Original Article

Introduction of metacognitive skills in biochemistry I MBBS students

V. Sampath Kumar¹, Amrut A. Dambal², D. Sridevi³, M. Girija Menon⁴, Anila Sushma⁵, TLS Gowri⁶

¹Dept. of Biochemistry, ESIC Medical College, Sanath Nagar, Hyderabad
²,³,⁴ & ⁵ Dept. of Biochemistry, Malla Reddy Institute of Medical Sciences, Suraram, Hyderabad
⁶Dept. of Anatomy, Govt. Medical College, Nizamabad

Corresponding author:
Dr. Velpula Sampath Kumar
Email: sampath.surya76@gmail.com

INTRODUCTION:

Metacognition is the knowledge and regulation of ones own cognitive system. Possession and use of metacognitive abilities is necessary for learning and the learners who are metacognitively strong are the best in their performances throughout their lives[1].Medical students are not simply learners but they are expected to be medical experts who should focus on their capabilities to continuously assess, monitor and improve their performance. Medical students must be prepared to cope with uncertainty and evolving understanding inherent in medical practice [2].Metacognition includes knowledge and regulation of ones own thinking processes. Metacognitive strategies consist of two dimensions: knowledge of metacognition and regulation of metacognition. Knowledge of cognition refers to what individuals know about their own cognition and it includes three different kinds of metacognitive awareness: declarative, procedural, and conditional knowledge [3]. Regulation of cognition which includes planning, monitoring, evaluation, information management and debugging [4] .It refers to a set of essential skills that help students control their learning. The regulation of metacognition also involves the debugging process which engages students to use strategies to correct errors or reflect on mistakes done, whereas the evaluation process is where students analyze their performance and weigh the effectiveness of the strategies used. Introduction of metacognitive skills are useful for taking conscious control of learning, planning, monitoring the progress of learning, identifying personal strengths and weaknesses, undertake appropriate remediation, analyzing and changing learning behaviors and applying strategies wherever necessary. [5] Students who are aware of Metacognitive skills can assess themselves and apply them from classroom to real life situations in practice to become a competent doctor. [6]

OBJECTIVES:
➢ To assess the metacognitive awareness levels in medical students
➢ To introduce the metacognitive skills in II MBBS students.
➢ To know the effect of introducing metacognitive skills in II MBBS students

➢ Perceptions of students towards metacognition strategies
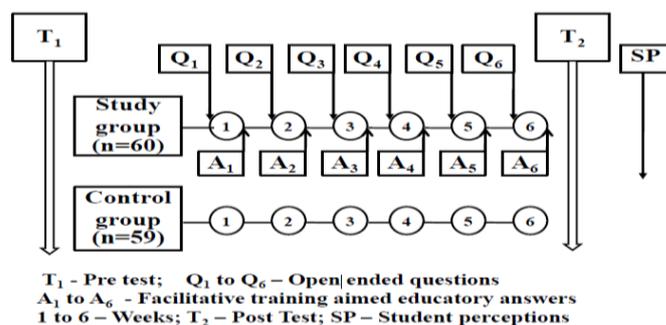
MATERIALS AND METHODS

Participants: I MBBS student volunteers, Malla Reddy Institute of Medical sciences.
The size of the study included 59 controls and 60 study subjects.
Ethical approval and Informed consent: Institutional Human Ethical Committee IEC/MRIMS/052016, informed consent was taken from all the participants.
Questionnaire, Data collection and Analysis: The pre-test Metacognitive Awareness Inventory (MAI) [7] was taken from all participants with 52-item self-report inventory and each item is rated on 5-Point Liker-type scale. Six weeks metacognitive training is given only to the study group with six open ended questionnaire and facilitative training aimed educatory answers of metacognition [8] through WhatsApp after sensitization. Post-test Metacognitive Awareness Inventory was taken after six weeks in both the control and study groups. MAI scores for knowledge of metacognition include Declarative knowledge (DK), Procedural knowledge (PK) and Conditional knowledge (CK).MAI scores for regulation of metacognition include Planning (P), Information Management (IM), Monitoring (M), Evaluation (E) and Debugging (D).
Statistical analysis was done by student t test using SPSS package version 20.

T_1 - Pre test; Q_1 to Q_6 – Open|ended questions
A_1 to A_6 - Facilitative training aimed educatory answers
1 to 6 – Weeks; T_2 – Post Test; SP – Student perceptions

RESULTS:

The paired t- test showed there was no significant difference in the pre and post test MAI scores of control group (p<0.760) where as the difference in pre and post test MAI scores of study group were statistically significant.(p<0.0001)

Analysis by paired t-test for MAI scores for the controls in the pre test and the post test were 3.8 ± 0.36 and 3.81 ± 0.38 with p-value <0.76 indicating insignificant statistical difference.

MAI scores for the study group in pre and post test were 3.83 ± 0.36 and 3.97 ± 0.39 with p value < 0.0001

Analysis of pre and post test MAI scores for knowledge of metacognition in controls were 3.82 ± 0.33 and $3.89+0.38$ (p value <0.68). MAI scores for knowledge of metacognition in study group were $3.86+0.41$ and $3.91+0.39$ (p value<0.362) No statistical difference was observed in both the groups. (TABLE 1)

Analysis of pre and post test MAI scores for regulation of metacognition in controls were 3.80 ± 0.35 and 3.77 ± 0.39 (p value <0.506).MAI scores for knowledge of metacognition in study group were $3.82+0.33$ and $4.01+0.28$ (p value<0.0001). Statistical Significant difference was observed in the post test for regulation of metacognition in study group. (TABLE 1)

The Individual P value MAI scores for knowledge and regulation of metacognition in study group especially in Planning (<0.031), Monitoring (<0.003), Evaluation (< 0.021) shows significance when compared to control groups and the rest of components P values like Declarative knowledge (DK), Procedural Knowledge (PK), Conditional Knowledge (CK), Information Management (IM) and Debugging (D) did not show any difference between study and control groups. (TABLE 2)

DISCUSSION:

Metacognitive skills, also referred to as higher order thinking skills, are needed to help individuals to become more adaptable, flexible, and able to cope in the context of a rapidly evolving information society [9].Past research has demonstrated that academically successful students use metacognitive strategies, notably identify their goals, self monitoring, self questioning, reasoned choice of their behaviors and self assessing [10].

In the present study, a highly significant difference in MAI scores among pre test and post test study group was observed for regulation of metacognition. No significance was observed in control group for regulation of metacognition. No statistical difference of MAI scores were observed in pre test and post test for both study and control groups regarding knowledge of metacognition.

Our study is in accordance with the study by Wei Han Hong et al who contemplated a better ability to plan, monitor and evaluate their own thoughts suggesting an increase in students level of regulation of metacognition.

Similar findings were observed by a study from Causley and Striven who considered regulation of metacognition encourages better use of the basic medical knowledge in nurturing clinical judgment, critical thinking and reflective practice. [11]

Students who are high achievers in reading, writing and science also exhibit higher levels of metacognitive skills and have developed greater abilities in self regulation. Hence medical students metacognitive skill will have an effect on their abilities to improve their academic and clinical performance.

The perceptions of the students showed around 60% felt they were able to understand the Metacognition and also improved their learning skills, 50% felt motivated interest in learning process, 65% were able to identify their grey areas in learning methods, 60% knew how to monitor and evaluate themselves and 56% were able to adapt to new learning methods.

CONCLUSION:

The results showed that training metacognitive strategies improve metacognitive skills in medical students which are important in enabling to plan, monitor, and evaluate themselves in order to cope with the hectic syllabus in the MBBS program and to be better lifelong learners.

REFERENCES:

1. Gonullu I, Artar M. The Impact of Metacognition Training on Metacognitive awareness Of Medical Students. J Theory Pract Edu 2014;10(1):1-23.
2. Quirk M. Intuition and metacognition in Medical Education; Keys to developing expertise. New York: Springer Publishing Company; 2006.
3. Brown AL. Metacognition, executive control, self-regulation, and other more mysterious mechanisms. In: Weinert FE, Kluwe RH, editors. Metacognition, motivation, and understanding. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1987. p. 65-116.
4. Schraw G, Moshman D. Metacognitive theories. Educational Psychol Rev 1995;7(4):351-3.
5. Dunlap JC. Problem-based learning and self-efficacy: How a capstone course prepares students for a profession. Educational Technol Res Dev 2005;53(1):65–85.
6. Niedringhaus KL. Teaching Better Research Skills by Teaching Metacognitive Ability. Perspectives Teaching Legal Res Writing. Winter/Spring 2010;18:2-3.
7. Schraw G. Promoting general metacognitive awareness. Inst Sci 1998;26:113-25.
8. Meijer J, Veenman MV, Van Hout-Wolters B. Metacognitive Activities in Text-Studying and Problem-Solving: Development of taxonomy. Educational Res Evaluat 2006;12(3):209-37.
9. Hong WH, Vadivelu J, Daniel EGS et al. Thinking about thinking: changes in first –year medical students metacognition and its relation to performance. Med Educat Online 2015;20;(27561):1-6.
10. Gonullu I, Artar M. Metacognition in Medical Education. Educat Health 2014;27(2):225-6.
11. Maudsley G, Strivens J. Science, critical thinking and competence for tomorrows doctors. A review of terms and concepts. Med Educ 2000;34:53-60.
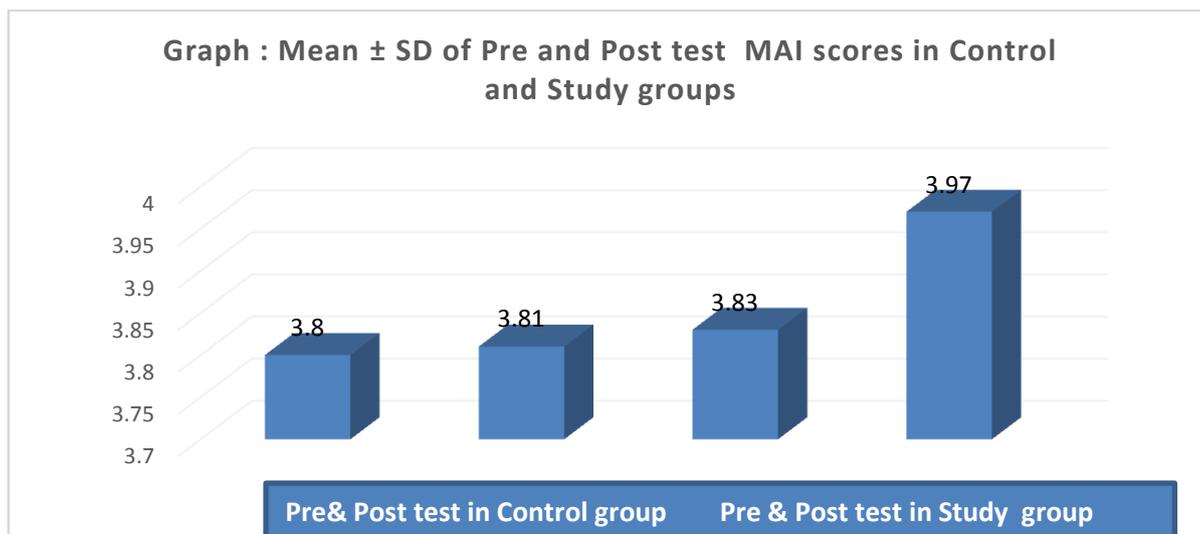
Graph : Mean ± SD of Pre and Post test MAI scores in Control and Study groups

Table 1: MAI score of knowledge and regulation of metacognition

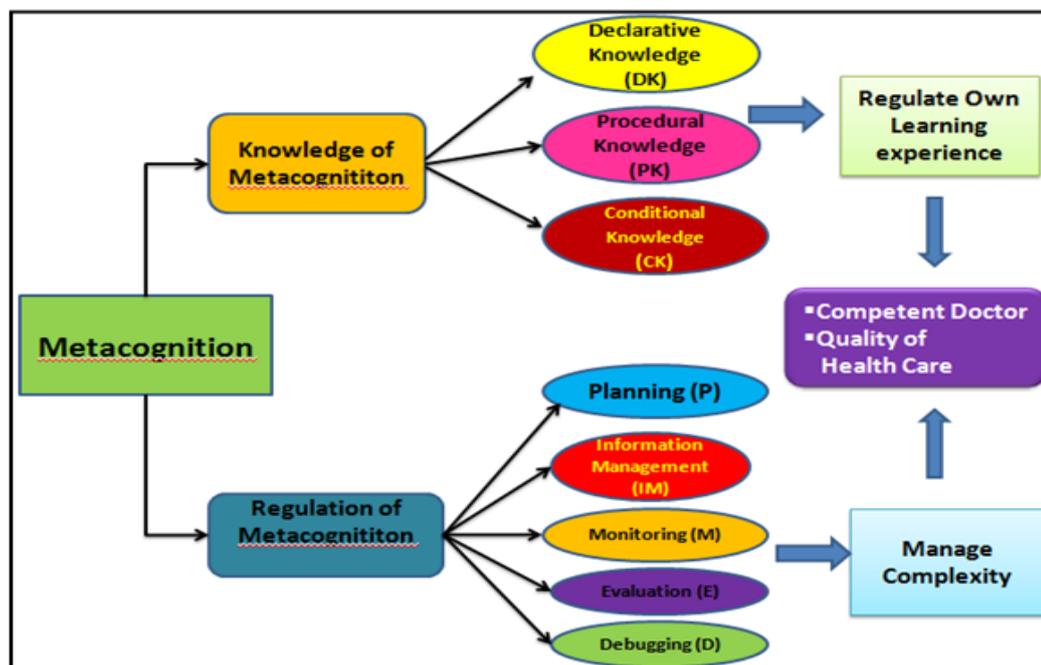|	Control Group		Paired t - test (P value)	Study Group		Paired t - test (P value)
	Pre Test	Post Test		Pre Test	Post Test	
Knowledge Cognition	3.82 ± 0.40	3.89 ± 0.38	<0.680	3.86 ± 0.41	3.91 ± 0.39	<0.362
Regulation Cognition	3.80 ± 0.35	3.77 ± 0.39	<0.506	3.8 2 ± 0.33	4.01 ± 0.28	<0.0001***

Table 2: Individual MAI scores for knowledge and regulation of metacognition

Component	Control Group		Paired t-test (P value)	Study Group		Paired t - test (P value)
	Pre Test	Post Test		Pre Test	Post Test	
DK	3.77 ± 0.52	3.84 ± 0.46	<0.053	3.80 ± 0.46	3.82 ± 0.39	<0.729
PK	3.79 ± 0.23	3.83 ± 0.22	<0.556	3.78 ± 0.24	3.83 ± 0.36	<0.519
CK	3.92 ± 0.33	4.00 ± 0.24	<0.225	4.02 ± 0.48	4.10 ± 0.38	<0.568
P	4.15 ± 0.27	4.13 ± 0.36	<0.165	4.12 ± 0.29	4.29 ± 0.29	<0.031*
IM	3.91 ± 0.28	3.86 ± 0.38	<0.455	3.98 ± 0.31	4.09 ± 0.27	<0.338
M	3.63 ± 0.29	3.60 ± 0.51	<0.825	3.65 ± 0.21	3.89 ± 0.30	<0.003**
E	3.75 ± 0.19	3.72 ± 0.15	<0.406	3.70 ± 0.27	3.95 ± 0.17	<0.021*
D	3.62 ± 0.34	3.61 ± 0.34	<0.179	3.66 ± 0.35	3.87 ± 0.19	<0.144

* Significant ** Very Significant *** Extremely Significant

Table 3: Perception of the students

S. No	Item	1. Strongly Disagree %	2. Disagree %	3. Neutral %	4. Agree %	5. Strongly Agree %
1	Able to understand Metacognitive strategies	_	_	13.6	64	22.4
2	The metacognitive strategies have improved your learning skills	_	_	20.2	60.6	19.2
3	Introduction of metacognitive strategies for MBBS Students is a mistake	65	24.4	7.4	---	3.2
4	Training has motivated your interest in learning	_	3.2	6.4	51.2	35.2
5	It helped you to identify your grey areas in learning methods	---	_	10.6	65	24.4
6	It assisted you to organize your time in accomplishing your goals	---	5.2	13.8	49	37.2
7	It aided you in monitoring your learning objectives	---	4.2	7.4	61.8	26.6
8	It lends a hand to evaluate yourself about learning strategies	---	_	23.4	45.8	26.6
9	Teaching metacognitive skills explicitly is useful to adapt new learning methods	4.2	_	5.2	55.4	39.4
10	Metacognitive strategies guide towards self-directed learning	---	---	4.2	39.4	52.2
11	Continuous practicing metacognitive skills will be useful to become a lifelong learner	_	---	8.4	34	57.6