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RELATIONSHIPS BETWEEN SUCCESS ORIENTATION, SELF EFFICACY ON SCIENTIFIC RESEARCH AND METACOGNITIVE THINKING SKILLS

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Abstract:
In this study, relations between metacognition, achievement orientation and scientific research self-efficacy were investigated. Research findings attested that metacognitive thinking skills play a mediator effect between success orientations and self-efficacy on scientific research. Further to that, success orientation rendered a positive impact on the perception of scientific research self-efficacy and success orientations positively affected meta-cognitive thinking. On the other hand, self-efficacy on scientific research had a negatively insignificant effect on meta-cognitive thinking skills. At the end of this research, it can be suggested to instructors that in tracking and learning processes in their class if they employ activities that stimulate metacognitive thinking skills after completing success-orientated activities, positive feedbacks could be obtained on students' perception of scientific research self-efficacy level. Aside from that since the paths between divergent and success orientations; problem solving, decision making, alternative evaluation and metacognitive thinking and conclusion and discussion, method and literature review and perception of scientific research self-efficacy show; it can be argued that these correlational results would be safely employed in academic processes.

Keywords: success orientation, self-efficacy on scientific research, metacognitive thinking skills, structural equation model

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1. Introduction

The success rate of any individual, being engaged in a constant process of formal or informal learning, has been under the influence of the reasons behind his/her learning motivation. Regarding that issue, Lin, Mckeachie and Kim (2003) reported that an individual may seek achievement for a variety of underlying objectives to acquire sufficient levels of knowledge and skills for any given profession or be motivated to learn for the sake of approval and recognition. Success could act as one medium towards any result or to realize a myriad of external objectives of the person concerned (Somuncuoğlu and Yıldırım, 1999). Akın (2006a) explains success objectives as individual perspectives of students that could have affected their cognitive, affective and behavioral reactions within a learning context. Ames and Archer (1988) conceptualized success objectives via classifying them as learning objectives and performance objectives. Of the two goal-oriented dispositions, Pintrich, Conley and Kempler (2003) defined learning objectives as an individual's act of thoroughly learning the target while Nichols, Jones and Hancock (2003) delineated performance objectives as an individual's attempt to appear more intelligent and gifted than the others. Elliot and McGregor (2001) preferred to describe objectives from a different viewpoint and stated that those that mediate in accessing the desired results are convergent objectives whilst the ones assisting in avoiding from undesired results are divergent objectives.

Success objectives shed light to the ways a person can be motivated (Weiner, 1990). They are reflective of individuals' conceptions about themselves and their performance in the learning process (Dweck and Leggett, 1988). The person either aims to learn for the sake of learning (quot. Lemyre, Roberts and Ommundsen, 2002) or to prove him/herself to others (Lemyre et al., 2002). Since learning objectives are under the supervision of concerned person, they could be much easier to control. As for performance objectives however, they could be a challenge to control due to their interrelation with a host of external factors beyond one's willpower (Hatzigeorgiadis, 2002).

The way objectives are classified is considered to lie in connection with metacognitive thinking skills, particularly as regards learning objectives. Self-awareness of someone in learning process toward his/her own cognitive progress can be realized via metacognitive thinking skills. Flavel (1976) described metacognitive ability as an individual's awareness of his/her cognitive traits and management of cognitive features of the person while Blakey and Spence (1990) defined the same concept as "the *thinking of thinking*". Based on the frequency of thinking Pintrich, Smith, Garcia and Mc Keachie (1991) explained metacognitive trait as an individual's frequency of thinking on the topic being read or studied. Martinez (2006) argues that metacognition, which defines the person's self-tracking and controlling of his/her thoughts, could be categorized in three sections as meta-memory and meta-comprehension, problem- solving and critical-thinking. While Kuhn and Dean (2004) highlighted the parallelism between metacognitive skills and critical thinking, Özbay and Bahar (2012) tended to describe metacognitive skills as self-regulation of learning process after the individual grasps

insights on the way s/he autonomously learns. In the words of Tobias and Everson, (1997) and Saban (2009:144) metacognition is the person's awareness on what s/he knows and unknowns. Anyone capable of employing his/her metacognitive thinking strategies can control his/her own learning process (Doğanay, 1997) and can illustrate the way s/he forms personalized meanings (Yurdakul and Demirel, 2011).

Since metacognitive skills, play pivotal role in any person's learning process it is required to explain concerned skills via a variety of affective traits. If that cannot be actualized, it then becomes infeasible to explain effective variables in the learning process, their limitations and interaction methods. Once this study is structured on the ground of a scientific approach, it is infeasible to argue that the objective is to find an answer to the problem via explaining all the related variables of learning process. On the other hand, the problem has been limited with the investigation of analyzing scientific research skills as a vital quality of modern age human beings in relation to metacognition. As known collecting data on a specific topic and conducting a scientific research is one of the learning methods. Büyüköztürk (2011:1) treated scientific research from the aspect of accumulating scientific information while Karasar (2009:45) defined it as a problem-solving process. To ensure a sound implementation of this process, it is essential for the person be endowed with required research competencies and affirmative attitudes. In another saying, the person is expected to possess an elevated self-efficacy perception on scientific research (Saracaloğlu, Varol and Ercan, 2005). Bandura (1997) described self-efficacy perception as an individual's capacity of having a successful performance experience. Self-efficacy on scientific research, on the other hand, relates to students' conviction in their ability to access any given scientific topic (Montcalm, 1999: quot. İpek, Tekbıyık and Ursavaş, 2010, 129). Zimmerman (1999) argues that self-efficacy on scientific research is reflective of the self-conviction of an individual in his/her academic performance. Hence, provided that the person is constantly and actively engaged in research activities, he/she would have an elevated perception of self-efficacy on his/her research skills (Kart and Gelbal, 2014).

Through determining a person's viewpoint toward a studied topic, self-efficacy perceptions play role in designating one's motivation toward the particular issue; reaction toward encountered challenges and opting for certain choices while making decisions (Bandura, 2002). It has been demonstrated that self-efficacy perception is an effective factor in personalized learning when following a learner-centered approach (Tuncer and Tanaş, 2011). From a different viewpoint, self-efficacy perception mirrors an individual's beliefs on his/her own efficacies (Woolfolk-Hoy and Burke-Spero, 2005). However, it is essential not to generalize self-efficacy perception. An elevated level of self-efficacy on any given domain could still lead to a decreased self-efficacy perception on a different domain (Akkoyunlu and Orhan, 2003). It has also been asserted that those individuals with elevated perceptions of self-efficacy on scientific research demonstrated higher academic performance (Zimmerman, Bandura and Martinez-Pons, 1992) and proved to be more decisive and resolved than the rest (Aşkar and Umay, 2011; Oğuz, 2012).

In relevant literature there is a wide range of studies having investigated success orientations (İzci and Koç 2012; Odacı, Çelik and Çikrıkci 2013; Arslan 2011); metacognitive thinking skills (Tunca and Alkın-Şahin 2014; Baykara 2011; Karasakaloğlu, Saracaloğlu, Özelçi 2012; Demir and Özmen, 2011; Tuncer and Kaysi, 2013; Dilci and Kaya 2012; Doğan 2016; Irak, Çapan and Soylu 2015); self-efficacy on scientific research (Kurt, İzmirli, Fırat and İzmirli 2011; Çuhadar, Gündüz, Tanyeri 2013; Oğuz, 2012; Tunca and Şahin 2014); the relationship between metacognitive thinking skills and self-efficacy on scientific research (Tuncer and Yılmaz 2016) and the relationship between success orientations and metacognitive thinking skills (Akın 2006b; Aydın and Yerdelen 2014; Koç and Karabağ 2013). However, no study has yet examined the relationship between success orientations and self-efficacy on scientific research and the mediator effect of metacognitive thinking skills. Thus, this study has focused on three basic problems as listed here in under;

- Do metacognitive thinking skills play a mediator effect between success orientations and perception of scientific research self-efficacy?
- What is the effect of success orientations on metacognitive thinking skills?
- What is the effect of success orientations on the perception of scientific research self-efficacy?

2. Method

One of the data collection tools employed to gather data in this research is Self-Efficacy on Scientific Research Scale developed by Tuncer and Özeren (2012). This scale consists of 12 items and four dimensions (*Literature Review, Method, Conclusion and Discussion, Suggestions and Reference Formation*). The second data collection tool of the research, a.k.a metacognitive thinking skills scale, has been developed by Tuncer and Kaysi (2013). This scale consists of 17 items and four dimensions (*thinking skill competencies, reflective thinking skills toward problem solving, decision-making skill competencies and alternative evaluation skill competencies*). The third data collection tool of the research, 2x2 success orientations scale, has been developed by Akın (2006a). This scale consists of 26 items and four dimensions (*learning convergent, learning divergent, performance convergent, performance divergent*). Calculated Cronbach Alpha reliability coefficients of data collection tools have been displayed in Table 1.

Table 1: Reliability coefficients of data collection tools

Scale	Cronbach's Alpha	N (Items)
Succes Orientation	.857	26
Metacognitive Thinking	.907	17
Scientific Research Self-Efficacy	.928	12

Kalaycı (2009) stated that depending on Cronbach's Alpha coefficient value, the reliability of scale could be interpreted as below:

- If $0.00 \leq \alpha < 0.40$ the scale is unreliable,

- If $0.40 \leq \alpha < 0.60$ the scale has low reliability,
- If $0.60 \leq \alpha < 0.80$ the scale is very reliable and
- If $0.80 \leq \alpha < 1.00$ the scale is highly reliable.

Once the Cronbach's Alpha reliability coefficients were contrasted with those values, it was validated that all three tools were highly reliable scales. Data collection tools' skewness and kurtosis coefficients are as seen in Table 2.

Table 2: Skewness and kurtosis coefficients of sub dimensions of scales

Scale	Dimension	Skewness	Kurtosis
Scientific Research Self-Efficacy	Literature Review	-,414	,297
	Method	-,569	,588
	Conclusion and Discussion	-,706	,587
	Suggestions and Reference Formation	-,405	,044
Metacognitive Thinking	Alternative evaluation	-,759	1,279
	Decision-making	-,769	,822
	Reflective thinking skills toward problem solving	-,417	-,032
	Thinking	-,761	1,059
Success Orientation	Performance convergent	,238	-,506
	Performance divergent	,128	-,921
	Learning divergent	-,244	-,542
	Learning convergent	-,623	,822

Since in relevant literature (Tabachnick and Fidell, 2013; McKillup, 2012; Wilcox, 2012b; Howitt and Cramer, 2011; Lind, et al. 2006) computed skew and kurtosis indices ranged within ±2 limits near to 0, it has been ascertained that a normal distribution existed (quot. Demir, Saatçioğlu and İmrol, 2016). According to these views in literature, scale sub dimensions demonstrated a normal distribution here too.

In the designation of rejecting or accepting the models formed on the basis of structural equation model, fit index values were taken into account. In order to interpret if studied models could be accepted or rejected all the previously confirmed and verified scales identified by certain researchers (Schreiber et al., 2006; Sümer, 2000; Wilson and Muon, 2008) have been examined.

As has also been reported by Stapleton (1997) in structural equation models fit index values viz. X^2, X^2 /sd GFI, NFI, CFI, RMSEA are investigated. Çokluk et al., (2010) stated that such fit index values provide Kay square (X^2 –Chi-Square), distance of observed correlation matrix from theoretical correlation matrix. Schreiber et al. (2006) accepted that once X^2 /df was below 2 or 3, it was an indication of perfect fit but Sümer (2000) argued that if this value was below 5, there was an average level of fitness. Likewise, Schreiber et al. (2006) stated that once GFI received .95 and higher values the data could then fit the model perfectly, but Sümer (2000) claimed that if this value equated to .85 and above, it was an indication of acceptable fit for model-data. CFI tested the model in terms of its relationship with implicit variables and if this value was

90 and above and.95 and higher, it was reported to have a perfect fit (Sümer, 2000). If the RMSEA and SRMR values are lower than .05 there is perfect fitness of model-data, if it is lower than .08 the fit is acceptable (Şimşek, 2007; Hooper & Mullen 2008; Schumacker & Lomax, 2010; Waltz, Strcikland & Lenz 2010; Wang & Wang, 2012; quot. Çapık, 2014).

2.1 Population and Sampling

Research population is Faculty of Education in Erzincan University. Faculty of Education Departments from which research approval was obtained could be included within the scope of research and within that framework data collection tools had been implemented to the undergraduate departments of Psychological Counseling and Guidance, Elementary Mathematics, Computer and Instructional Technologies, Music, Painting, and Science Teaching. Of this population, by applying criterion sampling method that is one of the purposeful sampling methods, the third and fourth grade students were selected. The sampling formed in light of these insights was composed of 470 students. In criterion sampling method, observation units are formed by collecting people, events, objects or situations having certain qualities (Büyüköztürk, Çakmak, Akgün, Karadeniz and Demirel, 2008, s.80). The reason for selecting criterion sampling method is that third and fourth grade students had taken scientific research methods course or had somehow employed scientific research skills in their studies.

261 (55,5%) of research sampling participants were female and 208 (44,3%) were male. As sampling age distribution of participations is examined, it is seen that 344 (73,2%) were in the age range of 19-22, 107 (22,8%) were in the age range of 23-26, 15 (3,2%) in the age range of 27-30 and 4 (0,9%) in the age range of 30 and above. Of all the students 149 students (31,7%) were from Psychological Counseling and Guidance department, 72(15,3%) were from Elementary Mathematics, 75 (16,0%) were from Computer and Instructional Technologies, 51(10,9%) Music, 51(10,9%) were from Painting and 72 (15,3%) were from Science Teaching departments. Sampling data revealed that 216 (46,0%) students in research sampling were 3rd and 254(54,0%) students in research sampling were 4th graders.

3. Findings

The first research finding is about sub problem; **"***Does metacognitive thinking skills play a mediator effect between success orientations and perception of scientific research self-efficacy?"* Figure 1 presents the structural equation model structured for that particular problem and computed values.

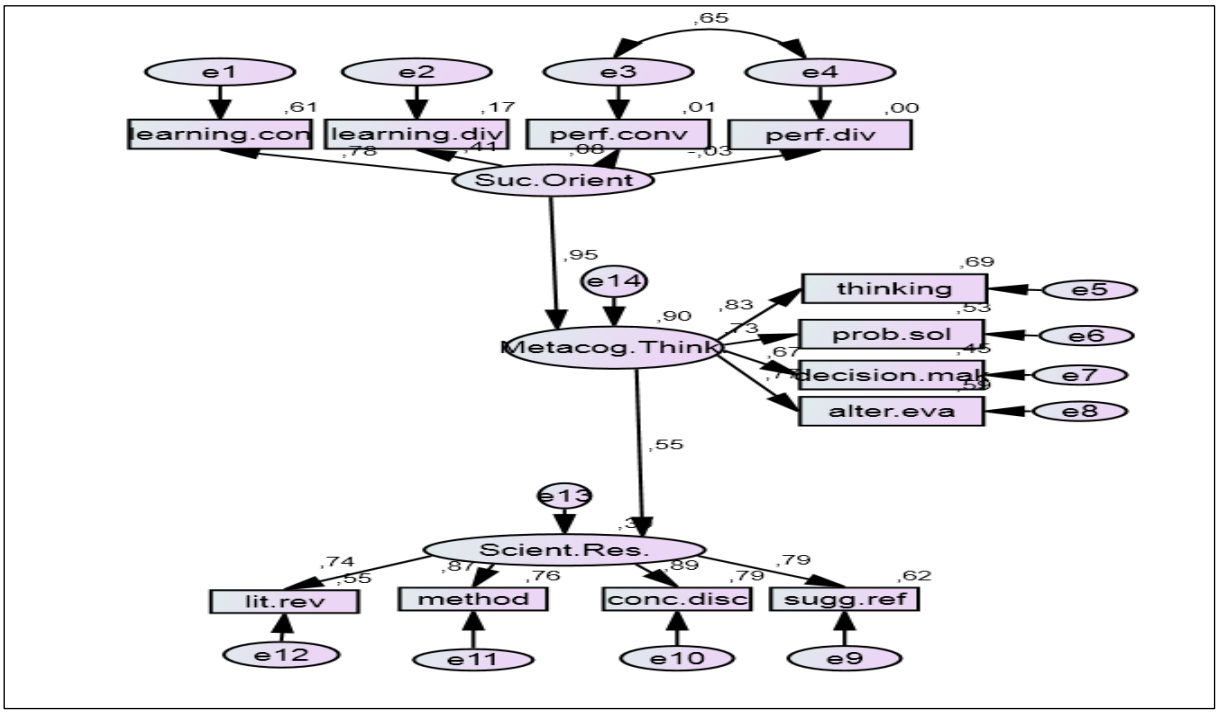

Figure 1: The model structured for the sub problem; *Does metacognitive thinking skills play a mediator effect between success orientations and perception of scientific research self-efficacy*?

As also manifested in Figure 1, in the structured model, there has been a modification only in between performance convergent and performance divergent sub factors. Estimated value before modification was.525 but after modification this value increased to .645. The paths in the model for Figure 1, regression weights and significance values, are demonstrated in Table 3.

Table 3: Regression weights and significance values of the model

Structural Relations			**Estimate**	**S.E.**	**C.E.**	**p**
Metacognitive Thinking	<---	Success Orientation	1.159	.130	8.941	***
Scientific Research	<---	Metacognitive Thinking	.757	.073	10.363	***
Learning convergent	<---	Success Orientation	1.000			
Learning divergent	<---	Success Orientation	.716	.090	7.968	***
Performance convergent	<---	Success Orientation	.178	.109	1.625	.104
Performance divergent	<---	Success Orientation	-.055	.102	-.532	.594
Problem solving	<---	Metacognitive Thinking	1.000			
Decision making	<---	Metacognitive Thinking	1.063	.063	16.826	***
Alternative evaluation	<---	Metacognitive Thinking	.922	.061	15.222	***
Thinking	<---	Metacognitive Thinking	.963	.054	17.754	***
Suggestions and Ref. For.	<---	Scientific Research	1.000			
Conc. and Discussion	<---	Scientific Research	1.021	.048	21.467	***
Method	<---	Scientific Research	.946	.046	20.363	***
Literature Review	<---	Scientific Research	.846	.051	16.619	***

Table 3 argues that the paths between learning metacognitive thinking and success orientations & metacognitive thinking as well as scientific research are significant. It has

also been reported that between success orientations and its sub factor *learning divergent* & metacognitive thinking and its sub factors such as decision making, alternative evaluation and thinking, scientific research self-efficacy and sub factors conclusion and discussion, method and literature review self-efficacies there were paths that had significant relations. Fit index values of structured model are exhibited in Table 4.

Table 4: Fit index values of the Model and state of acceptance / rejection

Fit index	Good fit*	Acceptable fit*	Measurement	Result
χ^2/df	≤ 3	≤ 4 - 5	4.054	Acceptable
GFI	≥0.90	0.89 - 0.85	0.944	Good
CFI	≥0.97	≥ 0.95	0.935	Acceptable
RMSEA	≤0.05	0.06 - 0.08	0.080	Acceptable
SRMR	<.05	<.08	.0620	Acceptable
IFI	≥0.95	0.94 - 0.90	0.944	Acceptable

(x^2: 202.712; df: 50 ; * Çokluk et al., 2010; Schreiber et al., 2006; Sümer, 2000; Wilson and Muon, 2008; İlhan and Çetin, 2014)

Fit index values of the sub problem; *What is the effect of success orientations on metacognitive thinking skills?* revealed that CFI, GFI and IFI values converged to 1; RMSEA and SRMR values converged to 0' and computed CMIN/DF ratio was 4.054. In light of fit index value in relevant literature, the model hereby was accepted.

Structural equation model of the next sub problem of the research; *What is the effect of success orientations on the perception of scientific research self-efficacy?* is as seen in Figure 2.

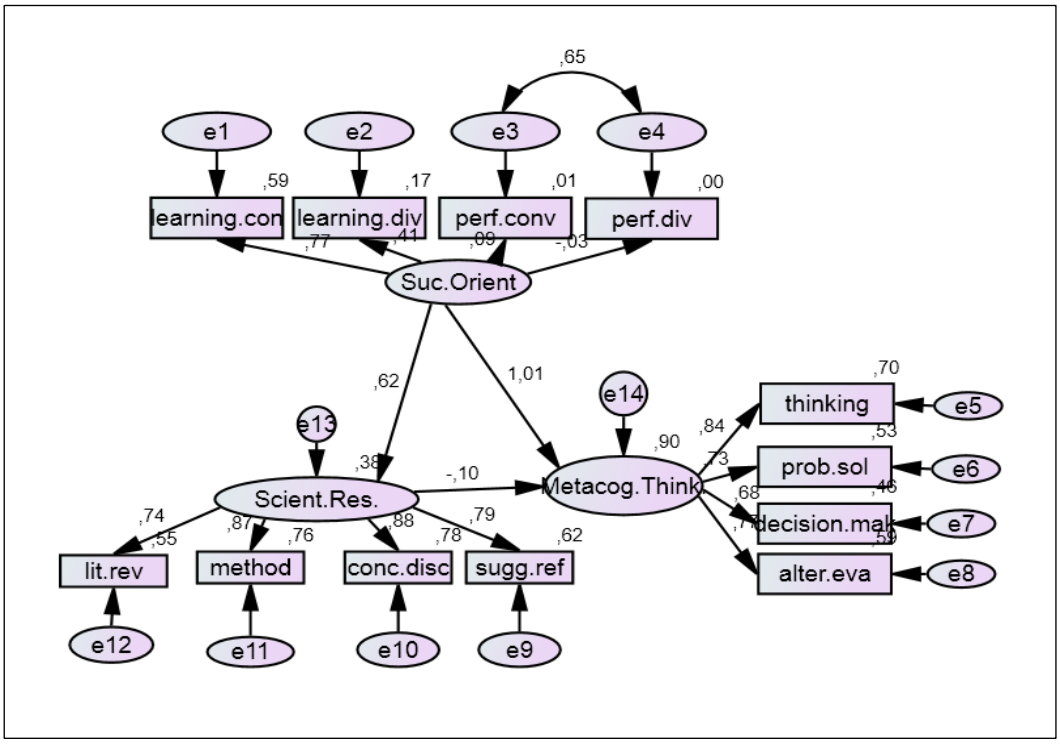

Figure 2: Structural equation model for the sub problem;
What is the effect of success orientations on the perception of scientific research self-efficacy?

As can be seen in Figure 2 in the structured model no modification has been conducted. This model shows that effect of success orientations on scientific research self-efficacy perception is (β=.62; p=.000) in positive direction. Likewise success orientations positively affected meta-cognitive thinking skills (β=1.01; p=.000). On the other hand the effect of scientific research self-efficacy perception on meta-cognitive thinking skills is in negative direction (β= -.10; p=.000). The paths in Figure 2 model, regression weights and significance values are displayed in Table 5.

Table 5: Regression weights and significance values of the model

Structural Relations			**Estimate**	**S.E.**	**C.R.**	**p**
Scientific Research	<---	Success Orientation	1.058	.147	7.187	***
Metacognitive Thinking	<---	Success Orientation	1.256	.214	5.879	***
Metacog. Thinking	<---	Success Orientation	-.074	.084	-.883	.377
Learning Convergent	<---	Success Orientation	1.000			
Learning Divergent	<---	Success Orientation	.735	.090	8.198	***
Performance Conv.	<---	Success Orientation	.186	.110	1.696	.090
Performance Div.	<---	Success Orientation	-.055	.103	-.531	.595
Thinking	<---	Metacog. Thinking	1.000			
Problem solving	<---	Metacog. Thinking	1.060	.063	16.844	***
Decision-Making	<---	Metacog. Thinking	.923	.060	15.306	***
Alternative Evaluation	<---	Metacog. Thinking	.957	.054	17..633	***
Sugges. and Ref. For.	<---	Scientific Research	1.000			
Conc. and Discussion	<---	Scientific Research	1.019	.047	21.461	***
Method	<---	Scientific Research	.946	.046	20.398	***
Literature Review	<---	Scientific Research	.857	.051	16.651	***

Table 5 shows that paths between learning divergent and success orientations; problem solving, decision making, alternative evaluation and metacognitive thinking and conclusion and discussion, method and literature review and scientific research self-efficacy are significant. On the other hand, not any significant relation existed between success orientations and performance convergent and also performance divergent. Obtained fit index values are as seen in Table 6:

Table 6: Fit index values of the model and state of acceptance/rejection

Fit index	**Good fit***	**Acceptable fit***	**Measurement**	**Result**
χ^2/df	≤ 3	≤ 4 - 5	3.994	Acceptable
GFI	≥0.90	0.89 - 0.85	0.935	Good
CFI	≥0.97	≥ 0.95	0.944	Acceptable
RMSEA	≤0.05	0.06 - 0.08	0.080	Acceptable
SRMR	<.05	<.08	.0620	Acceptable
IFI	≥0.95	0.94 - 0.90	0.944	Acceptable

(x^2: 203.67; df: 51 ; * Çokluk et al., 2010; Schreiber et al., 2006; Sümer, 2000; Wilson and Muon, 2008; İlhan and Çetin, 2014)

As obtained values are contrasted with values in literature it can be argued that structured model is within acceptable limits.

4. Findings and Discussion

Research findings attested that metacognitive thinking skills play a mediator effect between success orientations and self-efficacy on scientific research. Further to that success orientation rendered a positive impact on the perception of scientific research self-efficacy and success orientations positively affected meta-cognitive thinking. On the other hand, self-efficacy on scientific research had a negatively insignificant effect on meta-cognitive thinking skills.

In relevant literature, a range of studies pointed to the linkage between success orientations and metacognitive thinking skills (Akın 2006b; Aydın and Yerdelen 2014; Koç and Karabağ 2013). Aydın and Yerdelen (2014) analyzed the relationship between metacognitive strategies and success objective orientations and reported that the highest relations were observed between performance-convergent objectives and performance-divergent objectives. Koç and Karabağ (2013) detected that there was an averagely positive way relationship between learning orientation that was a success orientation and metacognitive ability, cognitive information and cognitive formation. Coutinho (2007) conducted a study among elementary and secondary level students and concluded that performance objectives had no relationship with academic performance and that metacognitive thinking acted as a mediator in between these two variables.

Another finding of this research is that between perception of scientific research self-efficacy and meta-cognitive thinking skills there existed an insignificantly negative relationship. As opposed to this finding Tuncer and Yılmaz (2017) reported that a positive relationship was present between perception of scientific research self-efficacy and meta-cognitive thinking and that this relationship explained circa 27% of the thinking variance score related to perception of scientific research self-efficacy on problem solving, decision making and alternative evaluation skills. It was detected that study of Tuncer and Yılmaz (2016), having manifested the positive and yet insignificant relationship between metacognitive thinking skill and certain dimensions of perception of scientific research self-efficacy, was identical to current study. In relation to that Rahman and his colleagues (2014) claimed that active implementation of metacognitive strategies played a vital role in the process of identifying, planning, monitoring and evaluating a specific research problem. Beyer (1987) also highlighted that metacognitive skills honed students' research skills. Aktürk and Şahin (2011) argued that students with higher metacognitive skills are able to monitor their own learning, employ critical thinking on any knowledge, update their knowledge level and develop and implement new learning strategies to learn even better.

At the end of this research, it can be suggested to instructors that in tracking and learning processes in their class if they employ activities that stimulate metacognitive thinking skills after completing success-orientated activities, positive feedbacks could be obtained on students' perception of scientific research self-efficacy level. Aside from that since the paths between divergent and success orientations; problem solving, decision making, alternative evaluation and metacognitive thinking and conclusion and

discussion, method and literature review and perception of scientific research self-efficacy show; it can be argued that these correlational results would be safely employed in academic processes.

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