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Research Article

Metacognitive awareness- evaluation and implications in medical students

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ABSTRACT

Background: Medical education is at cross roads today with a mismatch between students' expectations of their performance and the reality. This led us to explore the reason for the academic decline. During our search, we found that metacognitive awareness plays a key role in moulding the learning skills of adult learners. Hence this study was conducted to evaluate the metacognitive awareness of medical students studying in the first year of MBBS.
Methods: 100 first year medical students were included in the study and metacognitive awareness inventory questionnaire, a validated tool was administered to the students. This measures metacognitive knowledge and regulation. The results were obtained, tabulated and analysed.
Results: Metacognitive awareness among medical students was average. Metacognitive knowledge was found to be significantly better than regulation. On comparing the genders, we note that females have better metacognitive regulation while males score higher in metacognitive knowledge which was statistically significant.
Conclusions: The findings of the present study points towards the need of introduction of metacognitive strategies in the medical curriculum with more emphasis on problem based learning in order to make our learners become independent thinkers and efficient care givers.

Keywords: Metacognition, Metacognitive knowledge, Metacognitive regulation, Medical students

INTRODUCTION

In a profession like medicine, which is in the constant ambit of change, innovation and uncertainty, training of a medical student should be aimed at forming competent doctors who can address, manage, cope and adapt to any complexity. Medical professionals being lifelong learners cannot always depend on their trainers or facilitators to acquire knowledge. In such a situation, it becomes necessary for a student to be aware of his incompetencies, and have an insight of his deficiencies. A novice medical student has to metamorphose into an expert professional by learning to think about his/her thinking.[1] This concept known as metacognition was introduced by Flavell in the year 1979.[2]

Metacognition is defined as the activity of monitoring and controlling one's cognition and using this cognitive process to learn and remember[3]. There is a solid body of evidence suggesting that professionals with low metacognition are unable to monitor their own performance or use information to determine the difficulty of a task while past research has demonstrated that academically successful students use metacognitive strategies, identify their goals, and are able to self monitor and self assess.[4-6]

Metacognitive awareness includes two components; knowledge of metacognition and regulation of metacognition. Awareness of one's own cognitive process is known as metacognitive knowledge.[7]

Knowledge of the factors influencing how we learn and what we learn is known as declarative knowledge which is a sub component of metacognitive knowledge in addition to procedural and conditional knowledge. Knowledge about the learning and memory strategies suited best to an individual is known as procedural knowledge while conditional knowledge is the awareness of the conditions under which the student implements various cognitive strategies. The steps taken by a student in order to facilitate learning and memory is metacognitive regulation. It includes, planning, information management, debugging, evaluation and monitoring. To nurture clinical judgement and critical thinking among medical students, metacognitive regulation plays a key role.[8]

There is undeniable evidence suggesting the significance of metacognitive awareness in students in improving their academic performances. But most of the studies have been done in school children and in the West. Importance of metacognitive awareness in medical profession remains unexplored. Rather than following instructions blindly, medical students must be to be able think for themselves and adjust to the hectic syllabus in the MBBS program. Hence the present study is designed with aim in mind to assess the metacognitive awareness, both knowledge and regulation, in the first year medical students using the metacognitive awareness inventory. An assessment of metacognitive awareness in adult learners enables the educators to device tools to address the learning needs of the learners in future.

METHODS

The study was conducted in Jubilee Mission Medical College, Thrissur, Kerala, India, on 100 first year medical students after obtaining institutional ethics clearance (23/16/IEC/JMMC&RI). The consent of the participants was also obtained after explaining the methodology to them. Metacognitive awareness inventory questionnaire, a validated tool was administered to all the students who were willing to participate in the study.[9] Metacognitive awareness inventory is a 52 question based questionnaire with 17 questions assessing the knowledge of metacognition and 35 questions assessing regulation of metacognition. The questions were of the true or false pattern with the score of 1 mark for each answer that indicates the option 'true'.

Statistical analysis of the data: This is a cross sectional, descriptive study. The data obtained from the metacognitive awareness inventory was tabulated and analysed. The data was compared between the genders for metacognitive knowledge, regulation and both. The correlation between the subcomponents was also analysed using chi square tests. The comparison between genders was done using paired t tests. Both inter and intra group comparison for metacognitive knowledge, and regulation was done using ANOVA. The software used was Statistical package for social science (SPSS- version 22).

RESULTS

The total number of participants involved in this study is 86. Figure 1 demonstrates the gender wise distribution of the study group with 57% females and 43% males.

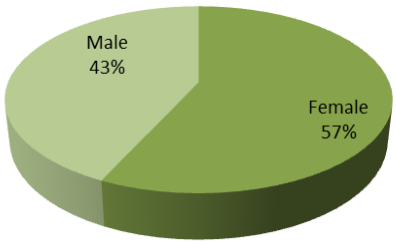

Figure 1: Gender distribution.

Table 1 shows an analysis of the metacognitive awareness of 86 first year medical students who were grouped according to their score percentages. 70 students have obtained scores ranging between 50-80% with a mean value of 33.18.The number of students with scores above 80% is only 5 while 11 students scored below 50 %. The three groups were statistically analyzed and it was found to be highly significant with p value of 0.001.

Analysis of the metacognitive knowledge and regulation of 86 students was done (Table 2 and 3). It was found that majority of the students belonged to the second group (50-80%) with mean value of 10.98 for metacognitive knowledge and 22.55 for metacognitive regulation.

On comparing the total metacognitive knowledge and regulation of 86 students (Table 4) it was found that the mean scores for knowledge is 10.76 and for regulation is 21.98 and this is found to be highly statistically significant (p value- 0.0001).

Table 1: Metacognitive awareness in medical students.

Metacognition awareness score	Number	Percentage	Mean	Std. Deviation	p value
<50% (low)	11	13%	24.6364	1.80404	
50-80% (average)	70	81%	33.1857	4.12238	0.001**
>80% (high)	5	6%	44.4000	3.20936	

*significant (p<0.05) , **highly significant (p<0.001).

Table 2: Metacognitive knowledge in medical students.

Metacognitive knowledge scores	Number	Percentage	Mean	Std. Deviation	p value
<50% (low)	18	21%	6.94	1.305	0.001**
50-80% (average)	54	63%	10.98	1.236	
>80% (high)	14	16%	14.79	0.893	

*significant (p<0.05); ** highly significant (p<0.001).

Table 3: Metacognitive regulation in medical students.

Metacognitive regulation scores	Number	Percentage	Mean	Std. Deviation	p value
<50% (low)	11	13%	14.91	2.023	0.001**
50-80% (average)	71	83%	22.55	2.922	
>80% (high)	4	5%	31.50	2.082	

*significant (p<0.05); **Highly significant (p<0.001).

Table 4: Comparison of metacognitive knowledge and regulation in medical students.

Metacognitive knowledge and regulation in medical students	Number	Mean	Std. Deviation	p value
Knowledge (17)	86	10.76	2.683	0.0001**
Regulation(35)	86	21.99	4.321	

*significant (p<0.05);**Highly significant (p<0.001)

Table 5 compares the components of metacognition between the genders and it is seen that males have better cognitive knowledge than females which is significant while females have better regulation which is not statistically significant. On comparing the overall metacognitive awareness scores, males have better metacognitive awareness than females though not statistically significant.

Table 6 shows the correlation of metacognitive knowledge and regulation with respect to gender with females having a mean value of 10.22 for knowledge and 22.16 for regulation and this was found to be statistically significant. While in males, the mean scores for knowledge were 11.46 and regulation was 21.76 which were also found to be statistically significant.

Table 7 is comparison between all the subcomponents of knowledge and regulation between males and females which does not show any statistical significance.

Table 5: Gender wise comparison of metacognitive awareness scores.

Metacognitive component	Sex	Number	Mean	Percentage	Std. Deviation	p value
Knowledge (17)	Male	37	11.46	67.41	2.292	0.034*
	Female	49	10.22	60.14	2.852	
Regulation(35)	Male	37	21.76	62.16	4.186	.668
	Female	49	22.16	63.32	4.455	
Metacognitive awareness (52)	Male	37	33.216	63.88	5.41159	.500
	Female	49	32.387	62.28	5.76200	

*significant (p<0.05); **Highly significant (p<0.001).

Table 6: Association between knowledge and regulation of cognition in males and females.

Sex	Metacognitive dimensions	Mean	Percentage	Number	Std. Deviation	P value
Female	Knowledge (17)	10.22	60.14	49	2.852	0.0001**
	Regulation (35)	22.16	63.32	49	4.455	
Male	Knowledge (17)	11.46	67.41	37	2.292	.000**
	Regulation (35)	21.76	62.16	37	4.186	

*significant (p<0.05); **Highly significant (p<0.001).

Table 7: Gender wise comparison of metacognitive awareness sub component scores.

Metacognitive sub component	Sex	Number	Mean	Percentage	Std. Deviation	P value
Procedural knowledge (4)	Male	37	2.89	72.30	1.048	0.283
	Female	49	2.65	66.33	0.991	
Declarative knowledge (8)	Male	37	5.00	62.50	1.414	0.082
	Female	49	4.41	55.10	1.632	
Conditional knowledge (5)	Male	37	3.57	71.35	0.987	0.095
	Female	49	3.16	63.27	1.179	
Information management strategies (10)	Male	37	7.22	72.16	1.228	0.512
	Female	49	7.41	74.08	1.413	
Debugging strategies (5)	Male	37	4.08	81.62	0.894	0.833
	Female	49	4.12	82.45	0.904	
Planning (7)	Male	37	3.62	51.74	1.255	0.524
	Female	49	3.82	54.52	1.495	
Comprehension monitoring (7)	Male	37	3.65	52.12	1.438	0.172
	Female	49	3.20	45.77	1.514	
Evaluation (6)	Male	37	3.19	53.15	1.488	0.157
	Female	49	3.61	60.2	1.255	

DISCUSSION

In the burgeoning world of medical education, the task of educators is to mould medical students to be flexible thinkers, agile learners and competent doctors. Good metacognitive awareness is a necessity to attain these goals and is a skill that can be honed and developed to maximally utilise their intelligence. The present study aims to find out the metacognitive awareness of first year medical students.

Of the 100 first MBBS students, only 86 were willing to participate in the study. Of these 49 were females and the rest males. As shown in Table 1, it was found that the metacognitive awareness of the medical students was average, with most of the students scoring within the range of 50-80%. Despite these students being admitted on the basis of their merit scores which were in the distinction range, their metacognitive awareness appears to be only average with only a handful having above 80% score. This is an issue to be addressed. In a profession like medicine, where an individual has to think independently and effectively, poor metacognitive scores would affect patient treatment in the long run. Contrary to the popular belief, metacognition is not an innate skill and is a strong predictor of academic success.[1] Poor metacognition translates into a person feeling more incompetent than his peers, resulting in higher anxiety as noted by Kruger and Dunning.[10] Metacognitive awareness in medical students has garnered limited attention in contrast to other professions, probably because it is assumed that the learners of medicine must have good metacognitive scores, which remains far from the truth.[11] An average score in our study indicates the requirement of implementation of metacognitive strategies which would help students increase their metacognitive awareness and thereby their academic performance.

On comparing the components of metacognition, namely metacognitive knowledge and metacognitive regulation, it was observed that the most of the students fell into the average category (knowledge- 63% and regulation- 83%) which was statistically significant as seen in table 2 and 3. When high scorers were compared for metacognitive knowledge and regulation, it was found that metacognitive knowledge (16%) was better than regulation (5%). This finding is supported by Divya Narang et al.[12] We have chosen to analyse the subcomponents of metacognition separately in order to develop an insight into the strength and weaknesses of our learners.

Many researchers are in agreement that metacognitive knowledge is better developed than regulation in adult learners as we see in Table 4, which implies that the students knew about themselves as learners, the strategies to be applied, and the conditions under which these strategies are most useful.[12-14] Academic performance has a positive relationship with metacognitive regulation rather than knowledge.[9] Data from the present study implicates that the medical students have acquired the knowledge but lack the ability to utilise this knowledge to keep up with the pace of the present curriculum, set goals, plan and evaluate themselves.[4] This reiterates the fact that the teachers need to establish effective teaching practices to help the learners shape their professional identity.[15]

Gender wise analysis of metacognitive awareness components (Table 5) revealed that males have better knowledge of metacognition than females, which is significant. This finding contradicts the finding of Divya

Narang et al, Iri Y wherein they have found that females have better metacognitive knowledge.[12,16] This is also in contradiction with the findings of Imran M et al, Rani R et al, Siddique A et al, and Ul Rehaman F et al who say that gender has no role to play in awareness of metacognition.[13,17-19] One of the plausible reasons for males having better metacognitive awareness than females could be that the areas of the brain related to metacognition is better developed in males, this area being the prefrontal cortex.[20] Our research, also in sync with the above studies, shows better metacognitive awareness scores in males though it is not statistically significant. However females seem to have higher skills in metacognitive regulation though statistically insignificant which suggests that they plan, regulate and evaluate their learning strategies better as also seen in the study done by Narang D et al.[12]

Table 6 compares the metacognitive knowledge and regulation scores within the sexes. Females have much better regulation than knowledge which is highly significant which means that they make better use of medical knowledge in situations that require critical thinking.[8] Better regulation also implies better academic performance, which is yet to be ascertained in our students. Males on the other hand have better knowledge than regulation which is statistically highly significant. This goes to say that the results of this study have unravelled the areas of weakness of the different sexes. Hence remodelling of curriculum and implementation of various metacognitive strategies should be done keeping in mind the educational needs of both the sexes.

The various dimensions of both knowledge and regulation of metacognition were compared in both sexes in Table 7. Though we did not get any statistically significant values, an interesting observation was that declarative knowledge is the best in both the sexes followed by procedural and conditional knowledge which are the subcomponents of metacognitive knowledge. This finding indicates that our students know what has to be learnt but are unable to identify the conditions in which this knowledge can be put to use. Even though the research about metacognitive awareness has progressed in leaps and bounds, the various dimensions of metacognitive knowledge and regulation have not been explored. This forms the future arena for research in this field. Identifying the lacunae in specific subcomponent would further help in evolving a more learner centric medical curriculum that would help in developing skills that optimise the use of a learner's intelligence. With regards to metacognitive regulation, it was found that both the sexes have better debugging strategies when compared to the other subcomponents.

CONCLUSION

This project was started assuming that medical students with their high academic credentials would have excellent metacognitive awareness. It was disappointing to find that most of our students scored only average and this in addition to the overwhelming volume of syllabus to be covered may lead to poor performance in their exit exams which is yet to be determined. According to our study, our students have attained the first of the four steps of metacognitive growth namely metacognitive knowledge. While the others, metacognitive experience, goals and task setting and actions or strategies have become a target to be achieved. Gender wise difference was also noted, with males having better metacognitive knowledge and females having better regulation. No significant gender wise difference was noted in the various dimensions of metacognitive knowledge and regulation. The conclusions of this study will be used to identify low scorers of metacognition and implement metacognitive strategies in them so that we give the world, competent doctors.

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