Journal of Education, Society and Behavioural Science

32(4): 1-9, 2019; Article no.JESBS.53452
ISSN: 2456-981X
(Past name: British Journal of Education, Society & Behavioural Science, Past ISSN: 2278-0998)

Relationship between Metacognitive Awareness and Reflective Learning of Medical Students at the Faculty of Medicine, Suez Canal University

Tahany Ahmed Mesbah[1], Rabab Abdel Raoof Abed[1*], Amira Salem Al-Sagheer[1] and Mona Sayed Ghaly[2]

[1]Department of Medical Education, Faculty of Medicine, Suez Canal University, Egypt.
[2]Faculty of Medicine, Suez Canal University, Egypt.

Authors' contributions

This work was carried out in collaboration among all authors. Author TAM prepared the proposal, collected the data make the analysis and literature review, then prepared the first draft of the manuscript. Author RARA reviewed and prepared the last version of the manuscript and share in the data analysis and discussion writing. Authors ASAS and MSG shared in preparing the proposal and revision of the whole work. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JESBS/2019/v32i430187
Editor(s):
(1) Dr. Theodore S. Kaniuka, Professor, Department of Educational Leadership, Fayetteville State University, USA.
(2) Professor, Dr. Redhwan A. Al-Naggar, Population Health and Preventive Medicine, Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh, Selangor, 47000, Malaysia.
(3) Dr. Shao-I Chiu, Associate Professor, Professional Development in Education, Da-Yeh University, Taiwan.
Reviewers:
(1) Elizabeth Joseph-Shehu, National Open University of Nigeria, Nigeria.
(2) Papadakis Stamatios, University of Crete, Greece.
(3) Yulia, Petra Christian University, Indonesia.
Complete Peer review History: http://www.sdiarticle4.com/review-history/53452

Original Research Article

Received 01 November 2019
Accepted 06 January 2020
Published 14 January 2020

ABSTRACT

Aim: To examine the relationship between reflective thinking and metacognitive awareness to help medical students to be independent learners who can control their learning and improve their professional performance.
Study Design: It is a cross-sectional correlational study.
Place and Duration of the Study: This study was conducted at the Faculty of Medicine-Suez Canal University in August 2018.

**Corresponding author: E-mail: dr.rababraoof@gmail.com;*

Methodology: This is a cross-sectional correlational study; the study population included the undergraduate medical students in all study years at the Faculty of Medicine, Suez Canal University. The sample was 264 randomly selected students by using a cluster sampling technique. The instruments that were used for data collection were the Metacognitive Awareness Inventory (MAI) to measure students' metacognitive awareness levels, Reflection-in-Learning Scale (RLS) to measure the students' reflective learning levels.
Results: The descriptive statistics of both MAI and RLS total scores of students in the six study years revealed that students have mean total MAI total scores = 178 ± 26 and have mean total RLS total scores = 60 ± 13.
The Spearman's correlation between the metacognitive awareness and the reflective learning skills of medical students revealed that there was a statistically significant high positive correlation between the metacognitive awareness and the reflection in the learning of FOM-SCU students ($p= 0.699$, p-value<0.0001).
Multiple regression analysis revealed that the weighted combination of the predictor variables explained approximately 50% of the variance of reflection in learning.
Conclusion: It is concluded from this study that the students at the Faculty of Medicine, Suez Canal University have fair to good metacognitive awareness and partial to ample reflective abilities. There is a significantly high positive relationship between metacognitive awareness and the reflective learning skills of medical students.

Keywords: Metacognition; reflection; self-directed learning; self-regulated learning.

1. INTRODUCTION

Education is no longer seen as transmission of knowledge, especially learner nowadays are taking more responsibility regarding his or her learning. Rather, the focus now is on knowledge construction, which in turn requires the learner to be lifelong learners and self-regulated. Metacognition is considered the main idea of self-regulated learning [1].

In this regards, metacognition means learner should be aware of his thoughts and performance and can control both to achieve the learning task. in simple words, it can be defined as "thinking about thinking" [2]. It is considered to be a higher-order intellectual process that the learner use in the process of learning such as planning for the learning process, using certain skills and strategies for problem-solving, self-assessing his/her performance, and estimating the extent of learning [3].

Metacognition includes metacognitive knowledge and metacognitive control or regulation [4]. Metacognitive knowledge means knowing what is the individual's cognition, such as information about the suitable skills and methods work best for his learning and how and when to use these skills appropriately [5]. This type of knowledge includes three categories which are declarative, procedural, and conditional knowledge [6].

In the other hand**,** metacognitive regulation means intellectual activities that regulate thinking and learning [7]. It refers to the actions used to regulate and control the learning process, these actions begin with planning and setting goals, and then monitoring and finally evaluation. Strengths of these skills depend on the quality of educational experience [8].

The good problem-solvers have highly developed metacognitive skills. These learners know how to detect points of weaknesses in their thinking, organize their thinking processes, and re-evaluate the effectiveness of their efforts [9]. Metacognition is related to academic achievement because learner knows how he thinks and he can control his learning [10].

As we can see metacognition is an important skill to improve leaner's achievement. We hypothesize in this study that reflective thinking correlates to metacognition, and enhancing the reflective practice will improve metacognition which in turn will affect students achievement positively. Reflection improves deep and lifelong learning and professional development [11]. Reflection on experience is an effective strategy to plan for actions in the future. The learner does not reflect on subject-based activities only, but he reflects on his thinking, higher intellectual skills, and his learning too [12].

We learn from reflecting on the experience, not simply from the experience as it happened; when

the experience goes unnoticed, no learning occurs. reflection is very important in situations where professional behavior is required to improve patient care and secure his/her safety [13]. Reflection is now implemented across medical specialties and in all levels of learning; undergraduate, postgraduate and continuing medical education, it is a key skill in professional practice as it facilitates learning through self-assessment, monitoring and improvement, and it maintains competence [14,15] reflection means the ability of the learner to critically analyze the learning task to understand the nature of the task and one's thinking and learning to improve in the future [16].

Reflection has many potential benefits: It has been linked to knowledge integration, reducing the educational disadvantage of low-achieving students, and producing high conceptual gains among students [17].

Planning and self-monitoring allow students to identify what they knew and what they did not know, thereby supporting students' representation and construction of scientific concepts [18].

Reflective practice has many benefits such as linking theory to practice, enhancement of critical thinking and analysis, improving patient care and finally, it fosters changes in practice [19].

Through reflection, the learner can identify his learning needs and maintain his competencies, specifically, essential ones such as clinical reasoning, professionalism and patient safety, it leads to the continuous improvement of practice and health system management [20].

This study aims to measure the metacognitive awareness and reflective learning of medical students at the Faculty of Medicine, Suez Canal University and assess the relation between them hoping to improve and foster the student-centred learning of medical students.

2. METHODOLOGY

2.1 Type of the Study

This was a correlational descriptive study in which both metacognitive awareness and reflective learning skills of medical students were measured.

2.2 Site of the Study

The study was conducted at the Faculty of Medicine, Suez Canal University, in Ismailia governorate during the academic year (2017-2018).

2.3 Population and Sample

The study population included the undergraduate students in all study years at the Faculty of Medicine, Suez Canal University.

Two hundred and sixty-four randomly selected students from all college years were invited to participate in this study according to the following equation.

$$n = 2 + [(Z_{a/2} + Z_{b/2}(1 - r^2)^{1/2})/ r]^2$$

(Dawson and Trapp, 2004)

Where

n= sample size
Z α/2 = 1.96 (The critical value that divides the central 95% of the Z distribution from the 5% in the tail)
Zβ = 0.84 (The critical value that separates the lower 20% of the Z distribution from the upper 80%)
r = correlation

Participants in this study were randomly selected using a cluster sampling technique. An equal proportion of students around 27.4 of each study year to be involved in the study. Forty-six students from 1st year, forty-seven students from 2nd year, fifty-five students from 3rd year, forty students from 4th year, thirty-seven students from 5th year and thirty-nine students from 6th year.

2.4 Data Collection and Instrumentations

2.4.1 Metacognitive Awareness Inventory (MAI)

MAI was used to assess the awareness of students about their metacognitive abilities. It is a 52-item self-report questionnaire with a 5-points rating scale (1=never to 5= always) following each item. The results of the exploratory factor analysis have demonstrated that the items are loaded on eight factors; being: declarative knowledge, procedural knowledge, conditional knowledge, planning, monitoring, information management strategies, debugging strategies, and evaluation [21]. The total score of the instrument is calculated through sum the mean of all items. According to Pantiwati [22] who divides the percentage of metacognitive awareness

scores by <40.0% which means very poor; 40.0-54.9% means poor; 55.0-69.9% means fair; 70.0-80.0 means good; and >80.0 means very good.

2.4.2 Reflection-in-Learning Scale (RLS)

RLS was used to assess the students' reflective learning. The 14 - item version of the RLS appraised the reflective learning process. Each item of this self-report questionnaire features a 7-point response scale anchored at the extremes by 1=never and 7=always. The tool includes a self-assessment question on personal efficacy for self-determination for the ability to reflect on learning [23].

The total score of the instrument is calculated through sum the mean of all items. According to Khan, et al. [24] the final score of RLS was further divided into 4 sub-scales representing the self-assessment question, participants scoring 14-34 were designated as limited reflective level, subjects having 35-55 score presented partial reflective level, as well as students, demonstrated 56-76 score have ample level of reflection and students have maximum level of reflection when they score 77-98.

MAI and RLS were introduced to each participant to assess his/her awareness about his/her thinking and reflective abilities.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS version 20). Data was presented in tabular and graphic forms. Data were tested for normality, appropriate tests were conducted consequently according to data normality, data were presented either by tables or graphs.

3. RESULTS

3.1 The Demographic Data of the Study Population

Fig. 1. showing the distribution of the students from all study years. The majority of the respondents were females 191 (72.3%) while the male respondents were 73 (27.7%). The participants from 1st, 2nd, 3rd, 4th, 5th and 6th years share a percentage of 17.4%, 17.8%, 20.8%, 15.2%, 14% and 14.8% respectively from the total participants.

3.2 Descriptive Statistics of the Study Questionnaires (MAI and RLS)

Table 1 shows means and standard deviations of both MAI and RLS total scores of students in the six study years which revealed that students have mean total MAI total scores= 178 ± 26 and have mean total RLS total scores= 60 ± 13.

While the descriptive statistics of the eight factors of the MAI questionnaire were shown in (Table 2) revealed that the students have the conditional knowledge higher than the other metacognitive knowledge components and have the skills of information management and debugging strategies higher than the other metacognitive regulation skills.

The descriptive statistics of the 14 items of the RLS questionnaire were shown in (Table 3) which revealed that the medical students have the skills of talking with colleagues, mentally processing the information, awareness of learning task and ponder for learning higher than the other reflective learning skills.

3.3 Correlations between Variables Using the Spearman Correlation Coefficient

The Spearman's correlation between the two questionnaires revealed that there was a statistically significant high positive correlation between the metacognitive awareness and the reflection in learning of FOM-SCU students. The Spearman's correlation coefficient was 0.699 as shown in (Table 4).

Table 5 showing the Spearman's correlations coefficient between the RLS total scores and the eight components of metacognition revealed that there was a statistically significant moderate positive correlation between them of FOM-SCU students. The spearman's correlation coefficient was higher between RLS total scores and conditional knowledge (p= 0.605, p-value<0.0001) than the other components of metacognition.

Table 1. Means and standard deviation of both the metacognitive awareness inventory and reflection-in-learning scale total scores in each study year (n=264)

Totals	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
MAI total score	183 ± 23	183 ± 22	162 ± 33	183 ± 21	178 ± 23	181 ± 21	178 ± 26
RLS total score	63 ± 13	61 ± 11	54 ± 14	60 ± 12	59 ± 14	62 ± 11	60 ± 13

Numbers represent mean ± standard deviation

Table 2. Means and standard deviations of the eight factors of the metacognitive awareness inventory in each academic year (n=264)

Factors	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Declarative Knowledge	3.45 ± 0.52	3.45 ± 0.61	3.03 ± 0.74	3.46 ± 0.47	3.33 ± 0.61	3.37 ± 0.47	3.34 ± 0.61
Procedural Knowledge	3.29 ± 0.64	3.44 ± 0.64	3.1 ± 1.3	3.48 ± 0.6	3.26 ± 0.58	3.35 ± 0.53	3.31 ± 0.8
Conditional Knowledge	3.61 ± 0.55	3.5 ± 0.55	3.2 ± 0.73	3.49 ± 0.5	3.44 ± 0.56	3.53 ± 0.52	3.45 ± 0.59
Planning	3 ± 1	3 ± 1	3 ± 1	3 ± 1	3 ± 1	3	3 ± 1
Information Management Strategies	4 ± 1	4	3 ± 1	4 ± 1	4	4 ± 1	4 ± 1
Comprehension Monitoring	3 ± 1	3 ± 1	3 ± 1	3	3 ± 1	3 ± 1	3 ± 1
Debugging Strategies	4 ± 1	4 ± 1	3 ± 1	4 ± 1	4	4 ± 1	4 ± 1
Evaluation	4 ± 1	4 ± 1	3 ± 1	4 ± 1	3	3 ± 1	3 ± 1

N.B. scales were rated out of 5
Numbers represent mean ± standard deviation

Table 3. Means and standard deviations of the reflection-in-learning scale items in each academic year (n=264)

Items		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
1.	Carefully plan tasks.	3.96 ± 0.21	3.81 ± 0.21	3.85 ± 0.21	4.10 ± 0.47	3.92 ± 0.23	4.05 ± 0.19	3.88 ± 0.09
2.	Talked with colleagues	4.80 ± 0.23	4.77 ± 0.17	4.02 ± 0.20	4.43 ± 0.21	4.38 ± 0.22	4.54 ± 0.22	4.48 ± 0.09
3.	Review study	4.24 ± 0.23	4.00 ± 0.24	3.60 ± 0.21	4.20 ± 0.25	3.68 ± 0.30	3.92 ± 0.24	3.93 ± 0.10
4.	Integration	4.11 ± 0.9	4.40 ± 0.19	3.62 ± 0.20	4.28 ± 0.19	3.92 ± 0.25	4.51 ± 0.20	4.12 ± 0.08
5.	Process mentally	4.59 ± 0.22	4.34 ± 0.19	4.11 ± 0.19	4.45 ± 0.19	4.32 ± 0.21	4.82 ± 0.17	4.42 ± 0.08
6.	Aware of learning task	5.13 ± 0.23	4.28 ± 0.18	4.04 ± 0.21	4.53 ± 0.21	4.54 ± 0.21	4.44 ± 0.19	4.47 ± 0.09
7.	Develop interrelation	4.50 ± 0.22	4.43 ± 0.19	3.82 ± 0.18	4,45 ± 0.19	4.35 ± 0.19	4.79 ± 0.15	4.36 ± 0.08
8.	Ponder for learning	5.04 ± 0.18	4.94 ± 0.20	4.25 ± 0.20	4.68 ± 0.18	4.35 ± 0.22	4.72 ± 0.17	4.66 ±0.8
9.	Change myself for study	4.13 ± 0.23	4.72 ± 0.18	4.04 ± 0.22	4.45 ± 0.13	4.43 ± 0.22	4.62 ± 0.18	4.38 ± 0.08
10.	Reflection on study	4.67 ± 0.24	4.16 ± 0.21	3.76 ± 0.23	4.05 ± 0.20	4.49 ± 0.23	4.79 ± 0.16	4.33 ± 0.09
11.	Make summary	4.63 ± 0.21	3.91 ± 0.24	4.05 ± 0.23	4 .33± 0.21	4.00 ± 0.25	4.62 ± 0.22	4.25 ± o.09
12.	Use capacity to reflect	4.65 ± 0.22	4.49 ± 0.19	4.09 ± 0.24	4.35 ± 0.18	4.30 ± 0.22	4.51 ± 0.20	4.39 ± 0.09
13.	Remove negativity	4.46 ± 0.26	4.55 ± 0.22	3.93 ± 0.22	3.98 ± 0.20	4.41 ± 0.27	4.49 ± 0.21	4.29 ± 0.09
14.	Self-assess	3.78 ± 0.14	3.94 ± 0.18	3.16 ± 0.15	4.02 ± 0.16	3.70 ± 0.16	3.97 ± 0.17	3.73 ± 0.07

N.B. scales were rated out of 7
Numbers represent mean ± standard deviation

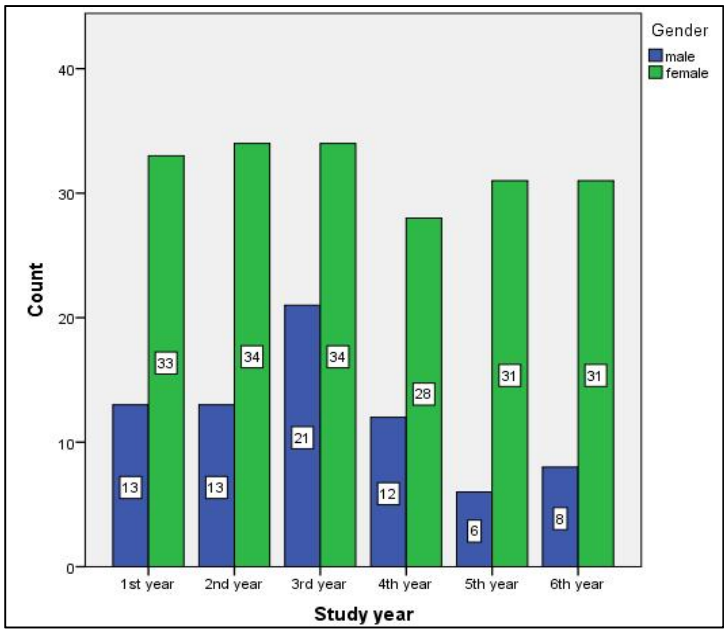

Fig. 1. The students' response in each study year (n=264)

Table 4. Spearman's correlation coefficient between the metacognitive awareness inventory and reflection-in-learning scale total scores

MAI score	RLS score	
	P	p-value
	0.699	<0.0001

Table 5. Spearman's correlation coefficient between reflection-in-learning scale total score and the eight factors of the metacognitive awareness inventory

	RLS total score	
	P	p-value
Declarative Knowledge	0.557	<0.0001
Procedural knowledge	0.446	<0.0001
Conditional knowledge	0.605	<0.0001
Planning	0.589	<0.0001
Information management strategies	0.577	<0.0001
Comprehension monitoring	0.584	<0.0001
Debugging strategies	0.463	<0.0001
Evaluation	0.569	<0.0001

Table 6. Multiple regression analysis between the metacognitive awareness inventory total score and four factors of reflection-in-learning scale

Model summary[b]					
Model	**R**	**R square**	**Adjusted R square**	**Std. error of the estimate**	**Durbin-Watson**
1	.762[a]	.580	.574	16.848	1.600

a. Predictors: (Constant), Selftesing, Planning, Reflection, Monitoring
b. Dependent Variable: MAI total score

3.4 Multiple Regression Analysis

We performed multiple regression analysis to predict the value of metacognition awareness based on the four factors of the reflection in learning scale, which are planning, monitoring, reflection and self-testing. These factors were extracted in a study which

Table 7. Correlation between metacognitive awareness inventory total score and each factor of reflection in learning scale

Coefficients[a]						
Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	86.260	5.043		17.106	.000
	Planning	1.000	1.139	.045	.878	.381
	Monitoring	3.484	1.305	.160	2.670	.008
	Reflection	7.196	1.283	.305	5.609	.000
	Self-testing	9.682	1.410	.383	6.866	.000

a. Dependent Variable: MAI total score

measures the validity and reliability of reflection in learning questionnaire by using confirmatory factor analysis [25].

Table 6 shows that The R Square and Adjusted R Square values, which are .580 and .574, respectively, which means that the weighted combination of the predictor variables explained approximately 50% of the variance of reflection in learning.

On examining the correlation between each factor of reflection in learning and the metacognitive awareness when the other factor is treated as covariates, the (Beta) coefficients, and their significance levels determined by t-tests revealed that all of the factors, except planning, are statistically significant. By examining the beta weights, self-testing followed by reflection followed by monitoring contribute largely to the prediction model.

4. DISCUSSION

4.1 Students' Perceptions Regarding their Metacognitive Awareness and Reflective Learning

In this study we examined the relation between metacognition and reflection first we determined the metacognitive score and reflection separately In our study the medical students have a percentage of metacognitive awareness scores ranging from 58.5% to 78.5% (M=178, SD=26, N=264) means fair to good metacognitive awareness levels [22].

Moreover, students have a reflective learning total scores ranging from 47 to 73 that means partial to ample levels of reflection [24].

After measuring metacognitive awareness and reflection among the study population, we examine the relation between students' Metacognitive Awareness (MAI) and reflection in learning (RLS). The Spearman's correlation revealed statistically significant high positive correlation between both (p=6.99, p-value <0.0001). This result may indicate that introducing more reflective activities will enhance and develop their metacognitive awareness skills.

The Spearman's correlations were tested between the eight components of metacognition and the RLS. It revealed a significant and positive correlation to each other with the highest correlation between RLS and conditional knowledge (p=6.05, p-value <0.0001). This finding may be due to the Problem Based Learning and Community-Based Medical Education environment that enhance problem-solving and experiential learning skills that foster the students' capacities of when and why to apply different cognitive actions.

This positive correlation between metacognition and reflection was consistent with the study of Mair that performed on year 2 undergraduate psychology students who were asked to complete the MAI using a six-point Likert scale before and after six weeks of online structured, critical reflective practice. This study revealed that reflective practice leads to increased metacognitive awareness (MAI baseline (M=4.12, SD=0.47), MAI post-study (M=4.23, SD=0.48)) [16].

The multiple regression analysis shows that metacognitive awareness was primarily predicted by self-testing and reflection, and to a lesser extent by monitoring and planning. This finding was consistent with the study of Kuper that was conducted on newly graduated nurses in the School of Nursing at the University of North Carolina, Wilmington in North Carolina, USA. This study differed from our study in using qualitative instruments for data collection as participants were assigned to self-reflect after a

minimum of 5 to 6 weekly clinical experiences using Self-regulation Learning Prompts for Reflection on Clinical Experience and self-evaluate metacognition using Evaluation Guide for Self-regulation Learning Prompt Responses. This study revealed that the reflection exercise-trained interns to become more metacognitive in their clinical reasoning in practice daily [26]. Also, a study was conducted by Turkey showed that when students practice reflection through writing short essays and discussing them in brainstorming session their response in the scale of metacognition enhanced [27].

4.2 Limitations and Implication for Further Research

This study explores the effects of reflective practices on metacognitive awareness and identifies exactly which reflective component has a great effect. Which opens the door for further research to plan for reflective activities to enhance students' metacognition. The used instruments (MAI and RLS) were valid tools and tested for reliability. However, this research was conducted at only one school (FOM-SCU) which might limit the generalizability of the findings, furthermore, reliance is only on quantitative analysis. However, a combination of quantitative and qualitative analysis might permit a further investigation.

5. CONCLUSION

It is concluded from this study that students at the Faculty of Medicine, Suez Canal University have fair to good metacognitive awareness and partial to ample reflective abilities. There is a statistically significant high positive relationship between students' metacognitive awareness and reflective learning that may emphasize the assumption of applying more reflective thinking activities will enhance the students' metacognitive awareness that in turn will lead to higher achievement and professional performance.

CONSENT

As per international standard or university standard, students' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This study was approved by the research and ethics committee at the Faculty of Medicine – Suez Canal University.

ACKNOWLEDGEMENT

Authors express their gratitude for students who agreed to participate in this study. Authors also wish to thank school administration who eases the work for this research, and finally, they gratefully thank members in the medical education department for their continuous help.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Cubukcu F. Learner autonomy, self-regulation and metacognition. Int Electron J Elem Educ. 2009;2(1):53–64.
2. Flavell JH. Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. Am Psychol. 1979; 34(10):906–911.
3. Schneider EF, Castleberry AN, Vuk J, Stowe CD. Pharmacy students ' ability to think about thinking. Am J Pharm Educ. 2014;78(8):148–155.
4. Veenman VJ, Bernadette HAM, Van Hout-Wolters, Afflerbach P. Metacognition and learning : Conceptual and methodological considerations. Metacognition Learning. 2006;1:3–14.
5. Mahdavi M. An overview : Metacognition in education. Int J Multidiscip Curr Res. 2014;529–535.
6. Arslan S, Akin A. Metacognition: As a predictor of one's academic locus of control. Educational Sciences. 2014;14(1): 33–39
7. Coutinho SA. The relationship between goals, metacognition, and academic success. Educate. 2007;7(1):39–47.
8. Çetin B. Metacognition and self-regulated learning in predicting University Students' Academic Achievement in Turkey. J Educ Train Stud. 2017;5(4):132-138.
9. Tosun C, Senocak E. The effects of problem-based learning on metacognitive awareness and attitudes toward chemistry of prospective teachers with different academic backgrounds. Aust J Teach Educ. 2013;38(3):61–73.
10. Bayındır D, Dağal AB. The investigation of the relationship between the level of metacognitive awareness, self-directed learning readiness and academic achievement of preschool teacher

candidates. Univers J Educ Res. 2016; 4(11):2533–2540.
11. Sandars J. The use of reflection in medical education: AMEE guide no. 44. Med Teach. 2009;31(8):685–695.
12. Chaffey LJ, Johanna E, Leeuw J De, Finnigan GA. Facilitating students' reflective practice in a medical course : Literature review. Education for Health. 2017;25(3):189-203.
13. Moore DE, Green JS, Gallis HA. Achieving desired results and improved outcomes: Integrating planning and assessment throughout learning activities. J Contin Edu Heal Prof. 2003;161(137):1.
14. Rogers RR. Reflection in higher education : A concept analysis. Innovative Higher Educaton. 2001;26(1):37–57.
15. Mann K, Gordon J, MacLeod A. Reflection and reflective practice in health professions education: A systematic review. Adv Heal Sci Educ. 2009;14 (4):595–621.
16. Mair C. Helping students succeed through using reflective practice to enhance metacognition and create realistic predictions. Psychol Teach Rev. 2012; 18(2):42–46.
17. Reiser BJ. Scaffolding complex learning: The mechanisms of structuring and problematizing student work. J Learn Sci. 2004;13(3):273–304.
18. Wilson T, Perry M, Anderson CJ, Grosshandler D. Engaging young students in scientific investigations : Prompting for meaningful reflection. British Journal of Nursing. 2012;19–46.
19. Jorwekar GJ. Reflective practice as a method of learning in medical education : History and review of literature. International Journal of Research in Medical Sciences. 2017;5(4):1188–1192.
20. Aronson L. Twelve tips for teaching reflection at all levels of medical education. Medical Teacher. 2011;200–205.
21. Schraw G, Dennison RS. Assessing metacognitive awareness. Contemp Educ Psychol. 1994;19(4):460–475.
22. Pantiwati Y. Self and peer assessments in active learning model to increase metacognitive awareness and cognitive abilities. Int J Instr. 2017;10(104):185–202.
23. Sobral DT. An appraisal of medical students' reflection-in-learning. Med Educ. 2000;34(3):182–187.
24. Khan NF, Saeed M, Yasmin R, Butt AK, Khan AA. Age and gender based differences in self-assessed reflection- in-learning scale. Journal of the Pakistan Dintal Association. 2018;27(3):133–139.
25. Karmen Kalk, Piret Luik, Merle Taimalu, Karin Täht. Validity and reliability of two instruments to measure reflection: A confirmatory study, trames. 2014;18 (68/63):2:121–134.
26. Kuiper RA. Promoting metacognition by reflecting with self regulated learning prompts 1. California Academic Press. 2002;33:1–7.
27. Mohamed Abdullah Turkey. enhancing metacognition skills by using reflective e-portfolio. Digital Design and publish Research Unit (DDPRU); 2017.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/53452