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Effects of Metacognition on Performance in Mathematics and Language- Multiple Mediation of Hope and General Self-Efficacy

Georgia Stephanou[1] & Fotini Tsoni[1]

[1] Faculty of Social and Humanities Studies, University of Western Macedonia, Greece

Correspondence: Georgia Stephanou, Faculty of Social and Humanities Studies, University of Western Macedonia, Florina, 53100, Greece. E-mail: gstephanou@uowm.gr

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Abstract

This study examined (a) students' reported use of metacognitive knowledge (declarative, procedural, conditional) and metacognitive regulation (planning, monitoring, information management, evaluation) when they are doing school work or homework, and the effect of metacognition on school performance in language and mathematics and (b) the role of hope (agency thinking, pathway thinking) in general self-efficacy, in the impact of general self-efficacy on metacognition, and in the effect of metacognition on school performance. One hundred and sixty-five 5th and 6th grade students (83 boys, 82 girls), randomly selected from 10 state primary schools of various regions of Greece, participated in the study. Data gathered at the second school term of the total three terms. The results revealed that: (a) the reported frequency of use of metacognitive knowledge (mainly, conditional) and metacognitive regulation (mainly, monitoring) was at a moderate extent, (b) hope (predominately, pathway thinking) was a positive formulator of general self-efficacy and of its impact on metacognition, but the influential role of the two constructs differed between and within the components of metacognition, (c) the three sets of predictors had complementary and positive effects on school performance but their relative power in influencing it varied between mathematics and language and within each school subject, with agency thinking being the most powerful predictor and (d) general self-efficacy mediated the impact of metacognition on school performance, while hope had direct impact on school performance beyond that of metacognition and general self-efficacy. The findings are discussed for their practical applications in education and future research.

Keywords: metacognition, hope, general self-efficacy, school performance

1. Introduction

During the last three decades, metacognition has documented as a critical contributor in self-regulated learning and successful learning (Abdellah, 2015; Dimmit & McComick, 2012; Efklides, 2014; Efklides & Misailidi, 2010; Gomes, Golino, & Menezes, 2014; Panadero, 2017; Stephanou & Mpiontini, 2017; Veenman, 2016; Veenman, Wilhelm, & Beishuizen, 2004). Despite the differences among the researchers about the components of metacognition, they agree that it consists of two key dimensions, metacognitive knowledge and metacognitive regulation which are mainly operationalized into monitoring (metacognitive knowledge and metacognitive experience) and regulatory (goals and activation of strategies) functions (see Adler, Zion, & Mevarech, 2016; Brown, 1987; Cleary, 2012; Efklides, 2001, 2008, 2014; Flavell, 1987; Jacobs & Paris, 1987; Perry, 2013; Schraw & Moshman, 1995; Tanner, 2012). Students who have well developed metacognitive knowledge and metacognitive regulatory skills and who use their metacognition they will excel academically (Alexander, 2008; Artelt, Naumann, & Schneider, 2010; Callan & Cleary, 2018; Carr, 2010; Efklides, 2011; Harris, 2015; Pintrich, 2002; Stephanou & Mpiontini, 2017; Thillmann, 2008; Winne & Nesbit, 2010; Zohar & David, 2009).

Most researchers have focused on the role of metacognition in science learning and problem solving (Taasoobshirazi & Farley, 2013; Zepeda, Richey, Ronevich, & Nokes-Malach, 2015), while a limited number of studies have examined how it is related to academic achievement across the full range of academic domains. In addition, students' developmental phase and educational level are crucial in understanding that link because elementary and older students might differ in prevalence and optimal combination of the constructs of metacognition (see Bakracevic-Vukman & Licardo, 2010; Schneider, 2008; Schneider & Lockl, 2006; Stipek & MacIver, 1989), and the high school context, compared to elementary school, is more autonomy-supportive, sets

more antaconistic goals and is less supportive (Eccles & Wigfield, 2000; Haselhuhn, Al-Mabuk, Gabriele, Groen, & Galloway, 2007; Midgley, Anderman, & Hicks, 1995; Stipek & MacIver, 1989). The present research examines metacognitive knowledge and metacognitive regulation in the fifth and sixth grade students, and how metacognition influences school performance in language and mathematics.

Although metacognition documented positive relation to academic achievement and successful learning (Bruning, Schraw, & Norby, 2011; Rosman, Mayer, & Krampen., 2015), academic self-regulation and success are not coming without motive (Benbenutty, Cleary, & Kitsantas, 2014; Caprara, Fida, Vecchione, Del Bove, Vecchio, Barbaranelli, & Bandura, 2008; Cera, Mancini, & Antionietti, 2013; Schunk & Zimmerman, 2006; Smit, de Brabander, Boekaerts, & Martens, 2017). Moreover, as Efklides (2011) suggests in her Metacognitive and Affective Model of Self-Regulated Learning (MASRL), the macro-level of SRL involves volitional, cognitive, motivational and affective trait-related person characteristics which also interact with micro-level process. Therefore, this study involves metacognition with self-efficacy and hope that are trait-related person characteristics and that have evidenced significant relationships with academic functioning and success.

Self-efficacy, which refers to an individual's belief in his/her ability to control challenging environmental demands by taking adaptive action (Bandura, 1997), is a crucial and proximal predictor of academic achievement. For example, high self-efficacious students get involved in more challenging and ambitious goals, insist more in pursuit the goals and, usually, get higher grades in various school subject and succeed (Coutinho & Neuman, 2008; Jansen, Scherer, & Schroeders, 2015; Lee, Lee, & Bong, 2014). Although, usually, following Bandura's (1997) suggestion, self-efficacy is thought as being either task-specific or domain-specific, the concept of generalized self-efficacy, that refers to a broad and stable sense of one's ability to deal effectively with a variety of demanding situations, has been suggested by some researchers (Luszczynska, Gibbons, Piko, & Teközel, 2004; Schwarzer & Jerusalem, 1995; Sherer, Maddux, Mercandante, Prentice-Dunn, Jacobs, & Rogers, 1982). In the present study, self-efficacy is perceived in its general sense.

As self-efficacy, but in a different way, past research has shown that the Snyder's (2000) cognitive goal- directed conceptualization of hope predicts goal directed behavior and student achievement (see Dixson, 2017; Feldman & Kubota, 2015; Rand, Martin, & Shea, 2011; Snyder, 2004; Stephanou, 2012). Hopeful students report school achievement success regarding competence, self-worth, attendance, course selection, grade, graduation rates and college going rates (Buckelew, Crittendon, Butkovic, Price, & Hurst, 2008; Ciarrochi, Heaven, & Davies, 2007; Kwon, 2000; Marques, Pais-Ribeiro, & Lopez, 2011; Ong, Edwards, & Bergeman, 2006; Pedrotti, Edwards, & Lopez, 2008; Snyder, Shorey, & Rand, 2006).

Overall, this study augments past research in three ways. First, despite the increased knowledge evidencing the positive role of the perception-based psychosocial factors of self-efficacy and hope in academic achievement, some aspects of how these factors influence academic outcomes are unknown (see Richardson, Abraham, & Bond, 2012, for a review). For example, the generalizability of the association of perception-based constructs with and academic behaviors has been limitedly examined as well as how these constructs interact each other has been narrowly studied. Second, few studies have examined the contribution of metacognition into academic achievement relative to self-efficacy (see Tian, Fang, & Li, 2018). Self-efficacy has impact on other cognitions and affect, and its influences on academic achievement behavior is also indirect (Bandura, 1997). For instance, self-efficacy proved a mediator factor of the impact of metacognition on school performance (Tian et al., 2018). Finally, to our knowledge, no study has investigated all three, metacognition, self-efficacy and hope, in prediction of school performance.

1.1 Metacognition and Academic Achievement

Although various conceptualizations of the term "metacognition" have been used in literature, it has been broadly defined as 'cognition about cognition' (Flavell, 1979) and refers to the regulation of one's own cognitive processes and encompasses the main constructs of meta-cognitive knowledge, metacognitive experiences and metacognitive skills / strategies (see Brown, 1978; Efklides, 2011, 2013; Flavell, 1978; Flavell, Miller, & Miller, 2002; Jacobs & Paris, 1987; Schneider, 2008; Veenman, 2011, 2016; Veenman, Van Hout-Wolters, & Afflerbach, 2006; Young, 2010).

Metacognitive knowledge or metacognitive awareness refers to individuals' knowledge of their own cognitive and affective processes, may vary between tasks, strategies, goals and other relevant to achievement of a pursuit goal information, and it consists of declarative, procedural and conditional knowledge (Efklides, 2008; Perry, 2013; Tanner, 2012). Declarative knowledge focuses on "knowing that", and refers to self, task, and strategies for achievement a specific task, procedural knowledge concerns "knowing how", and contains learning strategies and execution of procedural skills, while conditional knowledge is about 'when', 'where' and 'why' to use

certain cognitive actions or strategies (Flavell, 1979; Harris, Graham, Brindle, & Sandmel, 2009; Holland-Joyner & Kurtz-Costes, 1997; Pressley, Borkowski, & Schneider, 1989; Schraw, Crippen, & Hartley, 2006).

Metacognitive regulation refers to the actual activities that 'help control one's thinking or learning" (Schraw & Moshman, 1995, p. 354), that is, the implementation of metacognitive knowledge in the process of self-regulated learning, and it contains the three main components of planning, monitoring and evaluating (Artelt et al., 2010; Flavell, 1979; Hacker, 1998; Pressley, Borkowski, & Schneider, 1987; Schneider & Artelt, 2010; Veenman et al., 2006). Specifically: (a) Planning is comprised of activating relevant background knowledge, goal setting, determining time and effort allocation and selecting appropriate strategies for learnings, (b) monitoring involves the self- testing and assessment skills necessary to control the process of learning, ensuring that things make sense within the accepted cognitive frameworks, judging whether understanding is sufficient and the selected strategy is working, and searching for connections or conflicts with what is already known and (c) evaluation (Schraw, Crippen, & Hartley, 2006, p. 114) "refers to appraising the products and regulatory processes of one's learning" (Brown, 1987; Cera et al., 2013; Perry, 2013; Serra & Metcalfe, 2009; Schraw et al., 2006; Tarricone, 2011; Zimmerman, 2002).

Past researchers make evident the positive influential role of metacognition in academic achievement and learning (Artelt et al., 2010; Dimmit & McCormick, 2012; Dunlosky & Metcalfe, 2009; Efklides, 2014; Gaskill & Hoy, 2002; Hacker, Bol, & Keener, 2008; Thillmann, 2008; Winne & Nesbit, 2010) in various domains, such as mathematics (Callan & Cleary, 2018; De, Desoete, & Roeyers, 2000; Desoete, Roeyers, & Buysse, 2001; Desoete, Roeyers, & De Clercq, 2003), language and physical education (Stephanou & Mpiontini, 2017), reading competence (Soodla, Jõgi, & Kikas, 2016), language learning (Wang & Han, 2017), writing and reading (Chonan & Sawa, 2009; Harris, Santangelo, & Graham, 2010), music (Barbara & Alessandro, 2017), learning and performing better in the classroom (Pintrich, 2002), emotions in learning situations (Efklides, 2011, 2016; Karagiannides, Barboukis, Gourgoulis, Kosta, & Antoniou, 2015) and problem solving (Antonietti, Ignazi, & Perego, 2000).

Other studies (e.g., Artelt, Schiefele, & Schneider, 2001; Veenman, Kok, & Blöte, 2005; see also Schneider, 2010) show evidence that metacognitive knowledge and self-regulation not only are determinant factors in elementary school children but also predict math performance and reading comprehension in secondary school, independent of intellectual abilities. However, the topic of metacognitive regulation, in comparison to metacognitive knowledge, has received less attention in research on mathematical learning (Neuenhaus, Artelt, Lingel, & Schneider, 2011; see also Tian et al., 2018).

The importance of the various components of metacognition in the academic achievement of elementary school students might differ from that of older students because metacognition develops as childer get older via experience and practice. For example, the traces of metacognitive knowledge shown in kindergarten develop during adolescence and throughout the entire lifespan (see Artelt, Neuenhaus, Lingel, & Schneider, 2012; Handel, Artelt, & Weinert, 2013; Schneider, 2008), and metacognitive skills appear at the age of 8 to 10 years, and expand in the years thereafter (Berk, 2003; Veenman et al., 2004). Also, planning, in comparison to both monitoring and evaluation, matures earlier (Veenman & Spaans, 2005).

1.2 Association of Self-Efficacy with Metacognition and Academic Achievement

Self-efficacy, which is a form of motivational self-regulation exerted by competence self-beliefs, is one of the most determinative formulators of various academic outcomes. For example, self-efficacy is a positive predictor of mathematics problem solving and grades (Briggs, 2014; Chen, 2010; Pajares & Kranzler, 1995; Stevens, Olivarez, Lan, & Tallent-Runnels, 2004), test achievements for mathematics, languages, and science (Jansen et al., 2015; Lee et al., 2014; Skaalvik, Federici, & Klassen, 2015).

Self-efficacy beliefs also influence behaviors indirectly (Bandura, 1997; 2002). For example, it affects behavior via its impact on goal intentions (Bandura 2002). As Gollwitzer (1999) mentioned, implementation intentions (or action plans) refer to the translation of goals or intentions into specific actions (How should I behave?) and into the situational circumstances of performance (Where and when should I perform the action?). Therefore, students with high self-efficacy are expected to have stronger intentions, focus on their future behavior and develop success scenarios of their actions, leading to more committed to planning (see Zimmerman & Schunk, 2008).

Also, academic self-efficacy contributes to the use of complex and effective metacognitive learning strategies (e.g., Lee et al., 2014; Liem, Lau, & Nie, 2008; Pintrich, 1999; Schunk & Pajares, 2005). For example, once an action has been taken, individuals with higher self-efficacy, compared to others, believe that they can mobilize the resources required to meet action demands, and exercise control over challenges and over their own

functioning. Therefore, the individuals with higher self efficacy will put more effort into and pursue their goals longer, selecting more active coping strategies and being more effective in problem-solving, evidenced by the application of effective metacognitive monitoring and regulatory procedures (Lee et al., 2014; Liem et al., 2008; Schunk & Pajares, 2005).

Efklides (2011) suggests that metacognitive knowledge of self and self-efficacy is positively interrelated. Sang and Wang (2001) found that self-efficacy influences the effect of metacognitive knowledge on students' learning. Further, other researchers document a positive association between self-efficacy and declarative knowledge (e.g., Martocchio & Hertenstein, 2003). Coutinho (2008) and Tian et al. (2018) suggest that the association between metacognition and academic performance is fully mediated by self-efficacy.

1.3 Association of Hope with Self-Efficacy, Metacognition and Academic Achievement

According to Snyder (2000, p. 8), hope is the "sum of perceived capabilities to produce routes to desired goals, along with the perceived motivation to use those routes". The three key components of the Snyder's theory include the conceptualization of a goal, the developed routes to obtain the conceptualized goal (pathways), and the motivation to obtain the conceptualized goal (agency) (Snyder, 2000, p. 10; Snyder & Lopez, 2006, pp. 188-192). Although they are reciprocal, additive and positively related, agency and pathway are separate constructs, (Chang & Banks, 2007; Dixton, 2017; Magaletta & Oliver; 1999; Rand & Cheavens, 2009; Snyder, Harris, Anderson, Holleran, Irving, Sigmon, Yoshinobu, Gibb, Langelle, & Harney, 1991).

The majority of the studies support that higher levels of hope are associated with higher academic achievement at all educational levels (Feldman & Kubota, 2015; Rand et al., 2011; Stephanou, 2012; Snyder et al., 1991; Snyder et al., 1997; Snyder, Shorey, Cheavens, Pulvers, Adams, & Wiklund, 2002), and with positive academic outcomes (e.g., Buckelew et al., 2008; Ciarrochi et al., 2007; Gallup, 2009; Lopez, Bouwkamp, Edwards, & Teramoto Pedrotti, 2000), although some studies (e.g., Jackson, Weiss, Lundquist, & Hooper, 2003; Lackaye & Margalit, 2008) do not evident the link.

Previous researchers also report that hope is positively associated with positive affect, personal adjustment, self-beliefs and perceived quality of life (see Marques, Gallagher, & Lopez, 2017). For example, higher hope is linked to higher self-esteem (Gibb, 1990), higher self-worth (Ciarrochi et al., 2007; Curry, Snyder, Cook, Ruby, & Rehm, 1997; Kwon, 2000; Marques, Pais-Ribeiro, & Lopez, 2009), stronger problem solving skills (Kwon, 2000), effective problem-solving (Chang, 1998), better handling of stress (Chang, 1998) and stressful life events (Hellman & Gwinn, 2016; Valle, Huebner, & Suldo, 2006), and lower depression and anxiety (Ong et al., 2006). Also, hopeful individuals are more optimistic about the future, develop more and longer-term life goals and have higher success expectations (Snyder, Shorey, & Rand, 2006). In contrast, hope is inversely related to negative affect (Snyder et al., 1997), behavior problems (Valle, Huebner, & Suldo, 2004), and indicators of psychological distress and school maladjustment (Gilman, Dooley, & Florell, 2006). Hopeful children, in particular, report better interpersonal relationships and school success regarding attendance, course selection, grade point average, graduation rates, and college going rates (Pedrotti et al., 2008; Stephanou, 2011; see also Marques, Lopez, Fontaine, Coimbra, & Mitchell, 2015).

Yotsidi, Pagoulatou, Kyriazos and Stalikas (2018), in a review of twenty-three papers, reported that the dispositional hope was a powerful predictor of both academic hope and academic self-efficacy, and that hope indirectly predicted grade point average (GPAs). In the longitudinal study by Gallagher, Marques and Lopez (2017), hope was found to be a formulator factor of academic achievement across all the four years of studies as well as hope uniquely and directly influenced the number of enrolled semesters.

As above mentioned, hope and self-efficacy are motivational factors of achievement behavior. However, hope and self-efficacy focus on competence and control in different ways (Bryant & Cvengros, 2004; Dixson, Worrell, Olszewski-Kubilius, Subotnik, 2016; Feldman & Kubota, 2015; Rose & Robinson, 2007). Specifically, Bandura's (1997) theory suggests that self-efficacy is a stronger predictor of behavior than the actual outcome expectancy. Hope emphasizes equally competence and control belief. More accurately, hope is 'a positive motivational state that is based on an interactively derived sense of successful agency (goal-directed energy) and pathways (planning to meet goals)' (Snyder, Irving, Anderson, 1991, p. 287). Regarding to "outcome expectations in self-efficacy wherein the focus is on the given contingencies, pathways thinking reflects the self-analysis of one's capabilities to produce initial routes to goals, as well as additional routes should the first become impeded' (Snyder, Rand, & Sigmon, 2005, p. 262) or to identify multiple routes when obstacles arise (Snyder et al., 1991). Moreover, self-efficacy emphasizes the belief that goals can be achieved, while hope agency focuses on the belief that goals will be achieved. In Rand's (2018) words, unlike self-efficacy, hope is a generalized belief and involves the determination to achieve one's goals.

Past research evident the influential power of hope on academic performance even when controlling for other constructs, such as prior grades (e.g., Gallagher & Lopez, 2008; Gallagher et al., 2017; Snyder et al., 1991; Snyder, Shorey, et al., 2002) and self-esteem (Snyder, Shorey, et al., 2002). Despite the fact that a very limited number of studies have focused on the role of hope in academic achievement relative to self-efficacy (see Dixton et al., 2016), Feldman and Kubota (2015) found that college students' dispositional hope influenced the formulation of academic self-efficacy, which in turn predicted GPAs.

Hope, in addition, influences goal-directed behavior indirectly through its impact on self-regulation, since high hope individuals are able to handle stressful situations, override their own impulses responses and apply the proper ones toward a pursuit goal, identify and articulate strategies to manage potential barriers and self-regulate energy toward pathways even in front of obstacles and are better problem-solvers (see Alexander & Onwuegbuzie, 2007; Chang, 1998; Snyder, 2002).

1.4 Aim and Hypotheses of the Study

This research aimed to examine (a) students' reported metacognitive knowledge (declarative, procedural, conditional) and metacognitive regulation (planning, monitoring, information management, evaluation) when they are doing school work or homework, and the effect of the reported metacognition on school performance in language and mathematics, (b) the role of hope (both agency thinking, pathway thinking) and general self-efficacy in the reported metacognition, and in its impact on school performance and (c) the effect of hope in the generation of self-efficacy, and on its impact on both metacognition and school performance.

The research hypotheses were the following.

Metacognition will not be fully developed, with declarative knowledge being the favoring component of metacognitive knowledge and evaluation being the less favoring element of metacognitive regulation (Hypothesis 1).

Hope (mainly, agency thinking) will be a positive predictor of general self-efficacy (Hypothesis 2).

Hope will positively predict metacognition (Hypothesis 3a). The predictive strength of pathway thinking and agency thinking will vary between metacognitive knowledge and metacognitive regulation (with agency thinking being the most powerful predictor of metacognitive regulation) and within the components of each of them (Hypothesis 3b).

Self-efficacy will be a positive formulator of metacognition, particularly metacognitive regulation (Hypothesis 4a). The predictive power of self-efficacy will differ within the components of metacognitive knowledge and metacognitive regulation (Hypothesis 4b).

Hope will have a direct effect on metacognition beyond that of general self-efficacy (Hypothesis 5).

Metacognition (both metacognitive knowledge and metacognitive regulation), hope (mainly, agency thinking) and general self-efficacy will be positive influential factors of school performance in both Language and Mathematics (Hypothesis 6a). Self-efficacy will mediate the positive effect of metacognition on school performance (Hypothesis 6b). Hope will enhance the positive effect of both metacognition and general self-efficacy on school performance (Hypothesis 6c). The relative strength of predictors will differ between the two school subjects but no specific hypothesis is examined (Hypothesis 6d).

2. Method

2.1 Participants

One hundred and sixty-five 5th and 6th grade students (83 boys, 82 girls), randomly selected from 10 state primary schools of various regions of Greece, participated in the study. Their age ranged from 10 to 12 years with a mean age of 11.5 years (SD = .65). The students represented various parental socio-economical levels, with the 47,6%, 45,1% and 11,5% of their parents having completed tertiary education, secondary education and primary education respectively.

Also, the students' teachers (11 female, 9 male) participated in this research whom teaching experience ranged from 3 to 27 years.

2.2 Measures

2.2.1 Metacognition

The participants' reported metacognitive behaviours in doing school work or home work were assessed through the Junior Metacognitive Awareness Inventory for learners in grades 6 through 9 (Jr. MAI, Version B, Sperling, Howard, Miller, & Murphy, 2002). This self-report instrument includes two subscales, metacognitive knowledge

and metacognitive regulation, each of which consists of nine items, with response options ranging from 1 (Never) to 5 (Always). The metacognitive knowledge subscale comprises: Declarative knowledge (e.g., "I know when I understand something"), procedural knowledge (e.g., "I try to use ways of studying that have worked for me before") and conditional knowledge (e.g., "I use different learning strategies depending on the task"). The metacognitive regulation subscale measures five behaviors: Planning (e.g., "I decide what I need to get done before I start a task"), monitoring (e.g., "I ask myself how well I am doing while I am learning something new"), information management (e.g., "I focus on the meaning and significance of new information"), evaluation (e.g., "When I am done with my schoolwork, I ask myself if I learned what I wanted to learn) and debugging which refers to correction of mistakes. For this research, debugging was included in monitoring of metacognition. The Jr. MAI, Version B, is a valid and a reliable research instrument, and it has been widely used (see Kim, Zyromski, Mariani, Lee, & Carey, 2016; Lai, Zhu, Chen, & Li, 2015; Ning, 2018; Sperling, Richmond, Ramsay, & Klapp, 2012). In addition, it is a proper instrument in measuring metacognition in Greek population (see Panaoura & Philippou, 2003; Stephanou & Mpiontini, 2017).

In the present study, Cronbach's alphas were .77, .64 and .53 for total metacognition, metacognitive regulation and metacognitive knowledge respectively. Also, Cronbach's alphas for the subscales of metacognitive knowledge ranged from .50 for procedural, via .60 for conditional, to .64 for declarative. In a similar way, Cronbach's alpha for the subscales of metacognitive regulation were acceptable: Planning = .62, monitoring = .60, evaluation = .65 and information management = .68.

2.2.2 Hope

Dispositional hope was examined via the Children's Hope Scale (Snyder, Hoza, et al., 1997), which is designed to measure hope in children aged 7 to 16. This instrument contains six items: three refer to agency thinking (e.g., "I think I am doing pretty well") and three refer to pathway thinking (e.g., "I can think of many ways to get the things in life that are most important to me"). Responses range from 1 (None of the time) to 5 (All of the time), with higher scores indicating higher levels of dispositional hope. This scale is the most commonly used hope measure, with satisfactory psychometric properties (see Dixson, 2017; Valle et al., 2004; Snyder, Hoza, et al., 1997). The Greek version of the scale is a proper research instrument in examining hope in Greek population (Geitona, 2018; Stephanou, 2011, 2012). In the present study, Cronbach's alphas were .58 for agency thinking and .60 for pathways thinking.

2.2.3 General Self-Efficacy

The Greek version (Glynou, Schwarzer, & Jerusalem, 1994) of the General Self-Efficacy Scale (GSES, Jerusalem & Schwarzer, 1993; Schwarzer & Jerusalem, 1995) was used to measure Generic Self-Efficacy. The GSES is a single component self-report tool designed to assess the strength of an individual's belief in his/her own ability to respond to and cope with environmental demands and challenges, such as novel or difficult situations and any associated setbacks or obstacles. It consists of ten items and the response for each item ranges from 1 (Not at all true) to 4 (Exactly true). The higher the score, the greater the sense of self-efficacy. The scale has been translated in 32 languages, has been widely used, and it is a valid and reliable research instrument across various domains and countries (see Luszczynska, Gutiérrez-Doña, & Schwarzer, 2004; Schwarzer, 2014). In this study, the internal consistency of the scale was acceptable, since Cronabach's alpha was .76.

2.2.4 School Performance, and Personal Information

School performance in each of the two school subjects was the average score of the teachers' rating of their students' performance and of the term grade, which was obtained from the school records. The teachers rated each of their students' school performance on a 4-item scale (e.g., "How well does she/he do in Language?"). Responses ranged from 1 (very poorly) to 5 (excellent). Cronbach's alphas were .92 in Language and .95 in Mathematics.

Participant demographic data were obtained via a short set of questions, such as age, gender and grade level. In addition, students and teachers mentioned parents' educational background and teaching experience respectively.

2.3 Procedures

Initially, students' parents, teachers and school administration consent were requested and given, and, then, the scales were administered. The participating students and teachers were informed about the aim of this research, and anonymity and confidentiality were guaranteed. Data gathered at the second school term of the total three terms, in order the participants have adequate time to formulate an impression about school performance and metacognition relevant to school work or home work.

All students completed the scales individually in a quiet room outside their classroom, in front of the researchers.

In a similar way, the questionnaire was administered to the teachers in their own free time in school time, and they rated school performance for each of their students separately.

3. Results

3.1 Metacognitive Knowledge and Metacognitive Regulation

Descriptive statistics show that the students reported moderate use of metacognitive knowledge and metacognitive regulation while they are doing school work or home work (Table 1). Furthermore, according to the results from the repeated measure ANOVAs, the sub-components of both metacognitive knowledge, F (2, 162) =73.76, η^2 = .63, and metacognitive regulation, F(3, 161)= 26.10, η^2= .28, differed from each other in the reported frequency of use. Specifically, in metacognitive knowledge, the presented mean scores on Table 1 and the post hoc pairwise comparison indicate that the students referred to use of conditional knowledge more than declarative knowledge and procedural knowledge which was stressed least. Similarly, with respect to metacognitive regulation, post hoc pairwise comparisons and observation of the mean scores on Table 1 illustrate that the students reported the application of monitoring more than any other component, whereas evaluation was the least used.

The above results in the most confirmed Hypothesis 1.

Table 1. Descriptive statistics for students' reported use of metacognitive knowledge and metacognitive regulation while they are doing school work or home work

Components of metacognition	Mean	SD
Metacognitive knowledge		
Declarative	3.82	.59
Procedural	3.13	.86
Conditional	4.06	.90
Metacognitive regulation		
Planning	3.67	1.01
Monitoring	3.81	.84
Information management	3.67	.86
Evaluation	3.14	.84

3.2 Association among Hope, Self-Efficacy and Metacognition

3.2.1 Effect of Hope on General Self-Efficacy

Preliminary analyses showed that students' general self-efficacy (Mean= 3.00, SD = .51), agency thinking (Mean= 3.87, SD.= .62) and pathway thinking (Mean= 3.68, SD = .67) ranged from moderate to high.

The findings from correlation coefficient analyses showed that the higher the pathway thinking, $r = .42$, $p < .01$, and the higher the agency thinking, $r = .29$, $p < .01$, were, the higher the general self-efficacy was. Furthermore, the results from a regression analysis with the two components of hope as predictors revealed that hope explained 16% of the variance of general self-efficacy, $F(2, 162) = 35.60$, $p < .01$; pathway thinking contributed the most, beta = .42, $t = 5.90$, $p < .01$; yet agency thinking, beta = .28, $t = 3.81$, $p < .01$, had a significant positive contribution to self efficacy. These findings partially confirmed Hypothesis 2.

3.2.2 Effects of hope and general self-efficacy on metacognition, and the role of hope in the impact of general self-efficacy on metacognition

To examine the role of hope (pathway thinking and agency thinking) and self-efficacy in metacognition, and the effect of hope in the generation of the impact of self-efficacy on metacognition, a series of hierarchical regression analyses were conducted, with self-efficacy (entered into first step of the analysis), and agency thinking and pathway thinking (entered simultaneously into second step of the analysis) as the predictors. Separate analyses were performed for total metacognitive knowledge, total metacognitive regulation and each of the seven components of metacognition.

The findings regarding total metacognitive knowledge revealed that hope and self-efficacy, together, had positive effect on it, R^2= .49, $F (2, 162) = 17.76$, $p < .01$, and that agency thinking and pathway thinking, in combination, had direct effect on metacognitive knowledge beyond that of self-efficacy, R^2ch = .24, $F (3, 161) = 17.76$, $p < .01$. In a similar way, hope and self-efficacy, together, proved positive influential factor of total metacognitive

regulation, R^2= .18, F (2, 162) = 18.64, p < .01, while agency thinking and pathway thinking, in combination, had direct effect on it, beyond that of self-efficacy, R^2ch = .20, F(3, 161) = 13.93, p < .01.

The results (Table 2) regarding the components of metacognition showed that higher self-efficacy and higher hope was correlated with higher reported metacognitive knowledge (mainly declarative) and metacognitive regulation (predominately, monitoring). More specifically, the results from these analyses revealed the following.

Concerning reported declarative knowledge, the predictive model was found to be statistically significant, explaining 27% of the variance, F(3, 161)= 16.46, p < .01. Further, agency thinking and pathway thinking, together, enhanced the effect of self-efficacy on it, R^2ch= .05. Self-efficacy, however, proved unique positive contributor, beta = .46, t = 6.10, p < .01.

Conditional knowledge was found to be influenced by the two sets of predictors, in combination, R^2 = .15, F(3, 161) = 8.11, p < .01, and uniquely by the two types of hope, together, R^2ch= .03. However, the general self-efficacy proved the solo positive contributor of it, beta = .34, t = 4.21, p < .01.

Hope and self-efficacy, together, influenced planning of metacognitive regulation, R^2= .12, F (3, 161) = 7.86, p < .01, but agency thinking and pathway thinking, in combination, had no direct effect on it beyond that of self-efficacy. Self-efficacy positively contributed into planning, beta = .34, t = 4.20, p < .01.

In monitoring of metacognitive regulation, the predictive model was significant, accounting 19% of its variability, F(3, 161) = 11.56, p < .01, and pathway thinking and agency thinking, together, enhanced the effect of general self-efficacy on it, R^2ch= .04. In addition, the students who were high in both general self-efficacy, beta= .40, t = 5.08, p < .01, and agency thinking, beta= .15, t = 2.75, p < .01, were more likely to report use of monitoring, while pathway thinking had no direct effect on monitoring.

In information management, hope and self-efficacy, in combination, positively predicted its generation, explaining 15% of the variance, F(3, 161)= 6.78, p < .01, the two types of hope thinking, together, had direct and positive effect on it, beyond that of self-efficacy, R^2ch= .09, but only pathway thinking had unique impact on it, beta = .28, t = 3.04, p < .01.

Unexpectantly, while general self-efficacy and hope, in combination accounted for a significant and positive variability in evaluation of metacognition, R^2= .08, F(3, 161)= 5.80, p < .05, none of them had direct effect. Also, hope and self-efficacy had no impact on procedural knowledge uniquely or in combination.

The above findings partly confirmed Hypotheses 3b and 4a, while they totally confirmed Hypothesis 3a, 4b and 5.

Table 2. Results from hierarchical regression analyses for the role of self-efficacy and hope (agency thinking, pathway thinking) in the components of both metacognitive knowledge and metacognitive regulation, and for the role of hope in the impact of self-efficacy on the same components of metacognition

Predictors	Steps	R^2	F	R^2ch	Fch	beta	t
				Declarative knowledge			
Self-efficacy	1^o	.22	48.49**	.22	48.49**	.46	6.10**
Pathway thinking	2^o					.07	.37
Agency thinking						-.07	.34
		.27	16.46**	.05	4.70**		
				Procedural knowledge			
Self-efficacy	1^o	.019	3.16	.019	3.16	.19	2.20
Pathway thinking	2^o					-.14	-1.40
Agency thinking						.00	.02
		.035	1.95	.00	.29		
				Conditional knowledge			
Self-efficacy	1^o	.12	23.85**	.12	23.85***	.34	4.21**
Pathway thinking	2^o					.07	.77
Agency thinking						-.05	-.58
		.15	8.11**	.03	3.99*		
				Planning			
Self-efficacy	1^o	.12	23.19**	.12	23.19**	.34	4.20**
Pathway thinking	2^o					.05	.58
Agency thinking						-.06	-.72
		.12	7.86**	.02	2.39		
				Monitoring			
Self-efficacy	1^o	.16	32.87**	.16	32.87**	.40	5.08**
Pathway thinking	2^o					.09	1.02
Agency thinking						.15	2..75*
		.19	11.56**	.04	3.83*		
				Information management			
Self-efficacy	1^o	.10	11.41**	.10	11.41**	.15	1.85
Pathway thinking	2^o					.28	3.04**
Agency thinking						-.08	-1.00
		.15	6.78**	.06	8.32**		
				Evaluation			
Self-efficacy	1^o	.06	8.50**	.06	8.50**	.14	1.65
Pathway thinking	2^o					-.06	-.19
Agency thinking						-.13	-1.48
		.08	5.82*	.018	2.00		

Note: *: $p < .05$, **: $p < .01$, while the rest of the F-, Fch- and t- values, $p > .05$.

3.3 The Role of Hope, Self-Efficacy and Metacognition in School Performance in Language and Mathematics

Two separate hierarchical regression analyses were performed to examine (a) the role of hope, self-efficacy and metacognition in the formulation of students' school performance in language and mathematics, (b) the effect of self-efficacy on the impact of metacognition on the same performances and (c) the role of hope in the impact of self-efficacy and metacognition on the performances. Metacognition (metacognitive knowledge, metacognitive regulation), self-efficacy and hope (pathway thinking, agency thinking) were entered in the first, second and third step of analysis, respectively. The findings revealed that the three sets of predictors had complementary and positive effects on school performance but their relative power in influencing it varied between mathematics and language and within each school subject.

The results regarding language were the following: (a) the three constructs, in combination, positively influenced school performance, R^2= .32, F(10, 154) = 5.79, p < .01, (b) general self-efficacy had indirect impact on performance through metacognition, R^2ch = .025, Fch(7, 157) = 1,00, p > .05, (c) hope improved the effect of self-efficacy and metacognition on performance, revealing its direct effect on it, R^2ch = .22, F(8, 156) = 1.75, p < .01, and (d) agency thinking, compared to other predictors, was the most powerful positive formulator of school performance, beta = .31, t = 3.89, p < .01, followed by procedural knowledge, beta = .25, t= 3.42, p < .01, evaluation, beta = .18, t= 2.10, p < .05, monitoring, beta = .16, t = 1.95, p < .05, and declarative knowledge, beta = .11, t = 1.90, p < .05, while information management was a negative contributor of it, beta = - .29, t = - 4.14, p < .01, and (d) the rest of the variables did not influenced the formulation of performance uniquely.

The results regarding mathematics revealed that (a) hope, self-efficacy and metacognition, as a group, explained a moderate amount of the variance of school performance, R^2= .20, F (10, 154) = 3.80, p < .01, (b) general self-efficacy had direct effect on students' performance, beyond that of metacognition, R^2ch = .08, Fch(7, 157) = 8.20, p < .01, (c) hope (pathway thinking and agency thinking, together) accounted uniquely in school performance, beyond the impact of self-efficacy and metacognition, R^2ch = .06, F (8, 156) = 4.00, p < .01, and (d) agency thinking was the most powerful positive predictor of performance, beta = .28, t = 3.18, p < .01, followed by declarative knowledge, beta = .23, t= 3.00, p < .01, self-efficacy, beta = .19, t= 2.60, p < .01, monitoring, beta = .14, t= 2.10, p < .01, and planning, beta = .11, t= 1.98, p < .05, while information management was a negative contributor of performance, beta = - .28, t = - 3.40, p < .001.

The above findings partly, in the most and totally confirmed Hypotheses 6b, 6a and both 6c and 6d respectively.

4. Discussion

The present study examined the role of metacognition and motivation- function factors of general self-efficacy and hope in the formulation of school performance in mathematics and language in elementary school. This research also investigated the relationships shared between hope, general self-efficacy and metacognition in regards the same school performances.

The findings from the present investigation confirmed some results from previous studies and also revealed new relationships among the examined variables, leading to significant conclusions and implications for educational practice and achievement motivation research. The results from this research provide evidence for the relationship shared among metacognition, hope and self-efficacy and the way in which these constructs operate in predicting student achievement. The hypothesized sequential mediation effects of hope and self-efficacy between metacognition and school performance were in the most supported in this study.

4.1 Metacognition

The results regarding metacognition revealed that students' self-report metacognitive knowledge and metacognitive regulation in doing school work or homework were at moderate level, complimenting the notion that metacognitive knowledge develops beyond elementary school (Artelt et al., 2012; Schneider, 2008), and regulation of cognition develops slowly and might not be completely operative even in adults (Lai, 2011; Van der Stel & Veenman, 2014; Veenman & Spaans, 2005; Weil, Fleming, Dumontheil, Kilford, Weil, Rees, & Blakemore, 2013). The findings, in addition, confirming the literature (e.g., Schneider & Lockl, 2002; Veenman, 2011; Veenman et al., 2006) about the variability of the development of the components of both constructs, and in consistency with past researchers (e.g., Gourgey, 2010; Handel et al., 2013; Martini & Shore, 2008; Stephanou & Mpiontini, 2017), supported the least use of both procedural knowledge and evaluation of metacognitive regulation. The low use of evaluation might be also an evidence that students had not been trained trough the school curriculum to evaluate their own achievement behavior, although self-feedback is essential component of effective learning and transfer (Bransford, Brown, & Cocking, 2000; Schraw, 1998). On the other hand, in contrast to speculation that planning matures earlier than monitoring and evaluation (Veenman, 2011)

and to previous studies (see Stephanou & Mpiontini, 2017), students most frequently referred to monitoring.

The most use of conditional knowledge might be partly explained by the participants' beliefs in their own ability in handling effectively the demands of the familiar tasks of mathematics and language, since this specific knowledge is associated with metacognitive experiences (see Flavell, 1979; Efklides, 2008; Harris et al., 2009).

Moreover, the moderate level of both metacognitive regulation and metacognitive knowledge might result from a lack of emphasis on metacognition in most classrooms (see Eccles & Roeser, 2011; Metallidou, 2009), although achieving awareness of one's own cognition and how to regulate it at the primary years is a major factor in school functioning (Goswami, 2015; Schneider & Artelt, 2010). The moderate level of metacognition could be also associated with the self-report measure of Jr.MAI. Literature suggest that learners may not be consciously aware of their cognition, although they apply metacognitive strategies (Lai, 2011; Schraw & Moshman, 1995). More research needs to specify such issues.

Metacognition, supporting previous studies (e.g., Callan & Cleary, 2018; Harris, 2015; Zohar & Peled, 2008), played an important positive role in school performance in mathematics and language. The pattern of the effect of metacognition on academic performance, however, is complicated, evidencing, on one hand, the meditative role of self-efficacy and hope, and, on the other hand, the determinative role of its most often used components. The significant effect of conditional knowledge and the non-significant effect of procedural knowledge on mathematics could be due to the fact that school does not emphasize on how transforming the mastery/declarative knowledge into application in the complex task of mathematics.

The unexpectable negative role of information management in school performance is a puzzle. It seems that the participants thought that-- or they did- knew the surroundings and where they were with regard to their goals but they did not apply that knowledge to succeed, probably, due to inadequate skills to do it. Students can be trained to do so, as previous empirical research in metacognition training has addressed (see Csíkos & Steklács, 2010; Schneider & Artelt, 2010).

4.2 General Self-Efficacy

Self-efficacy, in consistency to its crucial role in self-regulation (Boekaerts, 1997; Zimmerman, 2000, 2008) and self-regulated learning (Boekaerts & Corno, 2005; Caprara et al., 2008; Moores, Chang, Smith, 2006; Panadero, 2017; Zimmerman & Schunk, 2011), contributed in metacognitive knowledge and, mainly, metacognitive regulation. Also, confirming past researchers (e.g., Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011; Stevens et al., 2004), the higher the self-efficacy was the higher the school performance was. Furthermore, general self-efficacy proved a mediator factor of the effect of metacognition on school performance in both language and mathematics. Taking in consideration that language and mathematics are high complex tasks, this specific result, at a very first glance, seems to be against previous findings (e.g., Gist & Mitchell, 1992) that support as the task complexity and the cognitive demands increase, the role of metacognition in performance increases. It is possible that the estimation of the average performance, and not its specific tasks, in both school subjects moderates the relationship between metacognition and performance. These results are also in agreement to theories of self-regulated learning that suggest that knowledge about relevant metacognitive strategies improves comprehension only when learners are also motivated to use these strategies (Maier & Richter, 2014).

The smaller effect of self-efficacy on metacognition and school performance (no unique contribution in language performance), comparing to other studies (e.g., Petosa, Suminski, & Hortz, 2003) that have shown higher effect of domain-specific self-efficacy on those variable, was probably because of the generality of the self-efficacy construct used in the present study.

4.3 Hope

High hope was found to predict school performance, confirming other studies (Snyder et al, 2002; Stephanou, 2012; see also Feldman & Kubota, 2015; Marques et al., 2017; Yotsidi et al., 2018) as well as it proved predictor of metacognition. Furthermore, the present results, supporting previous research studies (e.g., Bryant & Cvengros, 2004; Ben-Naim, Laslo-Roth, Einav, Biran, & Margalit, 2017; Dixton et al., 2016; Peterson, Gerhardt, & Rode, 2006; Tennen, Affleck, & Tennen, 2002), suggest that, while the influence of self-efficacy and hope are agentically mediated through one another, they operating as distinct constructs. As expected, students with higher hope were more likely than their lower-hope counterparts to report- and probably to engage in successful metacognitive behavior. Additionally, the results demonstrated that hopeful thinking had a direct effect on the reported metacognition beyond that of self-efficacy which, in turn, predicted metacognition.

The results also showed that hope served as a better indicator variable for the system of competence and control, hiding caution for research studies which identify self-efficacy as the better predictor variable when investigating

motivational constructs. This finding is similar to study by Levi, Einav, Ziv, Raskind and Margalit (2014) which showed the direct effect of hope on grade expectations, which, in turn, predicted academic achievement. Moreover, the findings of the study imply that perceiving oneself to be efficacious does not, in itself, promote student achievement.

The present findings suggest that hope is associated with crucial goal-relevant behaviors, it has unique theoretical explanatory power (see Luthans & Jensen, 2002; Marques et al., 2017; Rand, 2018), and, consequently, efforts to increase hopeful thought may be significant in helping students to move toward important school outcomes.

Another important finding revealed that, as pathway thinking and agency thought were separated each other, the predictive power of hope weakens and the role of self-efficacy becomes more important in both metacognition and school performance. This finding is in contrast to Chang and Banks (2007) and Campbell and Kwon (2001), who suggest the investigation of the two interrelated components (agency and pathways) of academic hope separately into the model of competence and control beliefs, while it supports the notion that although hope composed of two factors, it is "a positive motivational state that is based on an interactively derived sense of successful (a) agency (goal directed energy) and (b) pathways (planning to meet goals)" (Snyder et al., 1991, p. 287). For example, the generation of routes or strategies increases one's sense of agency which, in turn, enhances the strategic planning. Also, the participants' age might be associated with this specific finding. The fifth and sixth grade students' hope might be not yet divided into distinct pathway thought and agency thought.

The valence of the prediction of the two elements of hope varied between and within the components of metacognition as well as it varied between and within mathematics and language, in favoring agency thinking. This finding might be expected since, agency is the motivating component of hope (Snyder & Lopez, 2009), and individuals high in agency are determined, motivated and energy directed towards obtaining results (Creamer, O'Donnell, Carbon, Lewis, Densley, McFarlane, 2009). The high importance of mathematics and language for the participants might partly explain this result because agency is more strongly emphasized when objectives of considerable value to the individual exist (Snyder & Lopez, 2005, 2007). However, pathway thinking, and not agency thinking, uniquely influenced information management, in consistency with the Snyder's argument that high hope individuals do not react in the same way to barriers as low hope individuals, instead they view barriers as challenges to overcome and use their pathway thoughts to plan an alternative route to their goals (Snyder, 1994 as cited in Snyder, 2000 p. 10).

4.4 Limitations, Practical Implications, Future Research

There are some limitations in this investigation which could be considered fruitful research lines in the future. First, self-efficacy wας general construct. Stronger relations were found for specific domain-efficacy and academic performance (Petosa, Suminski, & Hortz, 2003), while other studies revealed that general self-efficacy and performance was mediated by task-specific self-efficacy (Chen, Gully, & Eden, 2004; Yeo & Neal, 2006). Similarly, this study examined dispositional hope but an individual may have hope for a specific goal which initially is based on her/his trait hope level (Edwards, Rand, Lopez, & Snyder, 2007; Snyder, 1994). A necessary step for future research is the examination of these general constructs jointly with domain-specific cognitions, as previous researchers suggest (see Barahona, García1, Sánchez-García1, Barba1, & Galindo-Villardón, 2018; Edwards et al., 2007; Luszczynska, Scholz, & Schwarzer, 2005; Marqueset al., 2017).

Second, data were gathered from a sample of 5th and 6th grade students. The findings might be unique to this age and to demands of the primary educational level. Therefore, it is interesting to explore these variables in different educational levels and other stages of life. Third, self–report measures were used, which could have produced common method bias variance. Future studies need to include objective measures. Additionally, following previous investigations, fairly simple measure of metacognition was applied. The complexity of this concept, involving knowledge and experience, may warrant further research into its measurement.

Despite these limitations, this study contributes to and expands the extant literature by highlighting the underlying mechanism by which metacognition contributes to school performance.

In recognition of the importance of metacognition, the present research examined its role in performance in two major school subjects. Metacognition was found to be significant and positive predictor of school performance, although some of its components had only indirect effect. As Efklides (2014) supports, metacognition is socially shared and constructed. More precisely, the adults' role is crucial in supporting children's metacognitive knowledge, especially procedural (Robson, 2016), and their metacognitive regulation (Mevarech & Fridkin, 2006) via training programs, prompts and scaffolds (see Azevedo, 2005; Dignath & Buttner, 2008; Schneider, 2010; Stark & Krause, 2009).

This research also aimed at identifying how self-efficacy, hope and metacognition are interrelated, and, in turn, how they influence academic achievement. The results revealed that knowledge about- and regulation of-relevant metacognitive strategies improves school performance only when learners are also high-efficacious and have high hope thought. Further, this study supports the notion that hope (mainly, agency thinking) has unique theoretical explanatory power in academic achievement beyond that of metacognition and self-efficacy.

It seems that hope had a beneficial important role in the process of pursuing a goal since being successful in the academic tasks requires a combination of planning and motivation (Feldman & Kubota, 2015). Hence, in mathematics and language teaching, teachers should increase students' hope that lead them to apply metacognition more actively and effectively, and, in, turn to succeed. Hope-based intervention could be based on previous effective relevant programs (e.g., Marques, Lopez, & Pais-Ribeiro, 2011).

General self-efficacy proved a positive contributor into metacognition and school performance, evidencing its high importance in explanation of student' motivation and behavior across different task domains. However, as Bandura has noted (1997), generic self-efficacy and domain self-efficacy are not entirely independent. To design training programs that could enhance students' general self-efficacy, along with their specific-domain efficacy, is required.

Conclusively, this research addressed a gap, but there is definitely more research needed to fully understand the role of self-efficacy, hope, and metacognition predictability of student school performance.

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