge of an individual on the different aspects of thinking and individual's skills on cognitive activities" (Papleontiou-louca, 2003). Pintrich and Great (1990) propounded that cognitive awareness consists of the strategies of planning, reviewing/checking and characterizing the cognition (as cited by O'Neil and Abedi, 1996).

Kluwe (1982) approached the term "cognitive awareness" from a different perspective by describing cognitive awareness activities. He characterized cognitive awareness as the thinking subject's ability to understand his own and others' thoughts. The thinking subjecthas the abilities of monitoring and regulating the course ofhis own thinking (as cited by Demir, 2009).

Cognitive awareness is an essential skill involving the other thinking aspects. In its simplest sense, cognitive awareness is somebody's being aware of his own thinking style or algorithm and knowing how to acquire systematic thinking skill. Theories and studies on cognitive awareness have indicated that cognitive awareness consists of at least two components. These are; an individual's having information and controlling his own thinking and an individual's knowledge and control over the learning process. While the former includes sub-components such as devotion, attention and attitude, the latter contains sub-components like evaluating, planning and organizing (Doğanay, 1996, 1997).

Metacognitive is about self-knowledge and cognitive processes and knowledge about how these processes work. "Using cognitive and metacognitive strategies correctly and effectively in learning directly affects performance and learning product, as it increases efficiency in both choosing new information and placing this information in memory and remembering for later use" (Üstün, 2012: 13). Metacognition helps students be more strategic in their learning situations (Victor, 2004). Metacognitive strategies such as planning, monitoring and evaluating allow children to control various cognitive processes of their problem solving processes. A child'semploying metacognitive strategies shows that he/she regards learning as a process and knows how to apply these strategies in new situations. Planning as a metacognitive strategy means deciding on the processes to be carried out for the processes of solving and finalizing a problem. The studies conducted have revealed that lack of planning is among the factors causing learning difficulties of children in schools (Victor, 2004).

Students' knowing how their cognitive processes work, in other words, their having metacognitive knowledge is regarded as vital to be independent students that can control their own learning and guide it (Webster, 2002; Muhtar, 2006). Metacognition is a higher order cognitive ability because it evolves in relation to an individual's self-knowledge and abilities in learning how to learn. The world of technology is still changing that it is ultimately rich and fast-growing not only makes it impossible for individuals to obtain all the information available, but also aggravates to decide which information will be more necessary in the future. Therefore, including metacognition in school programs seems completely to be rational.

## LITERATURE REVİEW

According to recent researches, people who have a higher level of metacognitive understanding are more strategic and competitive in cognitive enterprises (Garner and Alexander, 1989). According to Schraw and Sperling-Dennison (1994), the reason for this is that individuals with metacognitive memory are better able to schedule, sequence, and track their learning which improve their performance directly. It was found in a study conducted by Swanson (1990) that rather than discrepancies in mental ability, differences in strategy and success derive from differences in metacognitive awareness. These findings have indicated that metacognitive takes a compensatory role in cognitive performance by

promotinguse of strategies (Akın, 2006).

Information and studies related to metacognition started to increase more and more after the studies carried out by Flavell. The theoretical foundation of metacognition is based upon Piagetian theory of cognitive development, and it focuses on the consciousness necessary for reaching the strategies with cognitive knowledge, metacognitive awareness and knowledge (Garner, 1994). John Flavell, contributing a great amount to the field of metacognition, had considerably been influenced by the studies of Jean Piaget. Flavell attributed his metacognition theory to interpretation of Piaget's "Stage of Abstract Thinking". In this stage, individuals are aware of their internal thoughts and able to think over their own thinking.

Flavell made a breakthrough with his writing in 1979. In this study, Flavell admitted the intense attention and outbreak in metacognition-related areas such as verbal communication skills, persuasion and comprehension, reading, writing, language learning, memory, focusing, problem-solving, social cognition, emotional monitoring and self-teaching. Flavell explained his metacognitive model including the four classes of phenomena in this work. The behavior of and interactions among the four groups of phenomena (a) metacognitive awareness, (b) metacognitive perceptions, (c) objectives (or tasks), and (d) actions (or strategies) determine an individual's ability to manage a broad range of cognitive enterprises.

In the studies carried out, field experts have suggested different classifications for metacognitive awareness dimension just as for the definition of metacognitive awareness. Some of the classifications are as follows:

Brown (1978) sorted cognitive awareness into the categories of:

1. Planning,
2. Checking,
3. Reviewing.

Flavell (1979) studied cognitive awareness, including conscious acting in three categories as:

1. Self-knowledge
2. Knowledge about tasks
3. Strategic knowledge

Presseisen (1991) accounted cognitive awareness in two categories as:

1. Understanding and employing appropriate strategies
2. Monitoring the performance

The knowledge of cognitive awareness reveals what one knows about his own cognition or about cognition as a general concept (Akın, Abacı and Abaci, 2011). As main feature of the information age is the increasing and dating of information rapidly, the teacher who is in the struggle of transmitting as much information as possible throughout a semester and in a sense that he is the one and only resource of domination and information, should replace himself with the one who is confident in reaching out the information required, a researcher and who is making a dynamic effort to provide himself and his students reach the information. Metacognitive skill, which means that the person is aware of what he knows and can control what he knows, consists of many behaviors. The most suitable environment for the student to reach this ability is school and the most appropriate time is during the lesson in which educational approaches are adopted. Therefore, the course teacher should know the strategies, methods and techniques that will develop metacognitive skills (Özcan and Oktay, 2019). Globalization emerging from the rapid information flow makes it necessary to raise people that will be able to comprehend it in general and as its layers, in specific. For this reason, teachers ought to take the role of a distinguisher of the specific in the general and a mediator between the several specifics. It can be easily understood that the priority of teachers is to focus on the tasks that can increase their own personal quality since the concept of quality which arouse in the last quarter of the 20$^{th}$ century will stick to the issue of improving "the human quality" on the following period (Yetim and Göktaş, 2004).

The second extent of the research related to teacher competence was based on Bandura's Social Cognitive Theory and the term "self-efficacy". Bandura distinguished between two kinds of expectations. One of them, self-efficacy expectation, is that an individual believes he/she has 'the abilities to organize and perform the necessary actions for obtaining the required performance types'. Outcome expectation, on the other hand, is an individual's belief on the possible results of their actions/behaviors (Brouwers and Tomic, 2003; Gençtürk, 2008).

There are several studies on teachers' metacognitive awareness skills in the literature. Among these, in a study conducted by Kazu and Yıldırım (2013) with teachers, it was concluded that women teachers, teachers with higher professional seniority, teachers who graduated from education faculty, teachers working at the primary education level, and teachers with a lower number of students used cognitive awareness strategies more. In another study by Özturan Sağırlı et al. (2020), the cognitive awareness levels of education faculty students were investigated in terms of various variables. As a result of the study conducted with Science, Elementary Mathematics, Classroom and Social Studies teachers, the majority of the participants were found to have a high degree of knowledge. There was a positive and weak relationship between academic achievement and cognitive awareness, and the department of education variable made a substantial difference on cognitive awareness. In another study conducted by Öztürk and Açıl (2020) with social studies teacher candidates, The

metacognitive awareness of social studies teacher candidates was found to be unaffected by gender, grade level, or the average number of books read per year, but high academic success would increase metacognitive awareness. Another study addressing academic achievement and cognitive awareness was conducted by Hindun et al. (2020) with Biology students. In the study, it was established that the majority of students with high academic skills were also at a satisfactory level in terms of metacognitive awareness. It was determined that among the eight metacognitive components examined, the highest performance was realized in the "debugging strategies" dimension and the least performance in the "evaluations" dimension.

There are also studies in the literature in which the cognitive awareness levels of teacher candidates are discussed with different variables. For example, in another study by Bakioğlu et al. (2015), pre-service teachers' cognitive awareness levels were compared with their problem solving skills and technology attitudes. As a result, it was found that there is a significant relationship between the cognitive awareness levels of teacher candidates and their technology attitudes ($r = 0.191$, $p < 0.05$) and problem solving skills ($r = 0.451$, $p < 0.05$). However, in the study conducted by Demir and Kaya (2015), teacher candidates' cognitive awareness skill levels and critical thinking were compared. However, contrary to expectations, the findings revealed that there was a strong negative association between the participants' logical thinking scores and their cognitive knowledge dimensions. In addition, according to the findings of the study, the cognitive awareness levels of the students did not differ according to the major disciplines they studied and the gender variable. The relationship between pre-service teachers' academic procrastination and cognitive knowledge was explored in Vural and Gündüz's (2019) research. The research discovered a low-level negative association between academic procrastination and cognitive memory as a result of the findings. In addition, the study revealed that as the cognitive awareness levels of the teacher candidates increased, their academic procrastination behavior decreased. In the study, it was determined that pre-service teachers' cognitive awareness levels were “high” and female teacher candidates were in a better position in terms of cognitive awareness. In a study conducted by Aglina et al. (2020), cognitive awareness was compared with writing anxiety. The study showed that cognitive awareness plays an effective role in increasing students' writing performance by reducing the sense of anxiety in writing activities.

Among people who use and learn metacognitive strategies effectively evaluate themselves and guide themselves by making correct plans and organizations at various stages in the process of acquiring information. Teachers play a key role in this issue, as metacognitive skills do not appear spontaneously in learners. Especially students with low academic level need more teacher support in this regard (De Jager et al., 2005). Teachers need to know these strategies and how to teach these strategies to their students in order to transfer them to their students. These methods are important for teachers to understand and learn during their undergraduate education. This research is important in terms of exposing potential teachers' knowledge of metacognitive strategies.

**Purpose and importance of the study**

Determination of metacognitive awareness of pre-service teachers studying at faculties of education in higher education institutions with regards to their subject areas and the teaching profession can affect their ability to analyze themselves professionally and their job satisfaction. Teachers with a high level of metacognitive awareness may have a positive influence on their students. Studies to be carried out for promoting students’ levels of metacognitive awareness can considerably affect their levels of achievement.

The aim of this study was to establish the metacognitive awareness levels of pre-service teachers at Mustafa Kemal University's Faculty of Education. The following questions were attempted to be answered in line with this general goal.

1. Do pre-service teachers' levels of metacognitive awareness differ by gender?
2. Do pre-service teachers' levels of metacognitive awareness differ by department?
3. Do pre-service teachers' levels of metacognitive awareness differ by academic achievement?
4. Do pre-service teachers' levels of metacognitive awareness differ by age?

## METHODOLOGY

The research is in descriptive survey model. Descriptive research reveals a given situation completely and carefully. The most widely used descriptive research method in education is survey method (Fraenkel et al., 2012: 15). A survey model was employed for the current research. A survey model is a research tool that aims to tell the truth about a past or current situation. A individual or an entity examined in a study must be identified in their own circumstances (Karasar, 2013; Creswell, 2003; Yıldırım and Şimşek, 2011). In survey method, data is obtained to determine certain characteristics of a group. In the descriptive survey method, a large number of people are asked questions online, in person or by mail, with forms such as questionnaires (Fraenkel et al., 2012: 12-13). Since the aim of this study is to determine the levels of metacognitive awareness among teacher candidates at Mustafa Kemal University's Faculty of Education, it was decided to have a study method

suitable for the descriptive survey model of the research.

## Population and sample

The aim of this study was to determine the levels of metacognitive knowledge among teacher candidates at Mustafa Kemal University's Faculty of Education. Considering this aim, 314 students studying at Hatay Mustafa Kemal University Faculty of Education and selected through stratified purposeful sampling among 1200 students constituting the universe of the study constitute the study sample. Since it facilitates comparisons and analysis by identifying certain subgroups (Baltacı, 2018), the sampling method of this study was formed. According to Table 1, the population included 314 pre-service teachers in the departments of Turkish Language Teaching (n = 46), English Language Teaching (n = 29), Computer Education and Instructional Technology (CEIT) (n = 25), Science Teacher Training (n = 42), Special Education (n = 26), Psychological Counseling and Guidance (PCG) (n = 55), Art Education (n = 15) and Elementary Education (n = 76). In addition, 104 of the pre-service teachers participating in the research were males and 210 of them were females. As for age groups, the ones who were 22-year-old or below were defined as group 1. As a matter of fact, a 22-year-old student is normally at senior year. The 23-year-olds were defined as group 2. A 23-year-old student either matriculated one year delayed or could not graduate the previous year. The ones who were 24 years old or older were defined as group 3. Thereby, the students in this group either protracted the school excessively or they were engaged in their second university degree.

The grade point average was converted from a four-point system to a one-hundred-point system (Council of Higher Education). According to the letter grading system, C (C1-C2-C3) - 55-69 range was classified as 1, while B (B1-B2-B3) - 70-84 range as 2, and A- 85-100 range as 3 (Table 2).

**Table 1.** Numbers and departments of the prospective teachers forming the population of the research.

| | N | % |
|---|---|---|
| **Department** | | |
| Turkish | 46 | 14.6 |
| English | 29 | 9.2 |
| CEIT | 25 | 8.0 |
| Science Teaching | 42 | 13.4 |
| Special Education | 26 | 8.3 |
| PCG | 55 | 17.5 |
| Visual Arts | 15 | 4.8 |
| Elementary School Teaching | 76 | 24.2 |
| **Total** | 314 | 100.0 |
| **Gender** | | |
| Male | 104 | 33.1 |
| Female | 210 | 66.9 |
| **Age** | | |
| 22 and below | 168 | 53.5 |
| 23 | 87 | 27.7 |
| 24 and above | 59 | 18.8 |
| **Total** | 314 | 100.0 |

**Table 2.** Data related to grade point average.

| Grade point average | N | % |
|---|---|---|
| 1.00 (C-55-69) | 48 | 15.3 |
| 2.00 (B-70-84) | 236 | 75.2 |
| 3.00 (A-85-100) | 30 | 9.6 |
| Total | 314 | 100.0 |

## Data collection tools

The participant pre-service teachers were evaluated in terms of their levels of metacognitive awareness and of academic achievement. The data of the research were gathered via two measurement tools. The data regarding the subjects' levels of metacognitive awareness were obtained using "Metacognitive Awareness Inventory (MAI)", which was adapted to Turkish by Akın et al. (2007). In addition, the demographic and academic achievement levels of the participants were determined from "Personal Data Form", developed by the researchers. The demographic and academic success levels of the participants were obtained with the "Personal Information Form" created for this study. The Personal Information Form included information on the participants' gender, age, department, class, and academic achievement. The demographic information for the participants was obtained using this method.

The linguistic equivalence findings showed that the relationship between the initial and adapted forms of the scale was.93, according to the results of the Metacognitive Awareness Inventory's validity and reliability review. According to the exploratory factor analysis, there are eight sub-components under the main components that are cognitive knowledge and cognitive organization. These sub-components are explanatory information, procedural information, contextual information, planning, monitoring, evaluating, debugging and information management. The original and adapted scales were found to have a correlation of .95. The sub-components' item-test correlations ranged from .35 to .65. The inventory's internal quality and test-retest reliability coefficients were both declared to be .95 (Akın et al., 2007).

**Data collection and analysis**

The Metacognitive Awareness Inventory was used to collect the data. The SPSS 24 package software was used to analyze the results. The results of the analyses indicated that the data were distributed normally. Shapiro-Wilk was .105 p > 0.05, and coefficients of skewness and kurtosis were found to be -.194 and -.312 respectively. While the reliability value of the scale was gauged as .93 (Cronbach Alpha), the values for each sub-component were .76 for explanatory information, .68 for procedural information, .70 for contextual information, .72 for planning, .70 for monitoring, .73 for evaluating, .66 for debugging and .77 for information management.

## FINDINGS

### Differences in the metacognitive awareness levels of the pre-service teachers by gender

No significant differences were found (p > 0.05) between the mean test score of the male students ($\overline{X}$ = 201.11) and of the female students ($\overline{X}$ = 201.86) as a result of the analysis performed to reveal if there would be a significant effect of gender on the level of metacognitive awareness. In this case, it can be expressed that the gender factor does not have a significant impact on the level of metacognitive awareness. Information regarding the scale and its sub-componentswas given in Table 3.

As a result of the analysis that was held to reveal if there was a significant effect of students' genders on the explanatory information component, The mean test score of male students did not vary significantly from that of female students ($\overline{X}$ = 31.81) and of the female students ($\overline{X}$ = 31.79). The analysis on the procedural information component indicated that There was no substantial difference in the male students' man test scores ($\overline{X}$ = 14.93) and of the female students ($\overline{X}$ = 15.09). Therefore, it can be claimed that the factor of gender did not have a significant impact on the procedural information component.

On the other hand, the result of the analysis on the contextual information component of metacognitive awareness level showed that there was no significant difference between the mean test score of the male students ($\overline{X}$ = 19.75) and of the female students ($\overline{X}$ = 19.60). The analysis on planning componentrevealed that there was no significant difference between the mean test score of the male students ($\overline{X}$ = 26.30) and of the female students ($\overline{X}$ = 26.90). Hence, it can be suggested that the gender factor did not have a significant impact on the components of planning and contextual information.

The monitoring part of metacognitive awareness level was examined, and it was discovered that there was no substantial difference between the mean test scores of male and female students ($\overline{X}$ = 30.24) and of the female students ($\overline{X}$ = 30.87) (p > 0.05). In addition, the analysis on the evaluating component of metacognitive awareness level indicated that there was no discernible distinction between the mean test score of the male students ($\overline{X}$ = 23.37) and of the female students ($\overline{X}$ = 22.88) (p > 0.05). It can be mentioned that the gender factor did not have a significant impact on the components of monitoring and evaluating.

Furthermore, there was no difference in the mean test score of male ($\overline{X}$ = 19.55) and female students when it came to the debugging portion of metacognitive awareness level, according to the study and of the female students ($\overline{X}$ = 19.43). Finally, the result of the analysis on the information management component revealed thatthere was no difference between the mean test score of the male students ($\overline{X}$ = 35.12) and of the female students ($\overline{X}$ = 35.26) (p > 0.05). Therefore, it was concluded that the variable of gender had no significant effect on these two dimensions.

### Differences in the metacognitive awareness levels of the pre-service teachers by department

The subjects' perceptions towards their academic titles differed in terms ofthis variable. In this context, a Scheffe's test was performed to determine which group means were responsible, and it was discovered that the mean scores of the groups differed significantly. In addition, a Levene's test was used to examine homogeneity of variances, and the variances were found to be homogeneous (F = .582; p = .770 > 0.05). The results of the analysis were presented in Table 4.

While the metacognitive awareness levels of the groups were found to be higher for the students at the department of special education-mentally handicapped teaching ($\overline{X}$ = 210.65) by arithmetic mean, this was followed by CEIT ($\overline{X}$ = 207.48) and Science Teacher Training ($\overline{X}$ = 206.83) students respectively. The students with the lowest mean score ($\overline{X}$ = 189.38) were the ones at the English Language Teaching Department. According to these values, the students at the department of the students in special education had the highest level of metacognitive understanding, while those in the English language teaching department had the lowest. It can be inferred from Table 4 that the students having solved mostly STEM-based questions in the university entrance exam had higher scores than the

**Table 3.** The analysis results of the overall scale and its sub-components by gender.

| | N | X | SS | N | t | p |
|---|---|---|---|---|---|---|
| **Gender** | | | | | | |
| Male | 104 | 201.11 | 23.33 | 226 | .257 | .798 |
| Female | 210 | 201.86 | 25.99 | | | |
| **Explanatory Information** | | | | | | |
| Male | 104 | 31.8173 | 3.83587 | 312 | .045 | .964 |
| Female | 210 | 31.7952 | 4.24388 | | | |
| **Procedural Information** | | | | | | |
| Male | 104 | 14.9327 | 2.49763 | 312 | -.519 | .604 |
| Female | 210 | 15.0952 | 2.67014 | | | |
| **Contextual Information** | | | | | | |
| Male | 104 | 19.7596 | 2.60133 | 312 | .439 | .661 |
| Female | 210 | 19.6048 | 3.09205 | | | |
| **Planning** | | | | | | |
| Male | 104 | 26.3077 | 3.93904 | 312 | -1.270 | .205 |
| Female | 210 | 26.9048 | 3.91176 | | | |
| **Monitoring** | | | | | | |
| Male | 104 | 30.2404 | 4.34327 | 312 | -1.048 | .296 |
| Female | 210 | 30.8762 | 5.38062 | | | |
| **Evaluating** | | | | | | |
| Male | 104 | 23.3750 | 5.96134 | 312 | .911 | .363 |
| Female | 210 | 22.8810 | 3.60756 | | | |
| **Debugging** | | | | | | |
| Male | 104 | 19.5577 | 2.74066 | 312 | .336 | .737 |
| Female | 210 | 19.4381 | 3.38000 | | | |
| **Information Management** | | | | | | |
| Male | 104 | 35.1250 | 4.35709 | 312 | -.243 | .808 |
| Female | 210 | 35.2667 | 5.08166 | | | |

$p > 0.05$; $F = 4.564$.

**Table 4.** Analysis results on the participants' departments (Total Score).

| Department | N | X | SS |
|---|---|---|---|
| Turkish | 46 | 195.72 | 25.95 |
| English | 29 | 189.38 | 23.61 |
| CEIT | 25 | 207.48 | 23.29 |
| Science Teaching | 42 | 206.83 | 23.42 |
| Special Education | 26 | 210.65 | 29.02 |
| PCG | 55 | 200.44 | 25.21 |
| Visual Arts | 15 | 196.33 | 24.24 |
| Elementary | 76 | 203.84 | 23.47 |
| **Total** | 314 | 201.61 | 25.10 |

ones having solved mostly literature-based questions. In addition, This finding may be explained by the fact that the majority of special education students were in their second year of university.

ANOVA was used in order to determine whether there were any significant differences among the students' metacognitive awareness levels at different departments of the faculty of education, and a statistically significant difference was found between the mean scores of the students. As a result of the multiple comparison test, it was seen that the significant difference was between the students at the departments of (2) English Language Teaching ($\overline{X}$ =189.38) and (5) Special Education ($\overline{X}$ =210.65). The effect size ($n^2$ = .055) computedbased on the test result indicated that the difference was moderate (Table 5).

According to Table 6, it was understood that there were not any significant differences between the mean scores received from the component of explanatory information by the students at different departments of the faculty of education ($p > 0.05$). The groups were compared by performing ANOVA to test if there was a significant difference among the metacognitive awareness levels of the students for the component of procedural information, and a statistically significant difference was observed among the mean scores of the students. The result of the multiple comparison test indicated that the significant difference was between the students at the departments of (1) Turkish Language Teaching ($\overline{X}$ = 14.33) and (5) Special Education ($\overline{X}$ = 16.27). Mean scores of the other departments were; English Language Teaching ($\overline{X}$ = 14.28), CEIT ($\overline{X}$ = 15.80), Science Teacher Training ($\overline{X}$ = 15.71), PCG ($\overline{X}$ = 14.82), Art Education ($\overline{X}$ = 14.07) and Elementary Education ($\overline{X}$ = 15.08).

ANOVA was conducted in order to test if there was a significant difference among the metacognitive awareness levels of the students at different departments for the component of contextual information, and a statistically significant difference was found among their mean scores. As a result of the multiple comparison test, it was seen that the significant difference was between the students at the departments of (2) English Language Teaching ($\overline{X}$ = 18.07) and (5) Special Education ($\overline{X}$ = 21.04). Average scores of the other departments are; Turkish Language Teaching ($\overline{X}$ = 19.33), CEIT ($\overline{X}$ = 19.72), Science Teacher Training ($\overline{X}$ = 20.26), PCG ($\overline{X}$ = 19.76), Art Education ($\overline{X}$ =18.47) and Elementary Education ($\overline{X}$ = 19.79). The effect size ($n^2$ = .062) computed based on the test result indicated that the difference was high.

ANOVA was used to see whether there was a statistically significant difference between the metacognitive awareness levels of students from different departments for the aspect of planning. In addition, ANOVA, performed for the component of monitoring, revealed that there was a statistically significant difference among theirmean scores. The multiple comparison test indicated that the significant difference was between the students at the departments of (1) Turkish Language Teaching ($\overline{X}$ = 28.39) and (4) Science Teacher Training ($\overline{X}$ = 32.02). Mean scores of the other departments were; English Language Teaching ($\overline{X}$ = 30.07), CEIT ($\overline{X}$ = 32.04), Special Education ($\overline{X}$ = 31.54), PCG ($\overline{X}$ = 30.25), Art Education ($\overline{X}$ = 30.07) and Elementary Education ($\overline{X}$ = 31.18). The effect size ($n^2$ = .053) computed based on the test result indicated that the difference was moderate.

ANOVA, performed for the evaluating component level of metacognitive awareness, revealed that there was a statistically significant difference among the mean scores of the students. As a result of the multiple comparison test, it was understood that the significant difference was between the students at the departments of (1) Turkish Language Teaching ($\overline{X}$ = 22.11) and (5) Special Education ($\overline{X}$ = 25.92); the students at the departments of (2) English Language Teaching ($\overline{X}$ = 21.17) and (5) Special Education ($\overline{X}$ = 25.92). Average scores of the other departments are; CEIT ($\overline{X}$ = 23.24), Science teacher training ($\overline{X}$ = 23.19), PCG ($\overline{X}$ = 23.20), Art education ($\overline{X}$ = 22.33) and Elementary School Teaching $\overline{X}$ = 23.22). The effect size ($n^2$ = .058) computed based on the test result indicated that the difference was moderate.

ANOVA, performed for the debugging component level of metacognitive awareness, revealed that there were not any statistically significant differences among the mean scores of the students ($p > 0.05$). However, ANOVA, performed for the information management component level of metacognitive awareness, indicated that their mean scores differed by a statistically significant amount.The multiple comparison test revealed that the significant difference was between the students at the departments of (2) English Language Teaching ($\overline{X}$ = 32.21) and (3) CEIT ($\overline{X}$ = 36.56); the students at the departments of (8) Elementary Education ($\overline{X}$ = 35.78) and (5) Special Education ($\overline{X}$ =36.15). Average scores of the other departments are; Turkish Language Teaching ( $\overline{X}$ = 35.02), Science teacher training ($\overline{X}$ = 35.52), PCG ($\overline{X}$ = 34.85), Art education ($\overline{X}$ = 35.47). The effect size ($n^2$ = .050) computed based on the test result indicated that the difference was moderate.

**Table 5.** The analysis results related to the participants' departments (Total Score-Whole).

| Variance resource | Sum of squares | N | Mean-square | F | p | Variation | Effect Size (Eta square $n^2$) |
|---|---|---|---|---|---|---|---|
| Intergroup | 10941.295 | 7 | 1563.042 | | | | |
| Intragroup | 186381.078 | 306 | 609.088 | 2.566 | .014 | 2-5 | .055 |
| Total | 197322.373 | 313 | | | | | |

$p < 0.05$.

**Table 6.** The analysis results related to the scale and its components.

| Dimension | Variance Base | Sum of Squares | N | Mean-Square | F | p | Variation | Effect |
|---|---|---|---|---|---|---|---|---|
| Explanatory Information | Intergroup | 196,800 | 7 | 28,114 | 1,693 | .110 | | |
| | Intragroup | 5,082,958 | 306 | 16,611 | | | | |
| | Total | 5,279,758 | 313 | | | | | |
| Procedural Information | Intergroup | 130 | 7 | 18,605 | 2,840 | .007 | 1-5 | .061 |
| | Intragroup | 2,004,230 | 306 | 6,550 | | | | |
| | Total | 2,134,462 | 313 | | | | | |
| Contextual Information | Intergroup | 166,470 | 7 | 23,781 | 2,876 | .006 | 2-5 | .062 |
| | Intragroup | 2,530,384 | 306 | 8,269 | | | | |
| | Total | 2,696,854 | 313 | | | | | |
| Planning | Intergroup | 271,229 | 7 | 38,747 | 2,606 | .013 | 1-4 | .056 |
| | Intragroup | 4,549,816 | 306 | 14,869 | | | | |
| | Total | 4,821,045 | 313 | | | | | |
| Monitoring | Intergroup | 427,881 | 7 | 61,126 | 2,463 | .018 | 1-5 | .053 |
| | Intragroup | 7,594,007 | 306 | 24,817 | | | | |
| | Total | 8,021,889 | 313 | | | | | |
| Evaluating | Intergroup | 370,568 | 7 | 52,938 | 2,688 | .001 | 2-5 | .058 |
| | Intragroup | 6,026,807 | 306 | 19,695 | | | | |
| | Total | 6,397,376 | 313 | | | | | |
| Debugging | Intergroup | 99,125 | 7 | 14,161 | 1,415 | .199 | | |
| | Intragroup | 3,063,219 | 306 | 10,011 | | | | |
| | Total | 3,162,344 | 313 | | | | | |
| Information Management | Intergroup | 368,313 | 7 | 52,616 | 2,305 | .027 | 2-3 | .050 |
| | Intragroup | 6,985,525 | 306 | 22,829 | | | | |
| | Total | 7,353,838 | 313 | | | | | |

**Differences in the metacognitive awareness levels of the pre-service teachers by GPA**

The subjects' perceptions towards their academic titles are different in terms of this variable. In this context, A Scheffe's test was used to assess the groups had differences, and it was discovered that there was a substantial difference between the groups' mean scores. In addition, homogeneity of the variances was investigatedusing a Levene's test, and it was found that the variances were homogeneous (F = .190; p = .827 > 0.05). The results of the analysis were given in Table 7.

Metacognitive awareness levels of the groups were found higher for the students with A-level GPA ($\overline{X}$ = 210.10), followed by the students with B-level GPA ($\overline{X}$ =

**Table 7.** Analysis results on the gpa of the participants (Total Score).

| Division | N | X | SS |
|---|---|---|---|
| C | 48 | 197.69 | 22.66 |
| B | 236 | 201.33 | 25.53 |
| A | 30 | 210.10 | 24.28 |
| Total | 314 | 201.61 | 25.10 |

201.33) and the ones with C-level GPA ($\overline{X}$ = 197.69). It can be seen in the table that the cluster was mostly for the students with B-level GPA.

According to Table 8, there was no statistically significant difference between the groups' mean scores (p > 0.05). On the other hand, overall results regarding the components of the scale were given in Table 9.

According to Table 9, there was not a significant difference between the mean scores of the groups in terms of the components "explanatory information, procedural information, contextual information, planning, monitoring, evaluating and debugging" (p > 0.05). For the component of information management, ANOVA was used to see whether there were any statistically significant differences between the metacognitive awareness levels of students with different GPAs, and a statistically significant difference was found between their mean scores. As a result of the multiple comparison test, it was found that the significant difference was between the students with A-level GPA ($\overline{X}$ = 37.23) and the students with C-level GPA ($\overline{X}$ = 34.54). Mean score of the students with B-level GPA was found ($\overline{X}$ = 35.10). The effect size ($n^2$ = .020) computed based on the test result indicated that the difference was small.

**Table 8.** Analysis results on the GPA of the participants (Total Size).

| Variance base | Sum of square | N | Mean-square | F | P |
|---|---|---|---|---|---|
| Intergroup | 2918,805 | 2 | 1459,403 | | |
| Intragroup | 194403,568 | 311 | 625,092 | 2,335 | .099 |
| Total | 197322,373 | 313 | | | |

p > 0.05.

**Table 9.** The analysis results related to the participants' GPA.

| Dimension | Variance base | Sum of Square | N | Mean-Square | F | P |
|---|---|---|---|---|---|---|
| Explanatory Information | Intergroup | 33,116 | 2 | 16,558 | 0.981 | .376 |
| | Intragroup | 5,246,642 | 311 | 16,870 | | |
| | Total | 5,279,758 | 313 | | | |
| Procedural Information | Intergroup | 11,646 | 2 | 5,823 | 0.853 | .427 |
| | Intragroup | 2,122,816 | 311 | 6,825 | | |
| | Total | 2,134,462 | 313 | | | |
| Contextual Information | Intergroup | 25,315 | 2 | 12,658 | 1.473 | .231 |
| | Intragroup | 2,671,538 | 311 | 8,590 | | |
| | Total | 2,696,854 | 313 | | | |
| Planning | Intergroup | 34,830 | 2 | 17,415 | 1.132 | .324 |
| | Intragroup | 4,786,215 | 311 | 15,390 | | |
| | Total | 4,821,045 | 313 | | | |
| Monitoring | Intergroup | 93,282 | 2 | 46,641 | 1,829 | .162 |
| | Intragroup | 7,928,606 | 311 | 25,494 | | |
| | Total | 8,021,889 | 313 | | | |
| Evaluating | Intergroup | 91,436 | 2 | 45,718 | 2.255 | .107 |
| | Intragroup | 6,305,940 | 311 | 20,276 | | |
| | Total | 6,397,376 | 313 | | | |

**Table 9.** Continues.

| | | | | | | |
|---|---|---|---|---|---|---|
| Debugging | Intergroup | 23,237 | 2 | 11,619 | 1.151 | .318 |
| | Intragroup | 3,139,106 | 311 | 10,094 | | |
| | Total | 3,162,344 | 313 | | | |
| Information Management | Intergroup | 146,995 | 2 | 73,497 | 3.172 | .043 |
| | Intragroup | 7,206,843 | 311 | 23,173 | | |
| | Total | 7,353,838 | 313 | | | |

**Differences in the metacognitive awareness levels of the preservice teachers by age**

The subjects' perceptions towards their academic titles differed in terms of this variable. In this case, a Scheffe's test was used to assess the groups had differences, and it was discovered that there was a large difference between the groups' mean scores. In addition, homogeneity of the variances was investigated using a Levene's test, and it was found that the variances were homogeneous (F = .190; p = .827 > 0.05). The results of the analysis were given in Table 10.

Metacognitive awareness levels of the groups were found higher for the students of the 1st level of age group ($\overline{X}$ = 203.79), followed by the ones of the 2nd level of age group ($\overline{X}$ = 201.54) and the ones of the 3rd level of age group ($\overline{X}$ = 195.54). It can be seen in Table 11 that the cluster was mostly for the students of the 1st level of age.

According to Table 11, there were no major variations between the groups' mean ratings (p > 0.05). On the other hand, the analyses regarding other components of the scale were given in Table 12.

There was no substantial difference between the mean scores of the classes, according to Table 12 in terms of the components "explanatory information, contextual information, monitoring, debugging and information management" (p > 0.05).

ANOVA was performed to determine whether there were any significant differences among metacognitive awareness levels of the students with different age groups for the component of procedural information, and there was a statistically important difference in their mean ratings (p < 0.05). The arithmetic means of the groups made it clear that the students in the 1st level of age group had a higher mean score ($\overline{X}$ = 15.23), while the ones in the 2ndlevel of age group had ($\overline{X}$ = 15.22) and in the 3rdlevel of age group had ($\overline{X}$ = 14.24) mean scores. The multiple comparison test revealed that there was a substantial difference between the students of (1) 22 and below ($\overline{X}$ = 15.23) and (3) 24 and above ($\overline{X}$ = 14.24). The effect size ($n^2$ = .022) computed based on the test result indicated that the difference was moderate. ANOVA, performed for the component of planning, indicated that there was a statistically important difference in the students' mean grades. The arithmetic means of the groups indicated that the students in the 1stlevel of age group had a higher mean score ($\overline{X}$ = 27.17), while the ones in the 2nd group had ($\overline{X}$ = 26.51)

**Table 10.** Analysis results on the age variable of the participants (Total Score).

| Division | N | X | SS |
|---|---|---|---|
| 22 and below | 168 | 203.79 | 25.51 |
| 23 | 87 | 201.54 | 23.77 |
| 24 and above | 59 | 195.54 | 25.28 |
| Total | 314 | 201.61 | 25.10 |

**Table 11.** Analysis results on the age variable of the participants (Total Size).

| Variance base | Sum of square | N | Mean-square | F | P |
|---|---|---|---|---|---|
| Intergroup | 2967,834 | 2 | 1483,917 | | |
| Intragroup | 194354,539 | 311 | 624,934 | 2,375 | .095 |
| Total | 197322,373 | 313 | | | |

p > 0.05.

**Table 12.** The analysis results related to the participants' ages.

| Dimension | Variance base | Sum of square | N | Mean-square | F | p | Variation | Effect |
|---|---|---|---|---|---|---|---|---|
| Explanatory Information | Intergroup | 24,190 | 2 | 12,095 | 716 | .491 | | |
| | Intragroup | 5,255,568 | 311 | 16,899 | | | | |
| | Total | 5,279,758 | 313 | | | | | |
| Procedural Information | Intergroup | 46,987 | 2 | 23,493 | 3,50 | .031 | 1-3 | .022 |
| | Intragroup | 2,087,475 | 311 | 6,712 | | | | |
| | Total | 2,134,462 | 313 | | | | | |
| Contextual Information | Intergroup | 50,546 | 2 | 25,273 | 2,970 | .053 | | |
| | Intragroup | 2,646,308 | 311 | 8,509 | | | | |
| | Total | 2,696,854 | 313 | | | | | |
| Planning | Intergroup | 102,422 | 7 | 51,211 | 3,375 | .035 | 1-3 | .021 |
| | Intragroup | 4,718,623 | 306 | 15,172 | | | | |
| | Total | 4,821,045 | 313 | | | | | |
| Monitoring | Intergroup | 46,442 | 2 | 23,221 | 906 | .405 | | |
| | Intragroup | 7,975,446 | 311 | 25,645 | | | | |
| | Total | 8,021,889 | 313 | | | | | |
| Evaluating | Intergroup | 138,035 | 2 | 69,017 | 3,429 | .034 | 1-3 | .022 |
| | Intragroup | 6,259,341 | 311 | 20,126 | | | | |
| | Total | 6,397,376 | 313 | | | | | |
| Debugging | Intergroup | 3,614 | 2 | 1,807 | 178 | .837 | | |
| | Intragroup | 3,158,730 | 311 | 10,157 | | | | |
| | Total | 3,162,344 | 313 | | | | | |
| Information Management | Intergroup | 47,515 | 2 | 23,758 | 1,011 | .365 | | |
| | Intragroup | 7,306,322 | 311 | 23,493 | | | | |
| | Total | 7,353,838 | 313 | | | | | |

and in the 3rd group had ($\overline{X}$ = 25.68) mean scores. The multiple comparison test showed that the significant difference was between the students of (1) 22 and below ($\overline{X}$ = 27.17) and (3) 24 and above ($\overline{X}$ = 25.68). The effect size ($n^2$ = .021) computed based on the test result indicated that the difference was moderate.

ANOVA was performed to determine whether there were any significant differences among metacognitive awareness levels of the students with different age groups for the component of evaluating, and a statistically significant difference was found between their mean scores. The arithmetic means of the groups made it clear that the students in the 1st level of age group had a higher mean score ($\overline{X}$ = 23.55), while the ones in the 2nd level of age group had ($\overline{X}$ = 22.93) and in the 3rd level of age group had ($\overline{X}$ =21.78) mean scores. As a result of the multiple comparison test, it was found that the significant difference was between the students of (1) 22 and below ($\overline{X}$ = 23.55) and (3) 24 and above ($\overline{X}$ = 21.78). The effect size ($n^2$ = .022) computed based on the test result indicated that the difference was moderate.

## DISCUSSION AND CONCLUSION

With this study, it is predicted that the study will contribute to the field by determining the metacognitive awareness levels of teacher candidates according to their gender, department they study, academic achievement and age, and by making scientific suggestions based on scientific data in order to provide a healthy and effective structure in higher education education faculties and to increase academic efficiency. In addition, in line with this research data, it is expected that the study will contribute

to the literature. Putting forward the results of teacher candidates' metacognitive awareness levels according to various variables in the light of scientific research creates a resource based on scientific data for the relevant people in the applications in the future higher education system.

As a result of the study, it was discovered that teacher candidates' metacognitive awareness levels were generally high, and that teacher candidates' cognitive awareness levels were unaffected by gender or academic grades. The metacognitive awareness of teacher candidates, on the other hand, was found to vary depending on the department they attended, and this discrepancy was found in the three dimensions of the metacognitive awareness scale based on their ages. In the study, it was concluded that teacher candidates with high academic achievement scores had higher metacognitive awareness levels according to their arithmetic mean results. As a result, it is reasonable to conclude that academic achievement has a positive impact on cognitive awareness. In addition, it is seen that the differentiation in metacognitive awareness levels of pre-service teachers according to the departments they study is in favor of the students of numerical-weighted departments.

In the study, the scale's mean scores for male and female students were found to be very similar to each other. As a result, it is clear that prospective teachers' levels of metacognitive knowledge do not vary based on gender. Within the scope of this data, it can be concluded that there is no such difference between the genders, from basic education to higher education, that male and female students are given an equal education. According to their age, a significant difference between the metacognitive awareness levels of the students and their ages was determined in three dimensions (Procedural Information, Planning, and Evaluation). Also, this difference seems to be in favor of the first group. As a matter of fact, it is not surprising that this result is obtained when it is predicted that the majority of the students in the third group are probably the students who could not finish school on time. In this context, it can be said that the students who directly enter higher education after high school education and study in the department they want have a higher level of metacognitive awareness. Accordingly, it can be stated that it is important to orient students academically in secondary education.

The findings of this study in many studies in the literature reveal similar results. According to the findings of this report, teacher candidates have a high level of metacognitive awareness, but pre-service teachers' metacognitive awareness does not vary based on gender. Deniz et al. (2013), in their study, found that there was no substantial difference between metacognitive awareness scores and grade levels or gender differences in their sample, which confirms the findings of this study. In their research, Vural and Gündüz (2019) found that pre-service teachers had high levels of cognitive awareness, and that female teacher candidates had more of this awareness.

According to another finding, metacognitive knowledge among teacher candidates varies depending on the field of education. Bakiolu et al. (2015) discovered a connection between metacognitive awareness levels, technology attitudes, and problem-solving skills, and they concluded that the studied curriculum has an impact on metacognitive awareness and problem-solving skills. Kacar and Sariçam (2015), on the other hand, found that the metacognitive awareness of classroom teacher candidates did not vary significantly depending on the variables of class, field of graduation, and high school type. Likewise, Vural and Gündüz (2019) found that the cognitive awareness levels of pre-service teachers did not differ according to the departments, and that the teacher candidates who read the department voluntarily differ significantly from those who read the department unwillingly. In addition, Aykut et al. (2016) discovered a disparity between special education students' academic grade averages, grade levels, and metacognitive awareness in their research.

In the procedural understanding, preparation, and assessment dimensions of the scale, there is a substantial difference in metacognitive memory of teacher candidates according to their ages. Alkan et al. (2017) stated in their study that although pre-service teachers had insufficient theoretical knowledge, they believed that they would be successful after becoming a teacher, so students' self-efficacy beliefs were high. Accordingly, it can be said that as the age of the students in the university progresses, they tend to act with belief rather than cognition.

In the research, there is a result in favor of the cognitive awareness of the students who have high scores according to the arithmetic average results between the metacognitive awareness levels of the teacher candidates and their weighted grade averages. According to the findings of other studies, there was a statistically important positive association between pre-service teachers' general academic grade averages and their cognitive knowledge inventory scores. It is seen from the research results that cognitive awareness has a positive effect on success, that is, cognitive awareness affects success positively and high success also brings high cognitive awareness (O 'Neil and Abedi, 1996). This study's results revealed that there was a strong relationship between metacognitive awareness and academic achievement, and that metacognitive awareness increased significantly as performance level increased. Considering that academically highly successful students have high cognitive awareness (Meichenbaum and Biemiller, 1998; as cited in: Hartman, 2001) and considering the relevant literature findings, metacognitive awareness skill is effective on the

academic achievement of teacher candidates, so one of the reasons for differentiation as academic success is It can be said that there may be a differentiation in cognitive awareness skill levels.

According to Sarpkaya et al. (2011), pre-service teachers' attitudes toward mathematics and knowledge of using metacognitive methods vary significantly based on their understanding of academic achievement, although not from other variables. Individuals who score less than 2.5 points on the "Cognitive Knowledge Inventory" have a low level of metacognitive awareness, according to Akın et al. (2007), while those who score higher have a high level of metacognitive awareness. According to these explanations, it is seen that teacher candidates' have a high metacognitive awareness levels. Individuals' understanding of their own thought processes and methods, as well as their ability to track and control these processes, is referred to as metacognitive. As it is the output of metacognitive conscious thinking and consciousness, it can be concluded that teacher candidates who attend the education faculty analyze, monitor their thinking and learning, and have a high level of thinking about them. In this case, It can be said that teacher candidates have skills such as predicting, planning, monitoring and evaluating their own mental activities, they know which learning method is effective and which are ineffective, they have skills such as planning, using an approach that they think will be successful for a task and following the results.

## SUGGESTIONS

In line with the research findings, the following recommendations can be presented for administrators and researchers.

The factors leading academic achievement to affect cognitive awareness level can be investigated. Moreover, the courses and course contents to increase cognitive awareness can be included in programs.

In the context of the positive relation between academic achievement and cognitive awareness, applications that will encourage students with high level of academic achievement to study in education faculties ought to be executed for the sake of increased quality in the teaching profession.

To admit students with high level of academic achievement in education faculties, exam base points required for teaching programs in higher education institutions may be raised. Teachers ought to be promoted to receive postgraduate education to have developed cognitive awareness.

How teachers with higher cognitive awareness demonstrate achievement strategically and technically can be a research topic that is worth studying for pre-service teachers in their professional life. In this way, teacher proficiency can be adjusted for a better teaching. Pre-service teachers were found to be capable of forecasting, preparing, tracking, and assessing their own mental behaviors. The occupational gains of these abilities can be investigated in further studies.

## Limitations

This research was limited to the data collected from 314 pre-service teachers studying at eight different departments of a faculty of education. The research was conducted with the analysis of the data collected through the measurement tools for gauging metacognitive awareness and academic achievement levels, and the study was based on these two variables.

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