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An Investigation of the Relationship between Prospective Teachers' Self-Management and Self-Control Skills, Metacognition and E-Mobile Learning Readiness Perceptions

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Abstract:

Introduction: This study aims to investigate the relationship between prospective teachers' self-management and self-control skills, metacognition, and e-mobile learning readiness perceptions.

Methods: This study adopted a procedural model that was relational screening in nature. This study was conducted with 303 prospective teachers who attended Primary School Classroom Teaching, Primary School Science Teaching, Pre-school Teaching, and Psychological Counseling and Guidance departments in a State University Education Faculty in Turkey. In this study the "Self-control and self-management scale", the "Metacognition scale" and the "E-Mobile learning readiness scale" were used as data collection tools. It was determined that the data collection tools used in the study were valid and reliable.

Results: According to the results of the study, mobile learning readiness perception is positively affected by metacognition. Metacognition is positively affected by Self-management and Self-control Skills. In the study, the effects of e-mobile learning readiness perceptions on both metacognition and self-management and self-control skills were discussed in accordance with the proposed model.

Discussion: The aim of this study is to determine the relationships between the variables of prospective teachers' self-management and self-control skills, metacognition and e-mobile learning readiness perceptions. Four hypotheses in the proposed model were discussed according to the literature.

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Limitations: This study was conducted only with the participants consisting of teacher candidates at a state university in Turkey. However, the participants of the research can be expanded with different teaching areas of higher education.
Conclusions: Prospective teachers' self-regulation, self-assessment and control skills positively affect their metacognition skills. The metacognition skill of prospective teachers has a positive effect on mobile learning readiness perception.

Key words: mobile learning, metacognition, self-management, self-control.

Introduction

Teachers could assign learners some tasks, projects or research topics to support their learning. While some of these tasks which the learners are expected to fulfill are quite simple, some are seen complicated. The term complicated is actually related to the design of these tasks, not to the level of difficulty. An individual who encounters complicated tasks actively uses various cognitive and metacognitive processes to perform these tasks as they encounter multiple goals (Perry et al., 2002). To perform a complicated task, the individual needs to be aware of the task, analyze the aspects of the goal, collect information about the difficulties encountered, and organize the documents. In such a process, the individual is expected to think deeply in detail and use problem-solving skills (Flavell, 1979). Fulfilling complicated tasks formed by the combination of various goals requires individuals to have self-awareness (Pressley, 1995; Winne, 1995), to motivate themselves by interpreting knowledge in this process (Wang & Palincsar, 1989; Winne,1995, p.72), and to have a willpower at the end of the process in order to reach the goal (Corno, 1992). In this regard, the individuals use not only their metacognitive skills, but also their self-control and self-management skills.

In today's world, individuals inevitably consult several learning sources and use technology-based mobile learning sources to fulfill a complicated task. In a task or project involving complicated problem solving, they need a technological environment as well as metacognitive and self-regulated skills (Azevedo, 2005). In this regard, Azevedo et al. (2004) investigated the differences in conceptual knowledge gains of university students while using hypermedia environments to learn about complicated science topics such as circulating system. The materials accessed by the students included videos, photographs, diagrams, and texts. Students accessed these materials using technological devices. Three different learning goals about the circulating system were identified and the students were divided into three groups. Each group was given some different complicated tasks. All three groups were asked to think aloud while using the materials in the

hyper environment. Results showed that the students in the third group who had couch support could present more holistic and complicated mental examples about the circulatory system by focusing on topics such as using the strategies and monitoring the development. The students were found to fulfill a complicated task more easily in a process where a technology-supported learning environment existed, and self-control and management interacted with each other. In this context, it is highly important to explain how much students' e-mobile learning readiness, a new education paradigm, predicts metacognition, self-regulation and self-control skills in the light of a model to be established between self-management and self-control, metacognition and e-mobile learning readiness. In this regard, the study aims to identify the relationship between prospective teachers' self-management and self-control skills, metacognition and e-mobile learning readiness perceptions.

In the light of the literature, a model proposal was created according to the relationship between self-management and self-control skills, metacognition and e-mobile learning readiness perceptions variables. The relationships among the variables are explained under the literature review section. From this point on, the study comprises Literature Review and Model, Method, Results, Discussion, Conclusion, Recommendations, Limitations, and Future Research sections.

1 Literature review and model

1.1 Self-control and self-management (SCMS)

Due to the nature of learning, individuals' self-control and self-management skills increase their performance to achieve the things they want. Self-directed learning is regarded as learners' individual decisions about how and what to learn, how to consult outer sources or whether or not to consult them. Self-management is a process where thoughts, emotions, and behaviors are stimulated to reach goals and maintain their continuity (Zimmerman, 2002). According to Bandura (2009), self-management is defined as setting goals and using the required efforts and sources to reach these goals. In clinical psychology, self-management is explained on the basis of self-control skills (Cautela, 1969; as cited in Neck & Houghton, 2006). Learners who have self-regulation including self-control and self-management, take active roles in receiving, transforming, organizing information, reaching academic goals, and monitoring and evaluating self-efficacy perceptions (Ben-Eliyahu, 2019). According to the studies (Boekaerts & Corno, 2005; Pintrich, 2004), the definition of self-regulation generally includes the capability to observe and devise one's learning actively using various behavioral and metacognitive strategies, which could involve resource management, making effort, data processing and organizing, and self-testing. Self-regulated learning abilities are also reported to be highly important for achievement in different learning contexts (Lehmann et al., 2014; Pintrich,

1995). Self-regulation skill is affected by knowledge, motivation, and willpower. To have self-regulation, an individual is initially expected to know himself/herself. Individuals with high self-regulation know themselves (Pressley, 1995; Winne, 1995). As they know themselves, they can motivate themselves by interpreting their knowledge to reach the goals they set for the future (Wang & Palincsar, 1989; Winne, 1995). An individual who motivates himself/herself needs to maintain a task to reach a specific goal and have strong goodwill to observe the results (Corno, 1992). For instance, an individual who knows how to deal with the problems he/she encounters in the process uses his/her willpower correctly. He/she can also control himself/herself on how to behave in cases of interesting things or problems in the process of reaching a goal (Snow et al. 1996). On the other hand, Pintrich (2004) also highlights the motivation component in self-regulated learning and states that it should be paired with behavior, cognition, and context. According to Pintrich (2004), self-regulation is an inseparable part of an individual's personal development and is defined as "an active and constructive process where students identify their own learning goals, try to regulate their cognition, motivation, and behaviors, and is guided and limited by their goals and contextual features in their environment". Like other self-regulation models, Pintrich's (2004) model is also composed of four phases a) forethought planning and activation, b) monitoring, c) control of the context, self, and task, and d) reaction and reflection. Similarly, Zimmerman's (2008) self-regulated model also includes forethought, planning, and activation that stimulate students' motivation such as interest and self-efficacy. In such a process, self-regulated learning involves the cognitive, metacognitive, motivational and emotional aspects of learning.

On the other hand, things to do in order to become a self-directed learner, an important factor in self-regulation, are reported by Gibbons (2002) as follows:

- developing skills and processes to enhance individual learning: setting goals, planning, and evaluation,
- enabling to control learning: improving viewpoints, attitudes, and entrepreneurship,
- independent thought: learning to analyze, finalize, discuss, and create something,
- managing time effectively,
- designing and completing plans,
- designing and completing learning activities.

Learners who are engaged in these activities will form today's independent learner profile. Therefore, a teacher who has self-regulation skills will have the performance of controlling and managing complicated learning activities and provide students with the necessary guided learning support on this issue. It is expected that self-regulation skills, an important component of metacognition,

exist in the education of individuals learning how to learn. In addition, self-regulated learning (SRL) is considered to be a critical component of successful online education (Hill & Hannafin, 1997). On the other hand, aspects of self-regulation in Lehmann et al. (2014, p. 314) are investigated within three fundamental structures which include the cognitive aspects consisting of structural (specific knowledge and strategic knowledge) and procedural (knowledge process and goal framework) components; metacognition aspect consisting of structural (metacognition and task knowledge) and procedural (planning, reflection and evaluation) components; and motivational aspect consisting of structural (interest, belief, ability) and procedural (strategies about emotional processes and willpower) components. If it is acknowledged that these aspects are in constant interaction with each other, relationships between metacognitive processes and self-regulation and management processes will become clearer. Based on this point, the first, second and third hypotheses (H1, H2 and H3) of the research are as follows:

H1 = As the prospective teachers' self-adjustment skills increase, their metacognition skills increase significantly.

H2 = As the prospective teachers' self-assessment skills increase, their metacognition skills increase significantly.

H3 = As the prospective teachers' control skills increase, their metacognition skills increase significantly.

1.2 Metacognition

Metacognition is a process in which higher-order thinking and skills are encountered based on the fact that individuals take responsibility for their own learning. Metacognition, which is encountered as the process of learning to learn and learning to think, is an important component of the learner's awareness of his/her own learning process. Metacognitive skills have strategic importance for both problem-solving and self-regulation and control. Metacognition is a structure where planning, practice, evaluation, and review get involved in learning. The metacognition process includes an individual's process of awareness, knowledge, and control about self, and the knowledge and control about the learning process. Flavell (1979) shapes metacognition, which is considered as cognition about cognition, on two fundamental functions as the control of cognition and reflection of cognition; the metacognition process becomes meaningful with metacognitive knowledge and skills.

Metacognitive knowledge in such a process is the knowledge about an individual who solves problems or learns about self and his/her learning strategies. As to the metacognitive skills, it is related to the regulation of cognition that involves an individual's regulation and awareness of his/her own cognitive system and function (Fernandez-Duque et al., 2000a). Positive effects of learners' being

equipped with metacognition-related knowledge, skills, and attitudes will be reflected in their performance in their future life. Teachers who have metacognitive skills make positive contributions to their students in terms of providing them with necessary guided learning support. Metacognitive skills, which will be covered as an important factor within the 21st-century skills, will be encountered as an important factor in raising individuals who improve themselves.

According to Flavell (1979), described as "thinking about thinking" as well, metacognition is reported to be well-known as an internal psychological process that is required for effective learning and problem solving. In such a structure, prospective teachers need to have metacognitive skills such as awareness about what they are doing, organizing their actions, and evaluating themselves (Bellon et al., 2019). On the other hand, Flavell (1979) was the first one to introduce the term metacognition as a more general concept that covers the monitoring and regulation of cognitive performance. In the study of Vo et al. (2014) metacognition is reported to involve the capacity to estimate one's cognitive knowledge and ability. Bryce et al. (2015) state metacognition as the way people monitor, and control their cognition on task. According to Flavell (1979), there is a big difference between metacognitive monitoring and control. Metacognition is related to the ideas, beliefs, knowledge and theories possessed by a learner about how to regulate processes related to the goals and how to optimize outcomes; metacognitive skills, on the other hand, are self-regulatory behaviors performed by an individual when he/she is engaged in learning, which helps to control thinking or learning (Flavell 1979, Prins et al., 2006; Sandi-Urena et al., 2010). The process of metacognition requires metacognitive knowledge and skills. Metacognitive knowledge about cognition is reported to have procedural (how), declarative (what), and conditional (why and when) ideas (Zohar & Barzilai, 2013). On the other hand, metacognitive skills involve several models (some relevant constructs like self-regulation and metacognitive awareness); each model has insignificant theory-based variations and different terminologies. Metacognitive abilities are top-level managing abilities; some examples include monitoring, duty analysis, checking, reflection, devising, and evaluation of achievement. The procedural side of metacognition for control, prediction, and self-assessment is reflected by these skills. The term metacognition used in this study represents an overarching term. It involves some different names generally used such as "self-regulated learning", "thinking skills", and "learning to learn". While some other skills are also known in the business sector and referred as "21st-Century Skills" as Voogt and Roblin (2012) state, when compared to high-level skills, they constitute a more widespread framework of skills. Metacognitive skills are involved in the 21st-century skills. Metacognition is the process of learning to learn. Studies demonstrate the increasing importance of

metacognition for the improvement in learning and teaching. For instance, while Tarricone (2011; as cited in Haukås et al., 2018, p. 1) reports that metacognition is a fundamental factor for learning, Hattie (2012; as cited in Haukås et al., 2018, p. 1) claims that teachers who prioritize the metacognitive process and skills demonstrate better performance in terms of supporting their own development and the development of their students. On the other hand, recent studies emphasize that metacognitive skills (Fernandez-Duque et al., 2000b; Garner, 2009) and self-regulation (Hofmann et al., 2012) play an important role in learners' executive functions. There are three important research fields where metacognition plays important roles. These include cognitive and experimental psychology, higher-order thinking process, and education psychology, which have important effects on higher-order thinking processes and self-regulation. In addition, metacognitive processes and skills also take place as an important component in the studies on neuropsychology and brain (Keulers et al., 2019). Studies in this field also concluded that the effective use of metacognitive skills increases the learner's performance in learning.

Metacognitive processes and skills are structures that involve one's knowledge and control about self as well as the knowledge and control of the learning process. Definitions of metacognition are generally interpreted in two processes called one's knowledge about self and regulation of cognitive activities (Costa, 1984; Flavell, 1979; Mevarech et al., 2006). Metacognitive knowledge, metacognitive experiences (Flavell, 1979), and metacognitive skills (Efklides, 2006) form the three aspects of metacognition. The definitions and explanations made under the title of Metacognition are tried to be summarized in Figure 1.

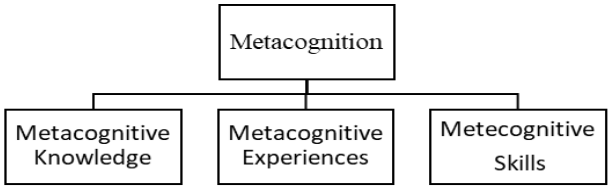


Figure 1. Elements of metacognition.

According to Figure 1, metacognitive knowledge involves declarative knowledge about the individual, task, and strategies. As to metacognitive skills, they refer to the procedures and behaviors used for regulating cognitive activities. On the other hand, the metacognitive experience, which is also called self-initiated metacognition, is defined as any conscious cognitive and affective experiences emerging in all kinds of task processes (Flavell, 1979). In this structure, the individual owns the learning responsibility. As such, metacognition involves the

learner's abilities in predicting, planning, monitoring, and evaluating their own mental activities. In such a process, individuals have the skills of evaluating what they know and do not know, controlling their own learning processes, planning, organizing, evaluating their own learning, and choosing and using learning strategies appropriate for them among several other strategies. For this reason, it is highly probable that teachers who have these skills would better provide their students with required guided learning support and organize the teaching process.

Teachers who have the planning, organization and evaluation skills of metacognition are expected to have a positive approach towards the e-mobile learning required by the 21st century. Hence, enterprising learners who plan, organize, and evaluate their own learning processes would be open to new technologies and renew themselves according to the context. Hence, Mohd Asraf and Supian (2017) investigated the relationship between mobile learning and metacognition in 21 undergraduate students and found that a larger vocabulary formed with the widespread use of cell phones contributed to the increase in learners' metacognitive skills. In this context, the fourth hypothesis (H4) of the research is as follows:

H4 = As the prospective teachers' metacognition skills increase, their E-MLR levels increase significantly.

1.3 E-Mobile learning readiness (E-MLR)

Mobile learning is identified as the spread of learning resources and services to learners regardless of time and place via any mobile device connected to internet (Hashemi et al., 2011). With the increase in mobile applications, almost everyone's using mobile learning has become common by connecting to wireless internet. Features of cell phones such as easy access to various materials that can be used in educational environments for academic purposes (e.g. a camera, sound, a photograph, a computer, a calculator) are highly effective for learning (Laurillard, 2009). However, before adopting a mobile learning strategy, a formal learning method and strategy, individuals' readiness level and attitudes towards this learning strategy need to be evaluated. There, it forms a new education paradigm for this new source and way of learning for students, who are the stakeholders of mobile learning (Alhassan, 2016). In addition to having a mobile tool with the required functions, students are expected to be psychologically ready to learn and be motivated to make learning more fruitful. An individual's enhancing readiness for learning by motivating himself/herself for learning in a long-time period and doing it through mobile learning are related to having a high level of readiness for mobile learning (Titova &Avramenko, 2013). In this regard, studies on mobile learning readiness have identified several variables that affect readiness for learning. Nwagwu and

Odetumibi (2011) state that these variables include education level, Trifonova et al. (2006) support that they also involve gender, and MacCallum and Jeffrey (2009) present the age factor. Studies with multiple variables on mobile learning have investigated applications that affect mobile learning like technological foundation, needs of student, and pedagogical gains (Alzaza & Yaakub, 2011; Cheung et al., 2011). An analysis of the related studies reported that education level, gender, and age caused significant differences in the mobile learning level. At this point, the pedagogical benefits of mobile learning and the positive effects of applications have also been reported. In addition, the presence of self-regulation and metacognition in today's e-mobile technologies as components to be benefited in the process of control and management is something expected.

On the other hand, a teacher who is a cognitive coach to make today's students independent learners is a teacher who is open to mobile learning processes, an expert on higher-order processes and skills such as metacognition, and is competent in self-management and control processes. Identification of prospective teachers' status about these issues is of importance in terms of increasing the nature of the guided learning support to be provided to them. For these reasons, the notion of this study is to find out what kinds of relationships exist between metacognition and e-mobile learning readiness perception and self-management and self-control skills. In line with this, the main purpose of the present study is to investigate the relationships between "self-management and self-control skills", "metacognitive skills" and "e-mobile learning readiness perceptions" among prospective teachers. In line with this purpose, the study sought answers to hypotheses of the proposed structural model (see by Figure 2).

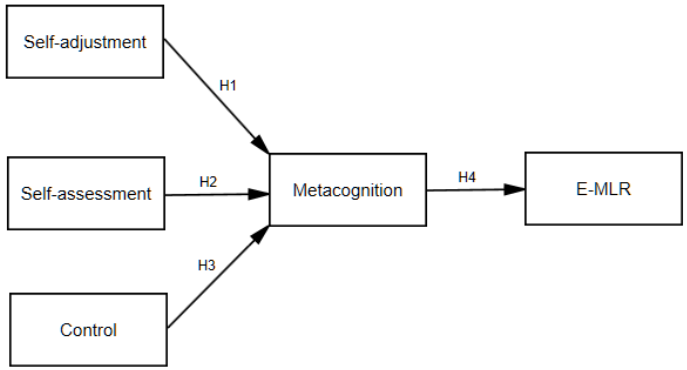


Figure 2. The proposed structural model.

In this model, the relationships between the self-adjustment, self-assessment, control, metacognition and E-MLER as shown by one-way arrows form the hypotheses for the study (see Figure 2). These hypotheses are as follows:
H1= As the prospective teachers' self-adjustment skills increase, their metacognition skills increase significantly.
H2= As the prospective teachers' self-assessment skills increase, their metacognition skills increase significantly.
H3 = As the prospective teachers' control skills increase, their metacognition skills increase significantly.
H4= As the prospective teachers' metacognition skills increase, their E-MLR levels increase significantly.
In line with the purpose of this research, the above hypotheses will be tested.

2 Results

2.1 Research design

This study adopted a procedural model that was relational screening in nature. Procedural studies provide three types of information. The first of them is the predictability of the behavior pattern taken as a criterion. The second is the indicators of the behavior pattern taken as a criterion. The third and last is the procedural validity of the test or tests related to the behavior pattern taken as a criterion (Borg & Gall, 1989). In this regard, the hypotheses developed to determine the relationship among prospective teachers' self-adjustment, self-assessment, control, metacognition skills and E-MLR are tested. From this point forth, it is aimed to reach all three types of information presented by the procedural research model. Schematic display of the behavior patterns taken as criteria and indicators of the behavior patterns taken as criteria in this study is given in Figure 1. An analysis of Figure 2 shows that in the first aspect of the study, E-MLR was taken as criteria. In other words, the dependent variables and the predictive variables were identified as metacognition. In the second aspect of the study, metacognitive skills were taken as criteria behavior patterns. In other words, they were taken as dependent variables. The predictive variables were identified as self-adjustment, self-assessment, and control aspects of self-management and self-control skills.

2.2 Participants

The participants of the study were prospective teachers from the Primary School Science Teaching, Psychological Counselling and Guidance, Classroom Teaching, and Pre-school Teaching Departments of State University Education faculty in the east Anatolia of Turkey, 2018-2019 academic year. The participants consisted of 303 prospective teachers from the departments identified by using improbable cluster sampling method. Distribution of the

sample by gender showed that 180 students (59.4%) were females, 120 students (39.6) were males, and 3 (1%) did not indicate gender. Distribution of prospective teachers by gender showed that there were 121 students in the Psychological Counseling and Guidance Department (39.9%), 58 students (19.1%) in the Pre-school Teaching Department, 61(20,1%) students in the Science Teaching Department, and 63 (20.8%) students in the Classroom Teaching Department. As to having participated in any training about mobile learning variable, 203 (67%) students reported they had participated in no training about mobile learning, 35 (11.6%) reported to have had training about mobile learning, and 35 (11.6%) did not respond to this question.

2.3 Data collection tools

In order to collect data, the "Socio-demographic Form" was used to identify participants' socio-demographic features, "E-Mobile Learning Readiness Perception Scale" (E-MLR) was used to identify students' perceptions about e-mobile learning readiness, "Metacognition Scale" (MS) was used to measure their metacognition, and "Self-Control and Self-Management Skills Scale" (SCMS) was used to evaluate their self-control and self-management skills.

2.3.1 The Socio-Demographic form

The Socio-Demographic Form was developed by the researchers and utilized on the purpose of collecting information related to independent variables of the study. It was also used with the intention of describing the sample in terms of their socio-demographic characteristics. The form included 8 questions about gender, department, class level, education level of the parents, income level of the family, type of high school graduated, and having received any training about mobile learning.

2.3.2 E-Mobile Learning Readiness Perception Scale (E-MLR)

Turkish adaptation of the E-mobile Learning Readiness Perception Scale developed by Lin et al. (2016) was performed by Gökçearslan et al. (2016) with 698 undergraduate students in the spring semester of the 2015-2016 academic year. The 17-item scale with 3 sub-scales has 7 items in the first aspect Optimism factor, 6 items in the second aspect Self-efficacy factor, and 4 items in the Self-learning factor. Cronbach's Alpha coefficient of the scale that explains the 76.9% of the total variance was found .95, and the test-retest correlation coefficient was found .68.

2.3.3 Metacognition Scale (MS)

The Metacognition Scale (MS), which had KMO=.914; Barlett Sphericity test $\chi 2=1.853$ df=153 $p<.001$, was developed by Demir (2013) to identify the

metacognitive skills level of prospective teachers. The MS has three sub-scales called Evaluation, Organization, and Planning. The Cronbach's Alpha internal consistency coefficient of the whole scale was .89. An item in the "Evaluation" sub-scale was "While listening to the teacher, I question whether I understand or not"; the Cronbach's Alpha internal consistency coefficient was .87. An item in the Organization sub-scale is "I check my activities about the topic of the course"; the Cronbach's Alpha internal consistency coefficient was .65. An item in the "Planning" sub-scale is "I can create the necessary conditions to activate the goals of the course", the Cronbach's Alpha internal consistency coefficient was found .70. The three sub-scales explain 53.07% of the total variance. Confirmatory Factor Analysis and chi-square value calculated for model-data were found to be significant ($\chi 2$=151.90, df=74, p<.01). Some fit statistics calculated using the same analysis were as follows: ($\chi 2$/df)=2.05, RMSEA=0.064, RMR=0.045, GFI=0.92, AGFI=0.89, NNFI=0.91, NFI=0.87, CFI=0.93).

2.3.4 Self-Control and Self-Management Skills Scale (SCMS)
Turkish adaptation of the Self-Control and Self-Management Skills Scale developed by Mezo (2009) was performed by Ercoşkun (2016) with 1006 undergraduate students in the fall semester of the 2014-2015 academic year. The three sub-scales explained 54.09% of the total variance (KMO=.91, Bartlett's test $\chi 2$=5119.371). Chi-square value calculated for model-data fit with Confirmatory factor analysis was found to be significant. Values of the scale obtained as a result of Confirmatory factor analysis met fit indices with RMSEA=.052, NFI=.97, CFI=.98, GFI=.96, AGFI=.94, RFI=.97 values.

2.4 Instrument validity and reliability
Validity and reliability analyses of the scales used in this study (E-MLR, MS, and SCMS) were made using the data set consisting of prospective teachers. Table 1 CFA results revealed the fit index and Cronabach Alpha (α) values.

Table 1

Data collection tools fit index and internal consistency values

Scale	*(χ2/df)*	*RMSEA*	*NFI*	*CFI*	*GFI*	*AGFI*	*IFI*	*α*
E-MLR	3.113	.045	.930	.945	.940	.910	.950	.950
MS	2.761	.060	.900	.935	.930	.920	.930	.890
SCMS	2.900	.070	.930	.920	.925	.915	.910	.820

When the DFA fit values for the data collection tools are analyzed according to Table1, E-MLR fit index values: ($\chi 2$/df)=3.113, RMSEA=0.045, NFI=0.930,

CFI=0.945, GFI=0.940, AGFI=0.910, IFI=0.950. When analyzed, it was determined that the $\chi 2$/df, RMSEA, NFI, CFI, GFI, and IFI are in the acceptable fit value range. The MS fit index values: $\chi 2$/df=2.761, RMSEA=0.060, NFI=0.900, CFI=0.935, GFI=0.930, AGFI=0.920, IFI=0.910. When analyzed, the $\chi 2$/df, RMSEA, CFI, GFI, AGFI, and IFI values are an acceptable fit. The SCMS fit index values: $\chi 2$/df=2.90, RMSEA=0.070, NFI=0.930, CFI=0.920, GFI=0.925, AGFI=0.915, IFI=0.910.

The criteria accepted for fit values in the literature are given in section assumptions of model suitability in data analyses title. Accordingly, when the fit index values accepted as criteria in assumptions of instrument validity suitability are compared the model fit index values are considered to be acceptable values.

Cronbach's Alpha (α) values were analyzed for the internal consistency coefficient of the data collection tools and determined to be: Internal consistency coefficient of E-MLR (α=0.95). Cronbach's Alpha values were found (α=0.92) for the "Optimism" sub-scale, (α=0.91) for the "Self-efficacy" sub-scale, and (α=0.83) for the "Self-learning" sub-scale. Internal consistency coefficient of the MS (α=0.890). Cronbach's Alpha values of the scale in the sub-scales were (α=0.820) for the "Evaluation" sub-scale, (α=0.660) for the "Organization" sub-scale, and (α=0.780) for the "Planning" sub-scale. SCMS internal consistency coefficient (α=0.820), Cronbach's Alpha values in the sub-scales were (α=0.780) for the "Self-adjustment" sub-scale, (α=0.760) for the "Self-assessment" sub-scale, and (α=0.750) for the "Control" sub-scale. Accordingly, the data collection tools used in the research (E-MLR, MS, and SCMS) are valid and reliable.

2.5 Data analysis

2.5.1 Investigating assumptions

Missing and incorrect encodings were reviewed before analyzing the data. Then outlier analysis was carried out with a view to analyzing the CFA and Path analysis assumptions, and Mahalanobis distance larger values were excluded from the analysis. Once it was found that the data were distributed normally and the variances were homogenous, multicollinearity, variance inflation factor (VIF) and tolerance values were analyzed, results indicated no close to zero tolerance, VIF more than 5, condition index accompanied by two variances more than 0.50 and bigger than 30. The analyses were performed on 303 participants (Tabachnick & Fidell, 2001).

2.5.2. Assumptions of model suitability

Confirmatory Factor Analayzses (CFA) was applied to test the validity of the data collection tools of this study. CFA fit index values were taken as a criterion for model fit values. In the literature, acceptable lower bound and fit index values for CFA are as follows: The ratio of chi square value to degree of freedom

($\chi 2/sd.\leq 5.$), Root Mean Square Error of Approximation ($0.06\leq RMSEA\leq 0.08$), Normed Fit Index ($0.90\leq NFI$), Comparative Fit Index ($0.90\leq CFI$), Goodness of Fit Index ($0.90\leq GFI$), Adjustment Goodness of Fit Index ($0.90\leq AGFI$), and Incremental Fit Index ($0.90\leq$ IFI) (Anderson & Gerbing, 1984; Hu & Bentler, 1999; Tabachnick & Fidell, 2013). The AMOS 23 software package was used for CFA and path analysis; the SPSS 21 software package was used for dataset entry, item statistics, test statistics and correlations among constructs.

3 Results

The results section involves initially the descriptive values demonstrating the standard deviations, correlation matrixes, arithmetic means, and then path analysis results. Table 2 demonstrates the correlation matrixes, arithmetic means, and standard deviation values of the variables used in the study.

Table 2

Correlations among constructs, means, standard deviations, skewness, kurtosis, (N=303)

Constructs	*1*	*2*	*3*	*4*	*5*	*M*	*SD*	*Skewness*	*Kurtosis*
1. Control	1					22.05	4.86	-.354	-.290
2. Self-assessment	.286**	1				19.16	4.56	-.624	-.311
3. Self-adjustment	.478**	.356**	1			26.10	5,.01	-.242	-.511
4. Metacognition	.443**	.299**	.518**	1		51.52	9.70	-.653	.642
5. E-MLR	.421**	.222**	.458**	.401**	1	78.60	8.79	.052	-.389

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

As it is seen in Table 2, arithmetic means of the dependent variables ranged from 78.60 to 19.16, and the standard deviations ranged from 9.70 to 4.56. Table 2 shows a significant relationship in the relationships between control, self-assessment, self-adjustment, metacognition and E-MLR ($p<0.01$). The majority of the variables in Table 2 had a near medium level significant relationship with variables. Variables were not related to each other at a level to cause multiple connection problems, yet they had a medium-level significant relationship. In addition, it was determined that the kurtosis and skewness values of the variables of the proposed model, which are indicators of normal distribution, are between -1 and +1 values.

Before examining to testing the hypothesis of the proposed model, model fit values were examined. Model fit values are given in Table 3.

Table 3

Model fit indices

Fit indices	*(χ2/df)*	*RMSEA*	*NFI*	*CFI*	*GFI*	*AGFI*	*IFI*
Values	3.292	.067	.990	.993	.991	.936	.993

Accordingly, when the model fit values of the research are analyzed according to Table 3, since (χ2=19.027; df=6; p=.037) χ2/df=3.292 is less than 5, this indicates an acceptability fit. The RMSEA value (RMSEA=0.067) shows an acceptability fit. The NFI value (NFI=0.990) shows a good fit. The CFI value (CFI=0.993) shows a good fit. The GFI value (GFI=0.993) shows a good fit. The AGFI value (AGFI=0.936) shows a good fit. The IFI value (IFI=0.993) shows a good fit. When Table 3 is examined, it is understood that the fit index values of the model are good fit values. Results of the hypotheses of the proposed model are shown in Figure 3.

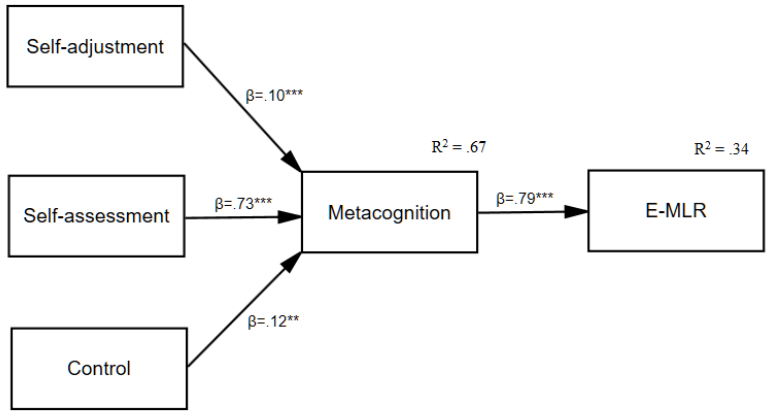


Figure 3. Representation of the standardized values of the path analysis results of the proposed model (**p< .01., ***p < .001., N =303).

Path analysis was applied to test the hypotheses established between self-adjustment, self-assessment, control, metacognition and E-MLR which are the variables of the study. Path analysis values are in table 4.

Table 4

Path analysis values

			β	*B*	*S.E*	*t*	*p*	*Hypotheses*	
Self-adjustment	→	Metacognition	.096	.174	.064	2.71	.000	H_1	Suported
Self-assessment	→	Metacognition	.732	.655	.032	20.59	.000	H_2	Suported
Control	→	Metacognition	.118	.207	.062	3.34	.007	H_3	Suported
Metacognition	→	E-MLR	.785	.488	.036	13.69	.000	H_4	Suported

B=unstandardized estimates; β=standardized estimates

According to Table 4, the self-adjustment variable (β=0.96; t=2.72; p<.001) directly and positively affects the metacognition variable. The self-assessment variable (β=0.732; t=20.59; p<.001) directly and positively affects the metacognition variable. The control variable (β=0.118; t=3.34; p< .01) directly and positively affects the metacognition variable. The metacognition variable (β=0.785; t=13.69; p<.001) directly and positively affects the E-MLR variable. In light of these results, H1, H2, H3 and H4 hypotheses are supported.
According to Figure 3, E-MLR variable explains 34% of the variance explained by the proposed model (R2=.34). The metacognition variable explains 67% of the variance according to the proposed model (R2=.67).

4 Discussion

The aim of this study is to determine the relationships between the variables of prospective teachers' self-management and self-control skills, metacognition and e-mobile learning readiness perceptions. Four hypotheses in the proposed model were discussed according to the literature (see Figure 2).
According to the results of the study, the findings obtained to test hypothesis 1 and hypothesis 3 show an increase in self-adjustment and control leads to an increase in metacognition. Planning, organization and evaluation skills of metacognition as learning to learn process are directly associated with the self-control and self-management of the individual. Hence, Zimmerman (2002) also defines self-regulation and self-management as “an individual’s own thoughts and actions planned, regulated, organized, and performed in a cyclical way in reaching the individual goals”. In this regard, the ability to monitor and control cognition is referred to as metacognition. Self-control and self-management play an effective role in this ability. Hence, metacognition has two components and as to Flavell (1979), it is defined as “thinking about thinking”. While the first component is knowledge of cognitive processes and products, the second component involves the self-regulation processes, indicating the ability to control, monitor, and evaluate cognitive processes. Cognition knowledge

includes a number of interrelated components; these are knowledge on using the strategies; metacognitive knowledge about the strategies, the person and the task; and metacognitive experience, which is the feeling about being successful or vice versa in fulfilling a task. Because metacognitive knowledge brings along the use of self-regulated strategy about the goal, these components are related. This process of self-regulation has impacts on the metacognitive knowledge, and it comprises a basis for a better metacognitive knowledge acquisition. In addition, Dinsmore et al. (2008) state that self-regulation is a significant constituent of metacognitive control processes. The analysis of students' errors also includes self-regulatory mechanisms. Hence, Lucangeli et al. (2019) have reported that there were positive relationships between self-control and self-management skills and metacognition process in terms of mathematical achievement. Similarly, Deng et al. (2019) found that self-control and awareness consecutively mediated the relationship between intellectual circulation and metacognition. The related study also showed that intellectual circulation is an important pioneer of metacognition. Džinović et al. (2019) investigated the mediative effect of self-regulation that involves the regulation of motivation styles, academic self-efficacy, and metacognition as self-regulation-related variables on the self-control. The results showed that students who had self-control skills and believe themselves in terms of meeting the requirements of the school have become more successful at school regardless of their autonomous motivation and complexity of their learning. On the other hand, the two aspects of metacognitive self-regulation include knowledge of thought processes and metacognitive skills (Veenman et al., 2006) or strategies of cognitive self-regulation (Pintrich, 1999); planning, monitoring, control, and reflection are the most commonly stated metacognitive strategies as the components of metacognition (Pintrich, 2004).

Self-adjustment and control sub-scales significantly predict the total score for metacognition. Prospective teachers' adjustment depending on the context under investigation and controlling it are closely associated with their knowledge and control about self and knowledge and control about the learning process. Džinović et al. (2019) highlighted the positive relationship between self-adjustment and control variables and metacognition. On the other hand, the metacognition process is not related only to the construction of knowledge, it is also a process associated with the management and control of knowledge and learning. Further investigations were performed about the connections that this construct has with other essential elements of the process of learning which include metacognition (Fox & Riconscente, 2008), self-learning, and self-regulated learning (Maggioni & Parkinson, 2008). There was an emphasis on the features and overlaps of self-regulation, self-regulated learning and metacognition (Lajoie, 2008; Efklides, 2008; Hofer & Sinatra, 2010) concepts.

As a matter of fact, these studies support the model that the self-adjustment and control subscales have a positive effect on metacognition.

According to the results of the study, the findings obtained to test hypothesis 2 says that self-assessment affects metacognition directly and positively. An individual's evaluating his/her own learning processes and making necessary organizations for individual learning accordingly are of great importance for individual development. Hence, Mellinger (2019) investigated the relationship between metacognition and self-assessment in a specific translation education and found that metacognition played a role in the translation task together with self-assessment. However, the fact that self-assessment does not predict metacognition significantly is a different finding. It is stated in the body of literature that self-assessment has positive effects on the development of metacognition (Siegesmund, 2017; Ibabe & Jauregizar, 2010). In a study by Ibabe and Jauregizar, (2010), it was found that an instructional design using online self-assessment feedback and self-assessment materials had a positive effect on students' academic performance and metacognition. In the study conducted by Zagyváné Szűcs (2018), it was investigated among six teacher trainers whether there is a difference between self-reflection and self-evaluation skills, which are the basic elements of self-regulation. As a result of the study, even though any generalization could not be made among the teacher trainer groups, it was determined that self-reflection and self-evaluation skills play a critical role in the professional development of teacher trainers. According to the results of the research they conducted in Roll et al. (2006), it was found that using self-assessment in the curriculum increased students' awareness of their own knowledge levels. In this context, it was determined that self-assessment made a positive contribution to metacognition.

According to the results of the study, the findings obtained to test hypothesis 4 says that metacognition affects e-mobile learning readiness perception directly and positively. The fact that individuals have self-control and self-adjustment skills in the process of learning to learn would have positive effects on their situational learning readiness perception such as connecting to new technologies, learning in the context they are in, and e-mobile learning. In some respects, mobile learning is broader; in this learning, learners are encompassed within the boundaries of educational institutions, and it has individual unstructured learning driven by curiosity and necessity (Traxler, 2010, p. 131). Hence, studies also show that self-adjustment and control sub-scales significantly predicted the e-mobile learning readiness perception scale. All the active components of active learning such as participating, questioning, experimenting, revising and exploring exist altogether; in such a process, students who have self-control and self-adjustment skills are expected to have increased e-mobile learning readiness perceptions. In e-mobile learning, learners decide on the things they know and

do not know by themselves, organize, evaluate and then perform their own learning, which is directly related to self-control and self-adjustment skills. In addition, e-mobile learning enables changes, development, and taking precautions against unexpected situations, and adapts these innovations to environments, which is also a reflection of another aspect of self-control and self-adjustment on e-mobile learning. Hence, in their study conducted with Jordanian university students, Al-Adwan et al. (2018) reported that self-management aspects were effective in relative advantage, complexity, social effect, and pleasure, and self-management aspects of learning.

In today's world, raising enterprising and independent learners depends on enabling them to improve themselves by adapting to new technologies. Mobile learning is a way of learning in which the learner can access e-learning content without being dependent on a specific place, dynamically benefit from services produced, and communicate with others. In such a process, prospective teachers' who have the learning opportunity free of time and place will have self-management and self-control skills in the lifelong learning network. Hence, prospective teachers will be engaged in the learning process when they want, which will lead to the use of self-management and self-control skills. Higher metacognition levels will also have positive effects on prospective teachers' e-mobile learning readiness perception. The structure of e-learning readiness was indicated by Hung et al. (2010) in six components that include computer, internet, and online communication self-efficacies, self-directed learning, learner control, and motivation for e-learning. Among these components, especially self-directed learning and learner control are directly related to self-management and control skills, which is a structure that supports the findings of the study. As such, self-management skills have a structure involving self-control and self-adjustment, which is also in line with the results of the study. On the other hand, self-directed learning in the m-learning context is an essential success factor in cases of flexible delivery, distance education, and resource-based learning such as m-learning (Prajapati & Patel, 2014). Metacognition and mobile learning have a direct and positive effect on e-mobile learning readiness perception. The results of the studies examined in the literature (Al-Adwan et al. 2019; Prajapati & Patel, 2014) support the proposed research model. Mobile Learning in the 21st century classrooms is a learning environment used by teachers to help children train their metacognitive skills. Blummer and Kenton (2014) examined the research strategies of children who want to reach information through mobile learning. As a result of the research, it was determined that if the metacognition skills of children were developed, they used different research strategies in different digital media to reach information.

Conclusion, recommendations, limitations, and future research

Prospective teachers' self-regulation, self-assessment and control skills positively affect their metacognition skills. The metacognition skill of prospective teachers has a positive effect on mobile learning readiness perception. Tsai and Chuang (2005) claimed that metacognitive activities have a significant role in e-learning, and they noticed the requirement of enhancing epistemological views of students by diversifying the use of metacognitive practices. In the literature, it has been determined that cognitive awareness has a positive effect on e-mobile learning readiness perception (Mac Callum & Jeffery, 2015). Damopolii and Kurniadi (2019) expressed that in biology teaching, mobile learning use will have a positive effect on the use of students' metacognition skills. In order to realize the impact of mobile learning use on learning, students need to be able to improve their metacognitive skills (Terras & Ramsay, 2012).

The fact that prospective teachers take responsibility for their own learning and making choices with self-control and self-management will improve their planning, organization and evaluation skills. This may positively affect their readiness for e-mobile learning. In such a process, prospective teachers are expected to use their self-control and self-management skills. From this point of view, training based on cognitive awareness strategies that improve teacher candidates' self-regulation, self-assessment and control skills can be provided. Pre-service teachers with metacognition skills will improve themselves and their learning processes, and this will let them develop a more positive attitude towards mobile learning. Moreover, prospective teachers' technological knowledge needs to be supported to increase their mobile learning readiness. To do this, there is a need for mobile learning environments to be prepared in line with the content of fields of pre-school, classroom, science and psychological counseling,

Interactive platforms that will enable mutual interaction through e-mobile learning supporting their self-control and self-management skills could be formed so that prospective teachers can solve the problems encountered throughout their teaching and be determined in reaching their goals,

For pre-school prospective teachers and Psychological counseling prospective teachers, who do not have a specific content in the curriculum and support children's development, a digital environment could be developed for information sharing with colleagues, becoming aware of current activities, and improving their metacognition through e-mobile learning,

For classroom and science teaching prospective teachers, who have a specific content in the curriculum and support children's development, a digital learning environment could be developed for enabling them to obtain current information,

reach goals by increasing their determination in the face of difficulties they encounter, and access current information with e-mobile learning environments. This study was conducted only with the participants consisting of teacher candidates at a state university in Turkey. However, the participants of the research can be expanded with different teaching areas of higher education. Quantitative research methods may create limitations in order to determine the latent aspects of the proposed model. For this reason, the details of the model can be revealed by using qualitative methods in future research. In addition, the model can be evaluated by considering the personal variables determined according to the literature for new research studies to be made regarding the proposed model.

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