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Emine Adadan

*Bogazici University*, emine.adadan@boun.edu.tr

Diler Oner

*Bogazici University*, diler.oner@boun.edu.tr

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## Examining Preservice Teachers' Reflective Thinking Skills in the Context of Web-Based Portfolios: The Role of Metacognitive Awareness

Emine Adadan  
Diler Oner  
Bogazici University, Turkey

*Abstract: This mixed method study aimed to examine if, and then potentially how, the level of preservice teachers' metacognitive awareness (MA) influences their reflective thinking on their teaching practicum experiences in the context of web-based portfolio construction. Data sources included two sets of reflection task responses and a Likert-type metacognitive awareness inventory. Data from these sources were coded and analyzed using quantitative and qualitative methods. The total number of high-level reflective thinking indicators produced by the preservice teachers with high MA was notably higher than those generated by the preservice teachers with low MA. A Wilcoxon-Mann-Whitney test revealed a statistically significant difference between the scores of high-level reflective thinking indicators exhibited by the preservice teachers with high MA and low MA. In addition, a statistically significant moderate relationship was found between the participants' total MA scores and their high-level reflective thinking scores. Findings suggested that when the participants were good at managing the three metacognitive processing skills, namely monitoring, evaluation, and planning, they more frequently exhibited the high-level reflective thinking indicators.*

### Introduction

Teaching is an extremely complex and demanding task that requires the coordination and integration of subject matter, student learning, curriculum, and pedagogy (Clark & Lampert, 1986; Feiman-Nemser, 2001; Hammerness et al., 2005). In order to prepare preservice teachers for such a challenging profession, teacher education programs usually “provide teachers with the core ideas and broad understanding of teaching and learning that give them traction on their later development” (Bransford et al., 2005, p.3). In addition to this particular knowledge base, researchers strongly point to the *metacognitive awareness* (MA) as the critical element in understanding the nature of teaching and developing personal teaching pedagogies during teacher education courses and afterward (Hoban, 1997; Loughran, 2006; Parsons & Stephenson, 2005; Shulman & Shulman, 2004). Hammerness et al. (2005) claimed that teachers with high MA develop such habits of mind that motivate them to frequently self-evaluate their performances and modify their views and actions as needed, whereas teachers with low MA usually rely on external feedback from others to adjust their views or actions. A few studies investigated whether the improvement in teachers' MA fosters their reflective thinking on their teaching practice (Graham & Phelps, 2003; Jaworski, 1998; Parsons & Stephenson, 2005; Whittaker & vanGarderen, 2009). However, based on the thorough search of the various educational databases, there has been

no study that empirically explored how teachers' meaning making about their own classroom practice changes with respect to the level of their MA.

Research in teacher education often draws attention to the central role of reflective thinking in the preparation of new teachers and in the profession of teaching (El-Dib, 2007; Jay & Johnson, 2002). As reflective thinking meaningfully bridges one experience to the next, giving direction and impetus to professional growth (Rodger, 2002), it is viewed to be the key to learning about teaching and developing professional expertise (Shulman & Shulman, 2004). However, there is still no consensus on to what reflective thinking essentially refers. Deriving from the work of various scholars (Dewey, 1933; Ertmer & Newby, 1996; Fuller & Bown, 1975; Loughran, 1996; Ford & Yore, 2012; Parsons & Stephenson, 2005), we define reflective thinking as the active and conscious processing and careful analysis of discrepancies among one's goals, practices (experiences), and observations (feedback), both individually and collaboratively, to arrive at new ways of understanding oneself as a teacher. In this respect, teachers' awareness and ability to plan, monitor, and regulate their own thinking, understanding, and knowledge about teaching appears to be a main ingredient for reflective thinking.

Drawing upon the theoretical basis of this study (see below), metacognitive awareness refers to individuals' awareness of knowledge of cognition relative to person, task and strategy, and the self-control mechanisms they use to monitor the process in a given context (Ridley et al., 1992; Schraw & Dennison, 1994; Schraw, 2001). There are, in fact, diverse views about how MA and reflective thinking are interrelated. Some consider reflective thinking as a means to MA (Desautel, 2009; Knight, 2002), whereas some others equate MA to reflective thinking (Mcalpine & Weston, 2000; Sellars, 2014). However, several researchers view MA as an antecedent of reflective thinking (Eraut, 2000; Graham & Phelps, 2003; Jaworski, 1998; Hammerness et al., 2005; Hatton & Smith, 1995; Larrivee, 2008; Rogers, 2001; Parsons & Stephenson, 2005; Whittaker & vanGarderen, 2009). These views have not been thoroughly validated by empirical studies except the two that explored the effect of introducing metacognitive strategies (i.e., case-based instruction, action research) in developing teachers' reflective thinking (Jaworski, 1998; Whittaker & vanGarderen, 2009). Whittaker and vanGarderen utilized case-based instruction as a metacognitive pedagogy to advance the participants' effective reflective thinking. Their findings indicated that promoting learners' MA positively helps in developing their reflective thinking. Whittaker and vanGarderen associated the participants' inability to reflect on complex teaching cases by offering extensive and insightful responses with their lack of MA required for reflection. In addition, Jaworski (1998) found that inservice teachers' involvement in action research increased their MA about their teaching or planning for teaching, providing more power in their reflective thinking. Unlike these studies (Jaworski, 1998; Whittaker & vanGarderen, 2009), the current study did not focus on promoting preservice teachers' metacognitive awareness. Instead, this study was built on preservice teachers' already available resources, namely metacognitive awareness, and web-based portfolios were utilized as a means for promoting reflective thinking. In other words, preservice teachers with high or low MA engaged in web-based portfolio construction, which offered them a meaningful context for reflecting on their teaching practice experiences and interacting with others for feedback on their practice.

### **Purpose of the Study**

This study examined how the level of preservice teachers' MA influences, if at all, their reflective thinking on their teaching practice experiences as they engaged in the web-based portfolio construction. More specifically, the goal was to describe the nature and

frequency of *reflective thinking indicators* (Oner & Adadan, 2011) exhibited by the preservice teachers with high MA and low MA. The subsequent goal was to find out the relationships among the frequency of high-level reflective thinking indicators, overall MA, and the components of MA, which might offer insight into the strength of association among these particular variables. The research questions follow:

- (1) What are the nature and frequencies of reflective thinking indicators exhibited by the preservice teachers with high MA and low MA?
- (2) How do the preservice teachers with high MA and low MA compare in terms of the frequencies of high and low-level reflective thinking indicators?
- (3) What are the relationships among the high-level reflective thinking scores, the total MA scores, and the scores for the components of MA?

## **Theoretical Framework**

### **The Nature of Metacognition**

Metacognition has been originally defined as “one’s knowledge concerning one’s own cognitive processes and products ... among other things, to the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear” (Flavell, 1976, p. 232). Following Flavell’s definition, several others also portrayed the mechanisms and processes of metacognition (e.g., Brown, 1987; Kuhn & Dean, 2004; Nelson, 1999; Schraw & Dennison, 1994). Although there is a lack of agreement on the nature of metacognition, researchers, relying on the original description of metacognition, generally concurred that metacognition includes the two related components, that is, *knowledge of cognition* (metacognitive knowledge) and *regulation of cognition* (metacognitive processing skills) (Brown, 1987; Flavell, 1976; Schraw & Moshman, 1995). The current study adopted this agreed-upon conceptualization of metacognition as a basis for the selection of instrument to assess participants’ MA (Schraw & Dennison, 1994).

Knowledge of Cognition (KoC) consists of declarative, procedural, and conditional knowledge (Brown, 1987; Schraw & Moshman, 1995; Schraw, 2001; Zohar & Barzilai, 2013). Declarative knowledge refers to knowing about oneself as a learner and strengths and weaknesses of one’s own learning. Procedural knowledge refers to knowledge of how to perform certain tasks or execute procedural skills. Conditional knowledge entails knowing when and why to employ certain knowledge and strategies. Regulation of Cognition (RoC) includes three fundamental metacognitive processing skills: *planning*, *monitoring* and *evaluation*, among others (e.g., autonomy, control, management, etc.) (Schraw & Moshman, 1995; Zohar & Barzilai, 2013). Planning is associated with setting goals, properly selecting and sequencing strategies, and allocating resources. Monitoring refers to one’s ongoing awareness of comprehension and task performance; whereas, evaluation involves an assessment of the products and efficiency of one’s learning and thinking.

The nature of KoC is described as relatively stable and storable, often fallible, and late developing information, because learners need to step back and consider their cognitive processes as objects of reflection; however, the nature of RoC is portrayed as relatively unstable, not necessarily storable, and age dependent (Brown, 1987). Research revealed that metacognition starts developing in the early ages and is continuous thereafter (Kuhn, 2000; Zohar & Barzilai, 2013). Kuhn (2000) claimed that the components of metacognition (KoC, RoC) develop at different rates, implying that it is a slowly advancing and multidimensional competence.

The following section focuses on the nature of reflective thinking, which was viewed as making sense of a particular experience (e.g., teaching practice) with cognitive and metacognitive processing.

### **The Nature of Reflective Thinking**

The earlier attempts (Boud et al., 1985; Dewey, 1933; Ford & Yore, 2012; Grimmett et al., 1990; Korthagen et al., 2001; Loughran, 2002; Schön, 1983; Parsons & Stephenson, 2005), including our definition (see the introduction section above [Oner & Adadan, 2016]), commonly characterized reflective thinking with its three components, namely *process*, *context*, and *outcome*.

*Process.* Researchers clearly identified reflective thinking as an active and conscious meaning-making process (Boud et al., 1985; Dewey, 1933; Ertmer & Newby, 1996; Ford & Yore, 2012; Korthagen et al., 2001; Parsons & Stephenson, 2005; Schön, 1983). For example, central to any exploration of reflection, Dewey (1933) described reflective thinking as the process of “active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends” (p. 9). Relatively recently, Korthagen et al. (2001) defined reflective thinking as “the mental process of structuring or restructuring an experience, a problem, or existing knowledge or insights” (p. 58).

There were several approaches that intended to describe the types of processes involved in reflective thinking (e.g., Boud et al., 1985; Dewey, 1933; Korthagen et al., 2001; Loughran, 1996; Schön, 1983). They differed in terms of their number and nature of phases (e.g., cyclical, sequential, irregular order), but they all shared some common features associated with the particular thought actions (e.g., identifying a problem). According to Boud et al. (1985), the processes of reflective thinking involves three phases: (a) *Returning to the experience* entails recollecting relevant events and replaying the experience in the mind’s eye to observe the event as it has happened and recognize one’s reactions to it, (b) *Attending to feelings* includes the dimensions of *utilizing positive feelings* that provide stimulus to persist in challenging situations and *removing obstructing feelings* that helps discharging any undesirable feelings and regaining the flexibility in responding to existing situations, (c) *Reevaluating the experience* involves re-examining experience with respect to the individual’s intent as well as structuring it into his/her knowledge framework. While reevaluating their experiences, individuals need to deal with such elements as *association* (making connections among ideas), *integration* (linking new insights with the already existing knowledge), *validation* (testing for the internal consistency), and *appropriation* (making the new insights our own in a personal way). The reflective thinking process is usually viewed as continuous and cyclical in which challenging experiences lead to reflective thinking and eventually to new interpretations and understandings (Boud et al., 1985; Korthagen et al., 2001; Rogers, 2001).

*Context.* Researchers often viewed the experiences as important as they provide context and act as stimuli for the reflective thinking process (Boud et al., 1985; Dewey, 1933; Korthagen et al., 2001; Loughran, 2002; Schön, 1983). Loughran (2002) called the notion of experience as “a puzzling, curious or perplexing situation” (p.33). Similarly, Schön (1983) described experience as a surprise, an unforeseen event that is inconsistent with teacher’s tacit professional knowledge, which consequently leads to reflective thinking. There are other contextual factors that play roles in the occurrence of reflective thinking, such as feedback, and collaboration with others (Korthagen et al., 2001; Rogers, 2001). It appears that reflective thinking occurs in response to such experience if the other conditions are favorable for

reflective thinking (Nelson & Sadler, 2013). Experiences for preservice teacher's reflective thinking may evidently rest in their observations and practices in the real classroom settings (Gelfuso & Dennis, 2014). If this is not possible, video analysis of critical teaching cases can be an option for creating the stimulating context for reflective thinking (Barth-Cohen et al., 2018).

*Outcome.* Learning and professional development appear to be the main outcomes of teachers' reflective thinking (Boud et al., 1985; Dewey, 1933; Korthagen, 2001; Loughran, 1996; Rogers, 2001). For example, Loughran (1996) stated that "reflection helps the individual to learn from experience because of the meaningful nature of the inquiry into that experience" (p. 14). In the current study, the targeted outcome of reflective thinking was to find a deeper understanding in their teaching practice concerning the nature of teaching.

### *Typologies of Reflective Thinking*

Schön (1983) characterized reflective thinking based on its *timing*, namely *reflection-in-action* and *reflection-on-action*. Reflection-in-action allows for constant interpretation, examination, and reflective conversation with oneself about the problem encountered during teaching to inform and guide new actions. Reflection-on-action refers to teachers' monitoring of actions following actual teaching for the purpose of analyzing and making decisions about what happened in the classroom.

Moreover, several taxonomies were proposed for identifying the *quality* of reflective thinking (Davis, 2006; Grimmer et al., 1990; Hatton & Smith, 1995; Jay & Johnson, 2002; Lee, 2005). For example, Lee's (2005) criteria for the quality of reflective thinking included three levels of depth. The first one is *recall* in which preservice teachers recall, describe, and interpret their experiences with regard to their own perceptions. The second one is *rationalization* in which preservice teachers search for relationships between various aspects of their experiences as well as interpreting their experiences with reasons. The third level is *reflectivity* in which preservice teachers examine their experiences from multiple perspectives with an intent to modify in the future.

### *Promoting Reflective Thinking*

Loughran (2002) recognized the need for the explicit attention to preservice teachers' learning how to reflect, and he claimed that "simply being encouraged to reflect is likely to be as meaningful as a lecture on cooperative group work" (p.33). Because reflective thinking is viewed not only an individual but also a social process (Nelson & Sadler, 2013), teacher educators could establish an environment where preservice teachers feel safe in sharing their teaching practicum experiences with and receiving feedback from their mentors and peers. Teacher educators may also consider integrating purposeful reflective activities into teacher education along with offering feedback (e.g., e-portfolios, reflective journals, case studies, action research, etc.). In the current study, all these issues associated with promoting reflective thinking were carefully considered; thus, the participants were provided with a web-based platform (an environment), supported with meaningful reflective activities and feedback (see Figure 1).

### **Web-based Portfolios and Reflective Thinking**

Portfolios are primarily employed in teacher education programs for the purposes of promoting preservice teachers' reflective thinking, learning, and also assessing their

professional progression (Chaudhuri & Cabau, 2017; Karsenti et al., 2014). Regardless of its format (e.g., paper-based, electronic, web-based), Wolf and Dietz (1998) describe a teaching portfolio as: “structured [and purposeful] collection of teacher ... work created across diverse contexts over time, framed by reflection and enriched through collaboration, that has as its ultimate aim the advancement of teacher ... learning” (p. 13). Thus, a teaching portfolio is supposed to exhibit such features as purpose, reflection, collaboration, and ultimately serving for the improvement in teachers’ knowledge and practice (Boulton, 2014; Slepcevic-Zach & Stock, 2018; Wolf & Dietz, 1998). Among these, the features of *reflective thinking* and *collaboration* have been given enormous attention by the researchers (e.g., Becta, 2007; Boulton, 2014; Chaudhuri & Cabau, 2017; Kabilan & Khan, 2012).

As Barrett (2011) suggested, reflective thinking is the “heart and soul” of a portfolio in that it holds the potential to transform the portfolio from a product into a process, which allows preservice teachers to focus on their learning (Strudler & Wetzel, 2011). With reflective thinking, preservice teachers could more critically interpret their teaching practice experiences and make meaningful connections among their portfolio goals, relevant evidences from their teaching practice experiences, and their reflections, which help foster their professional learning (Boulton, 2014; Lin, 2008; Wolf, 1994). Moreover, the portfolio construction process becomes more productive when there exists regular and ongoing collaboration and interaction between the owners of the portfolios, their instructors, and peers (Chaudhuri & Cabau, 2017; Kabilan & Khan, 2012; Oakley et al., 2014; Strudler & Wetzel, 2011; Wolf, 1994). Supportive feedback resulting in these interactions helps preservice teachers not only enhance the quality of their portfolio artifacts but also advance their learning about teaching, inspiring their reflective thinking on their teaching practice experiences (Becta, 2007; Boulton, 2014; Oakley, 2014; Parsons & Stephenson, 2005).

In the current study, *web-based portfolios* were adopted, given that web-based portfolio software, namely, BOUNCE© was designed and developed as a tool for supporting the participants’ reflective thinking (Oner & Adadan, 2016; Slepcevic-Zach & Stock, 2018). Electronic portfolios, as digital containers, enable individuals to store their portfolio artifacts as evidences of their learning journey over time (Barrett, 2011; Lin 2008). Along with its extensive storage capacity, electronic portfolios allow individuals to produce their portfolio artifacts in various media types (e.g., video, audio, text, images, and graphics, etc.) (Becta, 2007; Chaudhuri & Cabau, 2017). In addition, electronic portfolios are live documents usually being work in progress, so that the preservice teachers could easily modify their previous work and continuously keep a record of their progression in teaching (Karsenti et al., 2014; Lin, 2008). With a web-based format, the portfolios could be simultaneously shared across multiple audiences (instructor, peers, and other parties) since it is accessible from anywhere at any time (Oner & Adadan, 2011; Chaudhuri & Cabau, 2017; Karsenti et al., 2014; Rodgers, 2002). Such a capability of web-based portfolios allows preservice teachers to give and receive feedback to/from their peers and instructors concerning their portfolio artifacts (Becta, 2007; Chaudhuri & Cabau, 2017; Kabilan & Khan, 2012; Lin 2008

## Methods

This study adopted the features of embedded mixed-method design (Creswell & Plano Clark 2011). Thus, it utilized a quasi-experimental comparison group design in tandem with qualitative data collection and qualitative and quantitative data analysis procedures (Campbell & Stanley, 1963; Creswell & Plano Clark 2011). In line with the research questions, comparison groups were established based on the quantitative data representing the participants’ MA, and then the qualitative data involving the participants’ reflective thinking

on their teaching practice were coded and analyzed to describe the nature and frequency of reflective thinking indicators across the groups.

### **Participants and the Setting**

The participants were preservice teachers from two different departments, namely chemistry education (ChemE) and computer education (CompE), who were enrolled in two separate teaching practicum courses with their own cohorts. Each teaching practicum course was offered by the related department in the spring semester to the preservice teachers who were in the final semester of their program of study. All preservice teachers who enrolled in these particular teaching practicum courses were informed and invited to participate, and they all voluntarily participated in the study. A total of 36 of 43 preservice teachers fully completed all data collection tasks. Among these 36 preservice teachers, 20 (55%) were majoring in chemistry education, and 16 (45%) were majoring on computer education. Half of the 36 participants were female. The participants were between 21 and 28 years old, and none had any previous classroom teaching experience.

While analyzing the data, a total of 36 participants from two different departments were considered as one group. Then, this group was divided into two groups with high MA and low MA with respect to their scores on metacognitive awareness inventory (MAI) (described more fully in the data analysis section below).

The teaching practicum was a semester-long course in both departments with two components: fieldwork and university-based weekly seminar. For the fieldwork, the preservice teachers were required to observe 60 lesson hours and teach at least two lessons at an assigned internship school. They needed to teach these lessons at different times (at least two weeks apart) during the semester to allow time for reflection and feedback. In addition to the fieldwork, the participants met at university-based weekly seminar for two class hours to share their experiences and discuss issues on teaching, learning, and classroom management with their peers and instructor.

The two instructors of teaching practicum courses were not a part of the research team. Yet, they agreed to implement the course tasks (fully described below) as structured by the team. The instructors interacted with the participants in and out of weekly-seminar meetings as well as observing their teaching practices in the school settings or viewing the video recordings of them. The instructors also provided written feedback on their web-based portfolio artifacts.

The two members of the research team played the role of “observer as participant” (Glesne 1999), such that they met with the instructors several times to discuss the management of the course tasks and the challenges they experienced in their implementation. The team offered assistance to the instructors, when needed, such as technological support or the management of course tasks.

### **The Nature of Teaching Practicum Course Tasks**

The teaching practicum courses, in which this study took place, were structured around the idea of supporting preservice teachers’ reflective thinking as “a meaningful way of approaching learning about teaching” (Loughran, 2002, p. 33). In doing so, a customized web-based portfolio software, namely BOUNCE© (Oner & Adadan, 2012), was utilized as a tool for reflection, which included the blend of both technological (BOUNCE web-based portfolio software) and pedagogical (BOUNCE teaching practice model) components (Oner & Adadan, 2016).



The BOUNCE teaching practice model was grounded in two premises: One involved the three processes of effective portfolio development such as identifying teaching goals, collecting evidence to connect goals with practice, and the owners' critical reflections to become aware of their actions and thoughts (Wolf, 1994). The second one has to do with the three aspects of "teacher's life space", namely goals, experiences, and observations (Fuller & Bown, 1975). Thus, the task cycle of the BOUNCE teaching practice model was designed to offer the participants opportunity for noticing and reducing the discrepancies among these three aspects of their life space (see Figure 1). Consistent with these premises, the BOUNCE web-based portfolios included the four different artifacts: (a) a general teaching goal, (b) lesson plans, (c) teaching practice video-recordings, and (d) reflection tasks. The BOUNCE portfolio artifact development processes within each task cycle will be described in the following paragraphs.

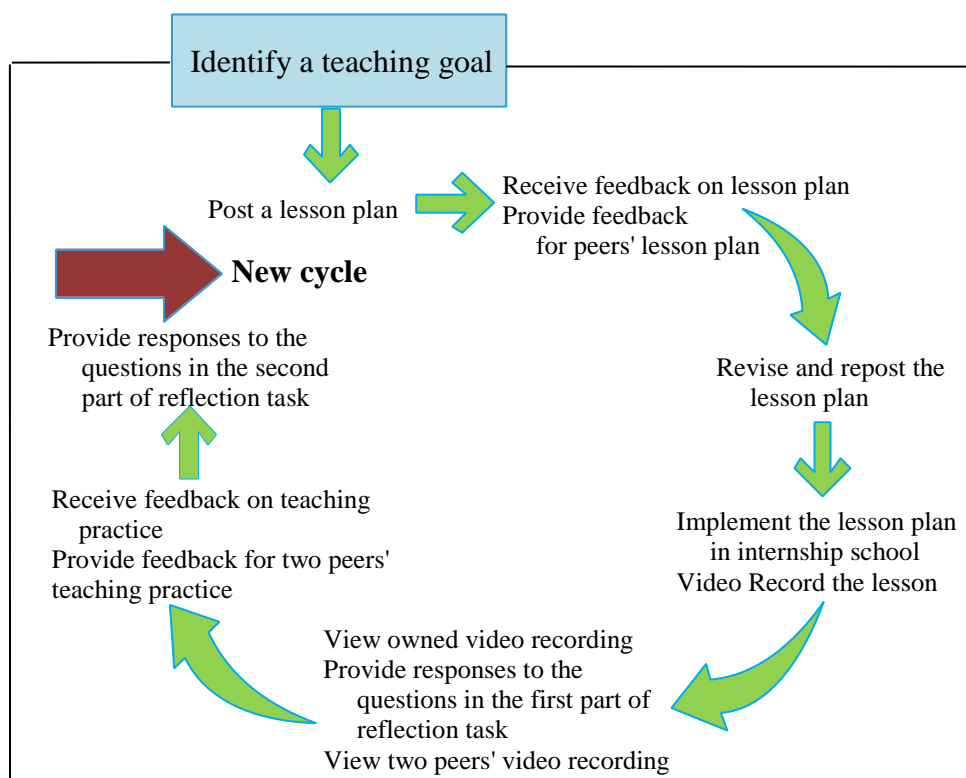


Figure 1. Task cycle of BOUNCE teaching practice model (Oner & Adadan, 2016).

As an initial task, the participants individually identified a general teaching goal (e.g., creating effective discussion environment), which helped shape their lesson plans and classroom teaching practices (*goals*) (see Figure 1). They developed their lesson plans in accord with their teaching goals, and they posted them on BOUNCE for receiving written feedback from their instructor and two peers. Then, they revised their lesson plans based on the feedback and reposted on BOUNCE. They also provided lesson plan feedback to two of their peers (not the ones from whom they received feedback).

The participants implemented their lesson plans in their internship schools (*experiences*). They recorded their teaching practice lessons by using video cameras and uploaded the video files to their BOUNCE portfolios. Before responding to the reflection task questions, the participants were asked to view their video-recorded classroom teaching sessions to focus their attention on their teaching performance and critically examine their actions from their own eyes (Loughran, 2002; Parsons & Stephenson, 2005). They then

completed the first part of their reflection task which required them to recognize the discrepancies between their goals and experiences and reflect on such discrepancies (see Figure 2; Appendix).

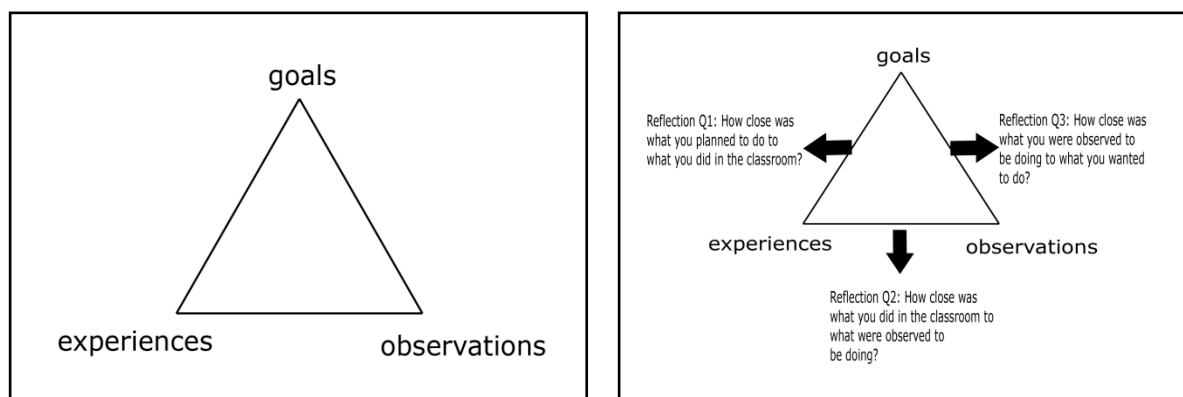


Figure 2. A teacher's life space and reflection task questions (Oner & Adadan, 2011, 2016).

Once the participants completed the first part of their reflection task, they invited their two peers and the instructor to view and give feedback on their teaching practice video-recordings on BOUNCE (*observations*). However, others were not the only assessors of their teaching practice, it is important to note that the participants themselves sometimes acted as the third eye as well, reaching new realizations and understandings about their own practice. In fact, the feedback from others offered preservice teachers invaluable opportunity for perceiving the discrepancies between their goals and experiences from others' point of view. Thus, based on the others' *observations*, the participants completed the second part of their reflection tasks (see Figure 2; Appendix). The participants also offered feedback to two of their peers by viewing their video-recorded teaching sessions. Note that the participants did not provide feedback to the ones that they received feedback for their teaching practice.

### Data Collection

The research questions were addressed by coding and analyzing two forms of data (qualitative and quantitative) coming from two sources, namely two sets of reflection task responses and a Likert-type metacognitive awareness inventory (MAI).

*Reflection Task Responses.* The participants completed the task cycle of the BOUNCE teaching practice model twice (see Figure 1) and generated two sets of reflection task responses throughout the spring semester. In this respect, the participants mainly responded to three overarching questions that likely helped them become aware of the inconsistencies among their goals, experiences, and observations by themselves and others (see Figure 2 and Appendix). The participants' reflection task responses in written form resulted in textual data, ranging from 750 to 4000 words in length.

*Metacognitive Awareness Inventory (MAI).* The participants filled out the MAI at the beginning of their teaching practicum course, before they started the task cycles of the BOUNCE teaching practice model. This instrument (Schraw & Dennison, 1994) measures two broad dimensions of metacognitive awareness, namely knowledge of cognition (KoC), and regulation of cognition (RoC). The MAI consists of 52 items with a 5-point likert scale, which varies from "1-always false" to "5-always true." As reported by Schraw and Dennison, the factors associated with the two components are highly reliable ( $\alpha = 0.90$ ) and intercorrelated ( $r = 0.54$ ). The internal consistency of KoC and RoC components are quite

high, ranging from 0.93 to 0.88 (Schraw & Dennison, 1994). In addition, the MAI has been found to have strong predictive validity for the subsequent performances (e.g., test performance) (Schraw & Dennison, 1994). However, there is no information available about convergent, divergent, and construct validity of the MAI.

The KoC component measures participants' awareness of their "strengths and weaknesses, knowledge about strategies and why and when to use those strategies" (Schraw & Dennison, 1994, p. 471). The MAI includes a total of 17 items relevant to the KoC component, involving three subscales: declarative knowledge (8 items), procedural knowledge (4 items), and conditional knowledge (5 items). In addition, 35 items of MAI are associated with the RoC component, which measures the degree to which participants plan, monitor, and evaluate their own learning. The RoC comprises five subscales, particularly planning (7 items), information management (10 items), monitoring (7 items), debugging strategies (5 items), and evaluating (6 items). The internal consistency of two components of MAI was also calculated by using the current data of the study, and the Cronbach alpha coefficients for the KoC and RoC components were found to be 0.89 and 0.93, respectively.

### Data Analysis

*Reflection Task Responses.* The textual data from two sets of reflection task responses were coded by utilizing the *constant comparative method* (Glaser & Strauss, 1967). Data coding started with dividing each participant's reflection task responses into meaningful units (Merriam, 1998). Each unit involved one particular issue (see Merriam, 1998). Coding of data units initially started with using the 6 codes (that is, reflective thinking indicators) from an earlier study (see Oner & Adadan, 2011), and as the coding proceeded, the researchers compared each unit of reflection task responses to the coding key and also looked for possible new codes in the data to include in the coding key (see Table 1 for coding key). However, no new code emerged from the current data.

Reflective Thinking Indicators	Descriptions
<i>High-level</i>	
Claim-Evidence (C-E)	Making claims about whether certain goals are met during teaching and offering either acceptable experience-based evidence or theoretical background information to support the claims associated with goals and experiences.
Reflection-in-action (RNA)	Assessing experience and expressing the emergent action taken (not always previously planned) during the experience to manage the incident.
Reflection-on-action (ROA)	Reflecting on self-experience concerning goals and experience and elaborating on possible changes as a result of observing oneself from outside.
Recognizing discrepancies (RECD)	Reflecting back on the peer and instructor feedback and recognizing discrepancies between goals and experiences after they are pointed out by peers or the course instructor.
<i>Low-level</i>	
Goal-experience discrepancy (GED)	Simply realizing and stating that some goals are not met during teaching.
Describing experience (DE)	DE from the point of view of the preservice teachers that does not qualify as C-E. In other words, these statements simply described what happened in the classroom without making any claims about what those events might indicate.

**Table 1. Coding key for reflective thinking indicators.**

As shown in Table 1, the reflective thinking indicators were divided into two, as high-level and low-level ones (see Oner & Adadan, 2011). This is because the six categories were

perceived to be uneven, as the coding proceeded, in term of reflecting the participants' interpretation of their teaching practice experiences and promoting learning (see Davis, 2006; Lee, 2005). In other words, the four high-level reflective thinking indicators (C-E, RNA, ROA, and RECD, see Table 1) showed more promise of minimizing the discrepancies among the three aspects of a teacher's life space compared to the other two (GED, DE; see Table 1 & Fuller & Bown, 1975). The categories of GED and DE were mainly descriptive without much analysis so that they were classified as low-level reflective thinking indicators (see Davis, 2006; Lee, 2005). Each reflective thinking indicator was defined with respect to its specific reflective features, and in particular the high-level reflective thinking indicators were derived from various theoretical grounds. For example, evidence-based explanations were viewed essential for scientific inquiry, since they exhibit advanced reasoning as well as a deeper understanding of phenomenon (McNeill & Krajcik, 2008). Similarly, preservice teachers may develop their own learning about teaching through building evidenced-based explanations of their own practice. The Claim-Evidence (CE) reflective thinking indicator was based on this idea. The reflective thinking indicators of Reflection-in-Action (RNA) and Reflection-on-Action (ROA) were basically grounded in Schön's (1983) work on reflection, both of which provide evidence about one's sophisticated considerations on their own professional practice (see Davis, 2006; Lee, 2005). The reflective thinking indicator of Recognizing Discrepancies (RECD) mainly demonstrated the preservice teachers' new realizations when they received feedback from others, and such realizations frequently gave rise to the reinterpretation of their teaching practice (see Davis, 2006; Lee, 2005). Such thought processes are believed to be closely linked to the one's metacognitive awareness, in particular with the regulation of cognition component. The reflective thinking indicator of Goal-Experience Discrepancy (GED) simply exhibited the participants' awareness about the existence of inconsistencies between their goals (what they had planned to do) and their experiences (what they had done in the class). The reflective thinking indicator of DE included the participants' description of an important event in their practice, but such descriptions did not go beyond the plain portrayal of an event, demonstrating no new ways of sense making concerning their own teaching practice.

The reliability of verbal data from the participants' reflection task responses was established in two different ways. The codes (reflective indicators) were adopted from an earlier study collecting similar data from a different group of preservice teachers (Oner & Adadan, 2011). This provided evidence that these previously identified reflective thinking indicators were capable of capturing the current data. In addition, 20% of the participants' reflection task responses (14 of 72) were selected at random, and two researchers coded the data independently. The segmentation of textual data into meaningful units and their coding into reflective thinking indicators were performed simultaneously (Strijbos et al., 2006) and thus inter-rater agreement was calculated at 96%. Inconsistencies in segmentation and coding across the raters were identified and resolved through discussions.

*MAI scores.* First, the total MAI score of each participant was computed by summing their individual item ratings (in a 5-point scale). The scores for eight MAI components were also computed for each participant by summing up the ratings of items associated with a particular component (see MAI description in the previous sections).

For research question 1, a median score of 193.50 was obtained by utilizing the 36 participants' total MAI scores. The participants whose total MAI scores were 193 or below were included in the low MA group, and the participants whose scores were above 193 were assigned to the high MA group. Based on the group assignment criteria, each group consisted of 18 participants. In addition, each participants' reflective thinking indicators at each task cycle were identified, and the total frequencies of the six different reflective thinking indicators were calculated for each group of participants by adding up the frequencies of

these six reflective thinking indicators in the first and second task cycle. In addition, the total frequencies of the six reflective thinking indicators within each group were represented in percentages. Then, comparisons were performed across the groups concerning the nature and frequencies (percentages) of reflective thinking indicators of teaching practice experiences.

For research question 2, the total numbers of high-level reflective thinking indicators (C-E, RNA, ROA, and RECD) were found for each participant to identify their high-level reflective thinking scores. The low-level reflective thinking scores were also calculated by adding up the total numbers of two low-level reflective thinking indicators (GED and DE). Then, the two Wilcoxon-Mann-Whitney tests were performed to identify if there were statistically significant differences between the high MA and the low MA group of participants' high-level and low-level reflective thinking indicators of teaching practice experiences.

For research question 3, the Pearson correlation coefficients were calculated between *all* participants' high-level reflective thinking scores and their total MA scores (calculated from MAI scale) and their scores for each MA component (8 in total) to find out the strength of association between these variables.

## Results

Research Question 1: *What are the nature and frequencies of reflective thinking indicators exhibited by the preservice teachers with high MA and low MA?*

Table 2 shows the frequencies and percentages of high-level and low-level of reflective thinking indicators generated by the preservice teachers with high MA and low MA. On the one hand, the preservice teachers with high MA generated a total of 645 reflective thinking indicators, and about 479 of these indicators (74.2%) were high-level. On the other hand, the preservice teachers with low MA created a total of 465 reflective thinking indicators, and 295 of these (63.4%) were classified as high-level reflective thinking indicators.

Reflective Thinking Indicators	High MA Group (N = 18)		Low MA Group (N = 18)	
	Frequency	Percentage	Frequency	Percentage
<i>High-level</i>				
Claim-Evidence (C-E)	104	16.1	68	14.6
Reflection-in-action (RNA)	37	5.7	31	6.7
Reflection-on-action (ROA)	213	33.0	122	26.2
Recognizing discrepancies (RECD)	125	19.4	74	15.9
<i>Total</i>	479	74.2	295	63.4
<i>Low-level</i>				
Goal-experience discrepancy (GED)	30	4.7	41	8.8
Describing experience (DE)	136	21.1	129	27.8
<i>Total</i>	166	25.8	170	36.6
<b>TOTAL</b>	<b>645</b>	<b>100.0</b>	<b>465</b>	<b>100.0</b>

**Table 2. The frequencies of reflective thinking indicators exhibited by a high level of MA and a low level of MA group.**

The most frequent high-level reflective thinking indicator appeared to be *reflection-on-action* (ROA) in both groups, but the frequency of observing such an indicator was still different across the groups. For example, the high MA group created a total of 213 ROA indicators (33%), whereas the low MA group generated as many as 122 ROA reflective thinking indicator (26.2%). The reflective thinking indicator of RECD was the second most commonly observed one. A notable difference was observed across the two groups regarding the frequencies of RECD reflective thinking indicators (High MA: 125 [19.4%]; Low MA: 74 [15.9%]). The least frequent reflective thinking indicator was *reflection-in-action* (RNA) in both groups.

The high MA group generated almost the same number of low-level reflective thinking indicators as the low MA group (see Table 2). However, the total percentages of low-level reflective thinking indicators markedly differed across the groups (High MA: 166 [25.8%]; Low MA: 170 [36.6]). Table 3 and Table 4 show the representative excerpts of reflective thinking indicators from the reflection task responses of high MA and the low MA group, respectively.

Research Question 2: *How do the preservice teachers with high MA and low MA compare in terms of the frequencies of high and low-level reflective thinking indicators?*

The Wilcoxon-Mann-Whitney test statistics on the participants' high-level reflective thinking scores indicated a statistically significant difference between the mean ranks of the two groups ( $U = 51.000$ ,  $p < 0.01$ ). That is, the Wilcoxon-Mann-Whitney test confirmed that the participants with high MA (Mean Rank: 24.67; Median: 25.50) generated greater number of high-level of reflective thinking indicators than the preservice teachers with low MA (Mean Rank: 12.33; Median: 14.00). However, the Wilcoxon-Mann-Whitney test statistics on the participants' low-level reflective thinking scores revealed no statistically significant difference between the mean ranks of the two groups ( $U = 157.000$ ,  $p > 0.05$ ). In other words, it could be assumed that the participants with high MA (Mean Rank: 18.78; Median = 10) produced a similar number of low-level reflective thinking indicators regarding their teaching practice experiences as the preservice teachers with low MA (Mean Rank: 18.22; Median: 9).

Research Question 3: *What are the relationships among the high-level reflective thinking scores, the total MA scores, and the scores for the components of MA?*

The Pearson correlations were calculated by merging the two groups of participants into one group. Table 5 shows the Pearson correlations between the participants' high-level reflective thinking scores, their total MA scores, and their scores for each MA component, namely declarative knowledge, procedural knowledge, conditional knowledge, planning, monitoring, information management, debugging strategies, and evaluation. The Pearson correlation analysis resulted in a statistically significant and positively moderate relationship between the participants' total MA scores and their high-level reflective thinking scores ( $r = 0.62$ ;  $p < 0.01$ ). Furthermore, Pearson correlations between the scores for all MA components and high-level reflective thinking scores were statistically significant at the 0.01 level. Interestingly, among the eight components of MA, the highest statistically significant Pearson correlation coefficient observed was for the relationship between the participants' monitoring scores and their high-level reflective thinking scores ( $r = 0.628$ ;  $p < 0.01$ ). The second highest association was recorded between the participants' evaluation scores and their high-level reflective thinking scores ( $r = 0.609$ ;  $p < 0.01$ ).

Categories	Examples
Claim-Evidence (C-E)	<p>My instructional objective was that students will explore and explain the relationship between the pressure of a gas and its volume at constant temperature. Based on their interpretations about the daily life phenomena during the closure of the lesson, I thought that students well understood the relationship between pressure and volume of a gas. This is because students completely and correctly explained the several phenomena (e.g., decompression sickness, bursting of a balloon, ear clogging as an airplane climbs) by relating their explanations to the pressure and volume relationship (Boyle's Law). For example, one of the students explained the decompression sickness as such: As divers go deeper in the sea, pressure increases, and the volume of a gas existing in divers' tissues decreases. Therefore, if divers suddenly start going up in the sea, the pressure quickly decreases, and the volume of a gas existing in tissues increases. This causes a damage in tissues, and this is called "decompression sickness". (PST 6 – Reflection Task 1)</p>
Reflection-in-action (RNA)	<p>I have experienced such a situation in the classroom that I did not plan but decided to implement. While I was explaining the relationship between the diffusion rate of gases and their molecular masses, I did not plan to talk about where the square root in the formula for Graham's Law of diffusion comes from. When students asked about that for the first time, I just told them that it came out as a result of experiments, because I did not want them to deal with mathematical procedures. However, later on in the same lesson, I got another question related to this issue. Since I noticed that I had enough time to complete my planned activities before the end of the lesson, I explained that the square root in that formula comes from kinetic energy equation. Thus, students understand the issue better, and they become more satisfied with my explanation. (PST 13 – Reflection Task 1)</p>
Reflection-on-action (ROA)	<p>If I repeat the lesson that I already did, the first thing that I would like to change to reach my teaching goal was to make decisions about increasing my interactions with students. For example, when I had been giving directions to students, I might have tried to keep students' computer screens closed. This may have prevented students from asking the directions again and again and decreased the number of students who did not understand what they need to do. Therefore, I would have presented them more useful, concrete and current information about where the blogs are used and the design features of blogs. (PST 15 – Reflection Task 1)</p>
Recognizing discrepancies (RECD)	<p>My instructor and my friend commented similarly on the issue of not expressing the reason for my warning to students, which was about not directly copying the text from the internet while preparing the brochure. They were totally right, when I think back, I should have definitely expressed my warnings' reason to students. Therefore, [If I had done so], in their another work, students will have remembered why the copying of whole text from the internet was wrong, and probably there will have been no need to repeatedly warn them. In addition, more importantly, in the early age, I might have prevented them from using the text that is not produced by themselves as if it was theirs. (PST 14 – Reflection Task 1)</p>
Goal-experience discrepancy (GED)	<p>During the lesson, I could not ask several of my questions that I planned to ask in my lesson plan. Following the first few of my questions, I had to change my other questions with respect to students' responses. I thought that students would have remembered how to write equilibrium constant equation [but they have not], and then I planned to ask my other questions. For example, I was going to ask them to give examples of equilibrium reaction from daily life, but I could not ask such a question. (PST 12 – Reflection Task 1)</p>
Describing experience (DE)	<p>The activity that I planned did not go well. When I tried it on Monday, [I divided the purple solution into two test tubes], and as I increased the temperature of one of the test tubes, the color difference [turn to dark blue] was apparent, but when I cooled down the other test tube, there was a problem, no fading in color was observed. On Wednesday, everything happened almost the other way around. When I heated up one of the test tubes, just a little bit of blue color was observed on the top of the solution, whereas when I cooled down the other test tube, its color was apparently faded. I think, on Wednesday, lab technician added the concentrated acid more than it was supposed to be. Compared to my Monday trial, on Wednesday, the color of beginning solution was quite dark purple. (PST 7 – Reflection Task 1)</p>

**Table 3. Examples of reflective thinking indicators from the high level of MA group.**

Categories	Examples
Claim-Evidence (C-E)	I believe that, to a great extent, students reached my instructional objectives. Tasks that I assigned to students required using the different features of interface and text organization functions. Students, who did not perform the given task, asked me for help. The most frequently asked questions had to do with how to make the text bold and how to add new slide. I individually approached to the students who asked such questions. First, I told them what they need to do, but if they still did not understand. I showed them where they need to click on the computer screen. I did not leave them alone until observing that they did the task right. They needed to use the same features again in another task, but no one asked me the same things again. In addition, I checked if each student completed this new task by using the required text organization features, and everybody did it right. (PST 18 – Reflection Task 1)
Reflection-in-action (RNA)	I planned to ask students for drawing a molecular level representation, but based on students' level, I had to make some changes in my plan. I tried to explain them what they need to do while drawing a molecular level representation. Because students never thought about the particular phenomenon at the molecular level, my explanations about how to draw took me longer than I expected. Thus, I had trouble with my time management. You may have noticed in my video recording that at some point, I was asking students if they have drawn molecular level representations before, and I was getting “no” as a response. (PST 1 – Reflection Task 2)
Reflection-on-action (ROA)	During the lesson, students identified the powdered sugar and table salt mixture as a homogeneous mixture, this took my attention. I never thought before the lesson that students will misunderstand the heterogeneous solid-solid mixtures. Therefore, I had trouble with guiding the discussion when students called a heterogeneous solid-solid mixture as a homogeneous mixture. It was quite difficult to ask good questions to handle students' responses without telling the right answer... If I had a chance to repeat the lesson, I would have tried to think about the topic from students' point of view. At points where I consider to be easy, students may have conceptual issues, and I am caught up unprepared. For example, if such a misunderstanding had come to my mind before the lesson, I would have asked better questions to guide the classroom discussion on the nature of solid-solid mixtures. (PST 2 – Reflection Task 1)
Recognizing discrepancies (RECD)	...After watching my teaching practice video, I had found my performance better than I expected, because I was not excited, I sequentially followed my lesson plan, and I finished what I planned within a 40-minute lesson. However, after getting the feedbacks, I understood that I was not able to create a discussion environment during the lesson, which was my general teaching goal. I was thinking that I achieved my teaching goal, because students' responses to my questions and their active participation to the activity seemed to me an appropriate learning environment for my teaching goal. After reading the feedbacks, I realized that when I got the first answer from a student, [if it was the right answer], I had approved the answer right away without giving a chance to other students to share their ideas. This had prevented students from having brainstorming. Although I basically tried to invite students to the blackboard and have one-to-one question-answer dialog with them, these indicators seems to not meet my teaching goal of creating discussion environment... (PST 4 – Reflection Task 1)
Goal-experience discrepancy (GED)	...students did not show the similar progress while working on the given task. Because some students were very quick, and some other students were somehow slow, I needed to have one-to-one interaction with students, and I individually offered further directions related to the task. On the board, I only showed certain issues when all students are stuck. However, I planned to show everything on the board step-by-step. (PST 11 – Reflection Task 2)
Describing experience (DE)	After offering students information required for creating graphs, I asked all students about their favorite fruit and generated a frequency table, and then students started creating a graph by using the information on the table. As they work on the task, I went around and helped them... Then I gave students three empty tables with different directions to be filled out individually. Once students filled out the tables, they needed to create different types of graphs, because each table had different types of data. While students were working on creating graphs on the computer, they tried to understand how to do certain things by asking my help. I believe that students learn better what I want them to learn when they find out such things at the time that they need them. (PST 17 – Reflection Task 2)

**Table 4. Examples of reflective thinking indicators from the low level of MA group.**



Pearson Correlation	Metacognitive Awareness								
	<i>DK</i>	<i>PK</i>	<i>CK</i>	<i>P</i>	<i>IM</i>	<i>M</i>	<i>DS</i>	<i>E</i>	<i>Total</i>
High-level reflective thinking	.45**	.42**	.50**	.52**	.42**	.63**	.49**	.61**	.62**

\*\* $p < 0.01$

Note: DK-Declarative Knowledge, PK-Procedural Knowledge, CK-Conditional Knowledge, P-Planning, IM-Information Management, M: Monitoring, DS-Debugging Strategies, E-Evaluation

**Table 5. Pearson correlations between the preservice teachers' scores for total MA (and for each MA component) and their high-level reflective thinking scores.**

## Discussion

This study aimed to investigate (a) how the level of preservice teachers' metacognitive awareness influences the nature and frequencies of their reflective thinking indicators, and (b) the associations among the high-level reflective thinking scores, total MA scores, and the scores for each MA component. The statistical and descriptive findings of the study provided comprehensive and consistent evidence from multiple points of view.

The first piece of evidence showed that the participants with high MA produced more reflective thinking indicators (645) about their teaching practice experiences compared to the participants with low MA (465). In addition, the total frequency of high-level reflective thinking indicators (the total number of cases of C-E, RNA, ROA, and RECD) observed in the group of participants with high MA was notably higher than those generated by the group of participants with low MA (see Table 2). Consistent with the descriptive findings, a Wilcoxon-Mann-Whitney test revealed a statistically significant difference between the frequencies of high-level reflective thinking indicators exhibited by the groups of participants with high MA and low MA.

The difference concerning the frequencies of total and high-level reflective thinking indicators between the two groups can be associated with the interaction between the features of context, and the level of preservice teachers' MA. Such contextual features involved the *processes of portfolio construction*, the *reflection tasks*, and the *feedback from others*. While the participants were constructing their portfolios, they identified their teaching goals, and collected the evidence pertinent to their goals (lesson plans and teaching practice video recordings) (Wolf, 1994). Reflection tasks were also a part of portfolio construction process, and these tasks were framed in a way to assist participants go beyond describing their teaching practice experiences and develop more in-depth interpretations and understandings of their teaching practice as they tried to minimize the discrepancies among their goals, experiences, and observations (see Appendix; Barth-Cohen et al., 2018; Fuller & Bown, 1975; Loughran, 2002). In this respect, reflection tasks were completed in two phases, and in the first phase, the participants were able to *return to their experiences* by viewing the video recordings of their teaching practice, and they also had the opportunity for *attending to feelings* connected with their experiences in real classroom settings (Boud et al., 1985). Then, the participants provided responses to the reflection task questions based on their observations and interpretations, in which they possibly *reevaluated their experiences* as they were comparing and contrasting their goals and experiences from their own eyes (Boud et al., 1985). In the second phase of reflection tasks, the preservice teachers reevaluated their teaching practice experiences after getting feedback from others (instructor and their peers), which was another contextual feature of the study. This offered the participants an opportunity for reviewing their experiences from others' eyes, which helped them notice the diverse ways for approaching their experiences or the different issues with their teaching

practice that they have not paid attention to (Fuller & Bown, 1975). The nature of reflective thinking (active and conscious process) and the features of current context, namely examination of teaching practice videorecordings, reflection task questions (a set of written prompts for scaffolding reflective thinking process), and feedback from others, had probably stimulated particular reflective thinking processes. It seems that the participants with high MA might have been more thoroughly and competently analyzed and interpreted their teaching practice experiences by going beyond mere descriptions compared to the participants with low MA (see Table 1 for the descriptions of C-E, ROA, RNA, RECD). This also created substantial difference both in the total frequencies of reflective thinking indicators and the frequencies of high-level reflective thinking indicators.

The frequencies of four high-level reflective thinking indicators (the cases of C-E, ROA, RNA, and RECD), each with the particular nature, differed across the two groups in favor of the participants with high MA (see Table 2). The ROA (*reflection-on-action*) cases was the most frequently observed high-level reflective thinking indicator. In the current study, the ROA cases represented preservice teachers' reflections on their self-experience concerning their goals and experiences, reconsidering probable changes in their planning and practice as a result of observing oneself from outside. The ROA cases also exhibited evidence for participants' high-level awareness about their teaching and student learning, which exceeds their *survival* concerns (Fuller & Bown, 1975, see Table 3 & 4 for the representative excerpts). The participants with high MA offered more changes in relation to their lesson planning, their teaching, and their students' learning following their teaching practice compared to the participants with low MA. As pointed out in the previous studies, reflection-on-action requires regulating metacognitive processing skills, more specifically planning, monitoring, and evaluation skills, while individuals elaborate on their teaching practice (Davis, 2006; Schön, 1983; Schraw & Moshman, 1995; Zohar & Barzilai, 2013). Thus, compared to their counterparts, the participants with high MA perhaps more frequently and capably managed their metacognitive processing skills, expressing relatively more sophisticated considerations about their teaching practice.

The RECD (*recognizing the discrepancies*) cases was the second more frequently observed high-level reflective thinking indicator. In the current study, with the RECD cases, participants not only noticed the inconsistencies between their own interpretation of their self-experience and the others' views about their teaching practice but also elaborated on their teaching practice in light of the feedback from others, offering further possible changes regarding their teaching practice (see Table 3 & 4 for the representative excerpts). Such reflective thinking processes might have enabled the participants, in particular those with high MA, to advance their reevaluations beyond *association* and *integration* to *validation* and *appropriation* (see Boud et al., 1985). That is, when the participants had received the feedback, due to the nature of the reflection task, they should have made comparisons to ensure the internal consistency between the new insights from the others points of view and the available ones (*validation*, Boud et al., 1985). In addition, if the participants had kept thinking about such inconsistencies, they personally might have arrived at the new insights from multiple perspectives (*appropriation*, Boud et al., 1985). When considering the characteristics of reflective thinking taxonomy offered by Lee (2005), both the ROA and the RECD cases (see Table 3 & 4 for the related excerpts) appear to be quite well overlapping with the level of *reflectivity*, representing the highest level of depth in reflective thinking.

The RNA (*reflection-in-action*) cases are the least frequently observed high-level reflective thinking indicator (see Table 2). This finding is consistent with Hatton and Smith's (1995) claim, which stated that reflection-in-action requires "the complex and demanding kind of reflection, calling for multiple types of reflection and perspectives to be applied during an unfolding professional situations" (p. 44). In other words, the participants should

have been able to consciously think about an action as it is happening. In doing so, they needed to first make sense of what is happening and then shape their successive practices by considering the multiple issues simultaneously. In fact, such kind of reflection can only develop as a result of substantial experience (Schön, 1983), alongside sophisticated metacognitive processing skills (Hatton & Smith, 1995). The participants of the study had no previous teaching experience, they had just started practicing teaching for the first time in classroom settings. Thus, the participants were less likely to think about their actions as they were teaching, and when they thought about their actions on the spot, the time management issue was their main concern when they tried to reshape their successive practices (see Table 3 & 4 for the excerpts).

A statistically significant moderate relationship was found between the participants' total MA scores and their high-level reflective thinking scores (see Table 5). There was also a statistically significant relationship between the participants' scores for each MA component (e.g., planning, monitoring, etc.) and their high-level reflective thinking scores (see Table 5). Among such cases, of the associations between the number of high-level reflective thinking scores and the participants' *monitoring*, *evaluation*, and *planning* scores, were the highest ones.

Researchers suggested a number of explanations regarding the relationship between metacognitive awareness and reflective thinking. Some considered reflective thinking as a means to metacognitive awareness (Desautel, 2009; Knight, 2002), while others suggested that metacognitive awareness is an antecedent of reflective thinking (Eraut, 2000; Graham & Phelps, 2003; Hammerness et al., 2005; Larrivee, 2008; Rogers, 2001; Parsons & Stephenson, 2005; Whittaker & vanGarderen, 2009). In this respect, consistent with our definition of reflective thinking, which is a form of active and conscious processing of experiences, the findings suggested that when the participants were good at managing the three metacognitive processing skills (*monitoring*, *evaluation*, and *planning*), they more frequently exhibited the high-level reflective thinking indicators.

The findings regarding the association between the components of MA and high-level reflective thinking were consistent with the previous studies, such that the most essential metacognitive skills were claimed to be planning, monitoring, and evaluation (Ertmer & Newby, 1996; Schraw, 2001). In fact, the participants of the study had to utilize these three metacognitive processing skills dominantly and frequently to complete the task cycle of BOUNCE teaching practice model. For example, as part of the task cycle, the participants planned their teaching practice lessons ahead of time. Ertmer and Newby (1996) reported three issues as important for planning, that is, setting goals, selecting strategies, and having alternatives for probable obstacles. While *planning* their lessons, the participants needed to consider their instructional objectives and already determined general teaching goals. They attempted to plan their teaching practice lessons by selecting proper learning tasks and teaching strategies within the limits of time (a lesson hour) and resources (available knowledge and materials) to show the observers that they were able to meet both their instructional objectives and their general teaching goal. Monitoring of an action (in the current case, the act of teaching) is regarded to be a sophisticated process, involving an awareness of one's actions, an understanding of whether the actions fit into the established sequence of activities, and a planning for the next steps (Ertmer & Newby, 1996). The participants were supposed to mentally *monitor* their teaching actions while they were executing their lesson planning to make sure that they were effectively moving toward their goals. Evaluation takes place after the completion of a task (e.g., execution of a lesson plan) and involves assessing whether the process was effective enough and to what extent the established goals were achieved (Ertmer & Newby, 1996). The participants went through the *evaluation* phase while they were working on the reflection tasks. First, they evaluated their

teaching performance from their own eyes, and as an evidence of their learning about teaching, they made judgments about the relative efficacy of their teaching and offered probable modifications for the improvement of their subsequent teaching. Then, they reevaluated their teaching performance based on the feedback they received from the others for further insight.

## Implications

The findings from the study provided empirical evidence for the significance of the level of metacognitive awareness in exhibiting advanced reflective thinking skills and perhaps maintaining such skills over a long-term professional teaching career. In the current study, the level of participants' existing metacognitive awareness was captured by MAI before they started working on the task cycles of the BOUNCE teaching practice model (see Figure 1). During these task cycles, there was *no* explicit attempt to promote the participants' metacognitive awareness, but the nature of these tasks might have implicitly helped participants improve their metacognitive awareness. In this respect, teacher educators may consider adopting similar tasks into their teaching practice courses (see Figure 1); however, they should include additional tasks that may contribute to the development of preservice teachers' metacognitive awareness in teaching practice, such as providing specific scaffolding guidelines for monitoring and evaluating teaching performance. Such guidelines are probably essential for promoting metacognitive awareness, when preservice teachers examine their teaching practice video recordings.

A value of timely and high-quality feedback on the participants' portfolio artifacts also needs to be recognized in terms of promoting reflective thinking and in turn metacognitive processes. Because observations from others (e.g., feedback) are one of the key components of teachers' life space (Fuller & Bown, 1975), the portfolio tasks were designed accordingly. To experience the teachers' life space, eportfolio software like BOUNCE allowed preservice teachers to easily share all sorts of artifacts (e.g., lesson plans, videorecordings of teaching practice) and the feedback providers rapidly had access to the relevant documents (or media files) online at anytime and anywhere. Thus, participants received timely feedback on their lesson plans and teaching practice experiences (videorecordings of teaching practice). In addition, an artifact page was carefully designed to improve the quality of feedback such that users needed to carefully read the content of each section of an artifact (lesson plans, reflection tasks) and enter specific feedback for each section included in the artifact (see Oner & Adadan, 2016 for BOUNCE artifact page). However, if teacher educators utilize similar tasks and online platforms (see Figure 1), they should also consider structuring the way feedback is given by providing specific instructions to the feedback providers. These instructions should be structured in a manner that help them focus on the discrepancies among the preservice teachers' goals, planning, and teaching practice experiences (see Oner & Adadan, 2016). Such instructions might be helpful for both parties (feedback receivers and providers) in terms of efficiently stimulating their metacognitive awareness.

This study also suffered from some limitations. First is related to external validity. Even if the number of participants were sufficient for conducting statistical analysis, it was not large or diverse enough to make grand generalizations. Second, reflective writings are acknowledged to be an important tool to promote reflective thinking, so that the participants' reflective thinking indicators were identified based on the written data. The extent of participants' writing was adequate to get the big picture, but additional data might have been

collected by inviting the participants for interviews after they completed their reflective writing.

### Suggestions for Further Research

Studies might focus on various issues while exploring the interaction between metacognitive awareness and reflective thinking in the context of teaching practice. In the current study, such an interaction between these particular variables was explored with the preservice teachers with no teaching experience. Researchers might consider comparing the nature and frequency of reflective thinking with respect to the level of preservice and inservice teachers' metacognitive awareness. In addition, longitudinal studies may be designed to examine how the degree of preservice teachers' metacognitive awareness influence their reflective thinking development in teacher education programs and maintenance or advancement patterns of such a reflective thinking development over the years in a teaching career. Researchers might also compare the nature and frequency of reflective thinking across teachers from different cultural backgrounds or educational fields, considering the level of their metacognitive awareness.

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## Appendix

*Reflection Question 1: How close was what you planned to do to what you did in the classroom?*

- (1a) To what extent were you able to achieve your general teaching goal in your teaching practice? In your answer, please provide specific examples of student responses and your interactions with students.
- (1b) To what extent were your students able to meet your instructional objectives in your teaching practice lesson? In your answer, please provide specific examples of student responses and your interactions with students. Write up at least two instances in detail that are representative.
- (1c) Were there any planned learning activities that: (i) you were not able implement? (ii) you had difficulty with implementing? Please discuss with reasons.
- (1d) Were there any activities in the classroom that: (i) you implemented but did not plan? (ii) you planned but changed? If so, why did you make such changes? Please discuss with reasons.
- (1e) Please evaluate your teaching practice in terms of student learning based on students' artifacts generated in the class artifacts and your assessment at the end of the lesson.
- (1f) Please explain at least two issues that you noticed regarding students' conceptual understanding or learning difficulties during your teaching practice by providing concrete examples.
- (1g) If you were to repeat your lesson, what would you have changed to better meet your general teaching goal? Please discuss at least two changes along with your reasons for making them.
- (1h) If you were to repeat your lesson, what would you have changed to better meet your instructional objectives? Please discuss at least two changes along with your reasons for making them.

*Reflection Question 2: How close was what you did in the classroom to what you were observed to be doing?*

- (2a) According to your instructor and feedback peers, what were some of the indicators that you were able to achieve your general teaching goal? Compare and contrast their feedback with what you wrote as a reply to question **1a** (focus mainly on discrepancies rather than similarities). Please summarize the feedback you received item by item, and then provide a response.
- (2b) According to your instructor and feedback peers, what were some of the indicators that your students were able meet your instructional objectives? Compare and contrast their feedback with what you wrote as a reply to question **1b** (focus mainly on discrepancies rather than similarities). Please summarize the feedback you received item by item, and then provide a response.

*Reflection Question 3: How close was what you were observed to be doing to what you wanted to do?*

- (3a) Compare and contrast the feedback you received regarding your teaching performance with what you wrote as a reply to question **1c** and **1d** (focus mainly on discrepancies rather than similarities). Please summarize the feedback you received item by item, and then provide a response.

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