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Components of Metacognitive Regulation as Correlates of Academic Success

Medical Science

KEYWORDS : metacognitive regulation, Academic success, comprehension monitoring, evaluation.

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ABSTRACT

The vision of educators is to have excellent academic performance from their trainees. Metacognitive regulation is one of the key parameters which have a positive impact on the academic success. The aim of this study was to evaluate the role played by the components of metacognitive regulation on academic outcome in medical student. This cross- sectional study was done in a medical college in south India. Metacognitive awareness inventory, a validated tool was administered to the I year medical students. Their overall academic performance in the first year was also determined. Results were analyzed using ANOVA and Spearman's correlation tests. Most of our students have average metacognitive regulation and components like planning, comprehension monitoring and evaluation play a significant role in determining academic success. Implementation of metacognitive regulation strategies in day to day learning will be beneficial and make the students self efficacious learners.

Introduction:

Many variables stake their claim in being determinants of academic success. Goal setting, reading strategies, personality of students, family and cultural background, learning styles and metacognition- are all variables to determine success in academics[1]. The field of cognitive psychology is a newly emergent field with metacognition rapidly gaining limelight as a predictor of academic performance. Metacognition is defined most simply as 'thinking about thinking' by Flavell[2]. It makes an individual competent enough to become aware of his incompetencies [3]. There is no single perfect tool for measuring metacognition and no single component of metacognition can be studied in isolation. It is the interplay between the various components that act as one of the determinants of a student's learning outcome.

Schraw and Moshman divided metacognition into two components namely metacognitive knowledge and metacognitive regulation both of which are inter related[4]. The effect of metacognitive knowledge on academic success has been evaluated by us as a part of a larger study which also includes the study of the role played by different sub components of metacognitive regulation[5]. Metacognitive regulation refers to activities that control one's own thinking and learning and includes five sub components which are information management, debugging, planning, comprehension monitoring and evaluation[6]. These sub components form a cycle which helps the learner understand what a task involves (information management), identify his competencies related to the task (debugging), create a plan for task completion (planning), monitor the progress of the plan (comprehension monitoring) and evaluate and reform the plan according to the needs (evaluation)[7].

Metacognitive regulation develops throughout the course of a person's life. Even though metacognitive knowledge starts to develop as early as the age of 3 years, metacognitive regulation becomes manifest at 8-10 years of age and grows linearly through adolescence to young adulthood which is our target population. Metacognitive regulation skills are moldable in our students and hence the interest in carrying out this study[8,9]. In order to optimize the academic performance, we need to characterize the level of metacognitive regulatory skills in our student population and device interventional remedies as and when required.

From an educator's perspective, based on metacognitive regulation awareness, students can be grouped into 4 categories: non engaging students, struggling, emerging and finally developing students[10]. Declassification of students from this continuum and creation of a single entity of learners namely the 'developing students' should be the aim of any curriculum. Acquisition of metacognitive regulatory skills is crucial in medical students. As researchers who are invested in teaching, we shoulder the responsibility of developing self efficacious learners capable of self and goal directed learning as long as they remain in the medical profession. Having taken the first steps in assessing the metacognitive awareness in our students, the natural course of action was to assess the effect of metacognitive regulatory skills on academic performance of medical students which was evaluated in this study.

Material and methods:

The participants of this cross sectional study included all the first year MBBS students of Jubilee Mission Medical College and Research Institute, in Kerala. The study was conducted after the institutional ethics committee clearance was obtained. Of the 100 first year students, 86 (49 girls and 37 boys) consented to participate in the study. Metacognitive awareness questionnaire was administered to the students during a theory hour and detailed instructions were given as to how to fill the questionnaire. It took the students about 20 minutes to fill it. The duration of the whole study was one academic year from August 2015 to July 2016. The results obtained were tabulated and analyzed.

Metacognitive regulation awareness inventory: This questionnaire is a part of the metacognitive awareness inventory which is a validated tool with 52 questions. Metacognitive regulation is a component of metacognitive awareness and has 35 questions [11]. The questions are of the true and false variety with one mark awarded for each answer that indicated 'true'. The results so obtained are tabulated. Based on the scores obtained the students were classified into 3 categories. Those with low metacognitive regulation (<50%), average (50-80%) and high regulators (>80%).

Academic scores: The average scores of all the three first year subjects included in I year MBBS curriculum

namely anatomy, physiology and biochemistry were calculated. The overall performance is determined. The average of the overall performance was used for analysis. This provides a fairly accurate measure of success in the university.

Statistical analysis: The metacognitive regulation scores were tabulated and compared to the overall academic scores using ANOVA .Spearman's Correlation studies were also done using the statistical package for social science (SPSS) version 22.

Results:
This study included 86 participants of which 49 are girls.

Table I- comparison of metacognitive regulation scores with the academic performance

Metacognitive regulation	N	Academic Mean	Std. Deviation	P value
<50	11	61.52	7.55	0.001***
50-80	71	63.38	8.08	
>80	4	69.17	11.02	

***ANOVA p<0.001

Table II- Correlation of metacognitive regulation and its sub components with academic performance

Spearman Correlations		Academic mean	Information management (10)	Debugging (5)	planning(7)	Comprehension monitoring (7)	Evaluation (6)	Metacognitive regulation(35)
Academic mean	**Correlation Coefficient**	**1**	**0.018**	**0.155**	**0.031**	**0.073**	**0.216***	**0.134**
Information management (10)	**Correlation Coefficient**		**1**		**0.284****	**0.298****	**0.222***	**0.631*****
Debugging (5)	**Correlation Coefficient**			**1**		**.239***		**.375*****
Planning (7)	**Correlation Coefficient**		**0.284****		**1**	**0.331****	**0.428*****	**0.664*****
Comprehension monitoring (7)	**Correlation Coefficient**		**0.298****	**0.239***	**0.331****	**1**	**0.450*****	**0.731*****
Evaluation (6)	**Correlation Coefficient**		**0.222***		**0.428*****	**0.450*****	**1**	**0.684*****
Metacognitive Regulation (35)	**Correlation Coefficient**		**0.631*****	**0.375*****	**0.664*****	**0.731*****	**0.684*****	**1**

*. Correlation is significant at the 0.05 level (2-tailed).**. Correlation is significant at the 0.01 level (2-tailed).

***. Correlation is significant at the 0.001 level (2-tailed).

Table III- Metacognitive regulation subcomponents – descriptive statistics

Metacognitive regulation subcomponent	N (<50%)	N(50%-80%)	N (>80%)
Information management	2	69	15
Debugging	6	49	31
Planning	37	41	8
Comprehension monitoring	48	28	10
Evaluation	21	47	18

Discussion:
The belief that one is capable of learning and that learning is one's own responsibility is two separate entities with a subtle difference. Both these have a potential to affect a student's metacognitive regulation. The regulatory skills of students form a powerful tool in predicting academic performance since they can be shaped, moulded and the skill honed. In this study we set out to explore the possibility that metacognitive regulatory skills like planning, information management, debugging, comprehension monitoring and evaluation extend an influence on the learning outcome of a medical student.

Table I shows the level of metacognitive regulation in medical students. Of the 86 participants, 71 had metacognitive regulation in the average category (50-80%) while only 4 students had good regulation (>80%). Also only a small number of students (n=11) had low regulation (<50%). From the table it is obvious that as the metacognitive regulation improves, the academic performance also improves to a statistically significant level. Similar findings have been reported by researches while a study done in Pakistan refutes the above findings[1,12-15]. Metacognitive regulation is known to help in conceptual learning. The parameters assessed under metacognitive regulation are information management, debugging, planning, comprehension monitoring and evaluation and of these, the last three are considered as higher skills[16]. Rote learning which the bane of the present day education system is and which is practiced often does not favor concept learning. This may result in a student over estimating his own capabilities which results in under preparation for exams. Lacking metacognitive regulation often leads to this result. Had the student been aware of the various sub components of metacognitive regulation like comprehension monitoring and evaluation and used them effectively while learning, he would have been aware of his lack of conceptual knowledge and hence would have utilized strategies to overcome his short comings[17]. This reiterates the significance of the role played by metacognitive regulation in learning outcome.

We further investigated the influences of the role played by the different subcomponents of metacognitive regulation of academic scores and this was shown in table II. We found that all the sub components had a positive correlation with academic scores with evaluation rising to a statistically significant level. Evaluation helps to identify newer problems, re define existing ones and devise strategies to overcome them[18]. With regards to correlation of the metacognitive regulation sub components with each other, all positively correlate with each other which demonstrates again the ex-

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istence of the interplay between them. The extent of utilization of each of the sub components may determine the final outcome in academics which is a territory that needs further exploration. The metacognitive regulatory skills such as planning, comprehension monitoring and evaluation show a statistically significant correlation with all the other subcomponents making them the key metacognitive regulatory skills. Of the key skills, comprehension monitoring is the last to develop and often remains underdeveloped even in adults[19]. It is interesting to note that these skills are affected by student's beliefs about learning and intelligence[7]. Intelligence is dynamic and can be cultivated but the learner who believes that intelligence is fixed is less likely to evaluate or plan his learning activities[20].

Table III gives us the descriptive statistics and an insight into the component usage in students with different metacognition regulation. In the poor category, the maximum usage is of comprehension monitoring followed by planning, evaluation, debugging and finally information management. In the continuum of metacognitive regulation, these students are in the struggling phase which implies that the students are not self efficacious learners and are not confident in their abilities to select learning strategies[21]. Though the key components are in place their under utilization leads them to fall into the low scorers of metacognitive regulation. It is hence paradoxical that despite having the right ingredients for success, their lack of knowledge as to when, where and how to apply them leads to their poor performance. A teacher's influence on this subset of students to help them learn becomes critical because these students lack metacognitive knowledge. Again, further studies in this direction are recommended.

Most of our students belong to the average metacognition regulation group. In them, sub components utilizes most was information management followed by debugging, evaluation, planning a comprehension monitoring. This may be due to their belief that the instructor knows everything and the responsibility of making them learn lies with the instructor and hence higher skills of metacognitive regulation play no role in their academic life[22]. As educators, the inclusion of formative assessments is particularly helpful in these students as it enables them to re assess their knowledge levels, estimate the lacunae in their study strategies and hence perform better. The high scorers of metacognitive regulation are similar to the average scorers. But the crucial difference is that debugging strategy is employed by them most often. This clearly shows that these students are aware and willing to incorporate strategies in their academic lives but the lack of planning becomes a major setback.

Conclusion:

In the metacognition regulation continuum, we were shocked to note that most of our students, even though academically strong were only in the non engaging and struggling category. Good academic performance without good metacognitive regulation implies only superficial knowledge acquisition and retention without mastery of concepts ultimately detrimental in medical profession. It is every educator's vision to have his students in the developing category of metacognitive regulation. Training metacognitive regulation strategies to students will be a step forward in the direction of this vision.

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