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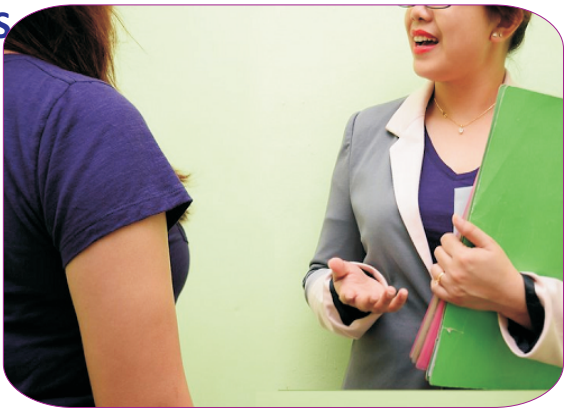
METACOGNITION OF PROSPECTIVE TEACHERS OF PHYSICAL SCIENCE IN RELATION TO THEIR ACADEMIC ACHIEVEMENT IN TAMILNADU, INDIA



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ABSTRACT

Metacognition helps learners to have control over what and how they learn, which can trigger the development of independent learning. Student success is promoted when students gain greater awareness of their own thinking and learning styles, i.e., when they engage in metacognition. An attempt was made to study about Metacognition in relation to Academic Achievement based on the background variables like gender and type of institution. The present sample consists of 793 prospective teachers of Physical Science from colleges of Education. Data were collected using a self-constructed scale on Metacognition and academic achievement. Data were analyzed using t-test, ANOVA, Post ANOVA (Waller Duncan) and correlation. The results revealed that there was no significant difference between male and female prospective teachers of Physical Science in their metacognition. Female prospective teachers of Physical Science were better than the male in their academic achievement. With regard to type of institution, Boy's colleges were better than the prospective teachers of Physical Science from Co-education and Girls colleges of education in their Metacognition. Co-education colleges were better than the prospective teachers of Physical Science from Boys and Girls colleges of education in their academic achievement. There was no significant relationship between metacognition of the prospective teachers of physical science and their academic achievement. But there was significant relationship between metacognition and academic achievement of male prospective teachers alone, compared to females.

KEY WORDS- *Metacognition ,Teachers Of Physical Science ,Academic Achievement , development of independent learning.*

I. INTRODUCTION

Today teachers need an instructional technique which is of low cost and which does not demand hard work, so that they could be more efficient in their teaching. And metacognition helps them to acquire it.

Literature suggests that students with higher metacognitive awareness are more strategic and successful in cognitive enterprise. According to Schraw and Dennison (1994), metacognitive awareness helps students plan, monitor and evaluate their learning, increasing their performance directly.

METACOGNITION

There has been a growing recognition that metacognition or self awareness including awareness of

oneself as learners, helps one to learn more effectively' (Scottish Consultative on the Curriculum, 1996). The term 'metacognition' refers to 'the individual's own awareness and consideration of his or her cognitive processes and strategies' (Flavell 1979). Metacognition was originally referred to as 'the knowledge about and regulation of one's cognitive activities in learning processes' (Flavell, 1979; Brown, 1978). It refers to a unique human capacity of people to be self-reflexive, not just to think and know, but to think about their own thinking and knowing.

Metacognition is a significant part of human ability. Firstly, if learners are not aware of when comprehension is breaking down and what they can do about it, teacher's strategies will fail. Secondly, students without metacognitive approaches are basically learners without direction to review their progress, accomplishments, and future directions. Metacognition helps students to be consciously aware of their learning, understand situations in which it would be useful, and processes involved in using it.

ACADEMIC ACHIEVEMENT

Academic achievement is the important outcome of any educational setup. It is influenced by so many factors both personal and social. Thus, to maximize the achievement within a given set of conditions, has become the realistic goal of every education.

The dictionary of Education, Good (1973), defines Academic Achievement as accomplishment or proficiency of performance in a given skill or body of knowledge. Academic achievement is the success obtained by the individual during the academic session in terms of aggregate marks secured in various subjects in the examination conducted by the school, colleges and Universities. The term "Academic Achievement" is said to be the coinage of the great Greek Philosopher, Plato, according to whom "Academic achievement means the attainment level, at which a student functions in his or her school task through a regular curriculum in a fixed place to which he named as the academy."

II. NEED AND SIGNIFICANCE OF THE STUDY

One of the main goals of education is to make the students gain the thinking skills and strategies. A good education should be able to show the student teachers how to learn, how to remember, how to motivate themselves and how to control their own learning, so that they can teach how to learn. For all these reasons, it is quite important to investigate the process of the metacognitive skills of student teachers. Using metacognition, learners can have the control over what and how they learn, which can trigger the development of independent learning.

Student success is promoted when students gain greater awareness of their own thinking and learning styles, i.e., when they engage in metacognition, when they think about their thinking, when they self-monitor or check their comprehension, and when they self-regulate or accommodate their learning strategies to meet the demands of the learning task at hand.

If students have well developed metacognitive knowledge and metacognitive regulatory skills they will use their metacognition to excel academically. Therefore, it is important to assess metacognition of student teachers to determine if this knowledge and skills are related to academic achievement.

III. STATEMENT OF THE PROBLEM

The researcher intends to find out the relationship of academic achievement of prospective teachers of Physical science with respect to certain background variables. Hence it is stated as "Metacognition of prospective teachers of Physical Science in relation to their Academic Achievement in Tamilnadu, India"

IV. OBJECTIVES OF THE STUDY

1. To find out the significant difference in the metacognition of prospective teachers of Physical Science with respect to gender and type of institution.
2. To find out the significant difference in the academic achievement of prospective teachers of Physical Science with respect to gender and type of institution.

3.To find out the relationship between metacognition and academic achievement of the prospective teachers of Physical Science.

V. HYPOTHESES OF STUDY

1.1 There is no significant difference between male and female prospective teachers of Physical Science in their metacognition.
1.2 There is no significant difference between male and female prospective teachers of Physical Science in their academic achievement.
1.3 There is no significant difference among prospective teachers of Physical Science from Boy's, Girls and Co-education Colleges of Education in their metacognition
1.4 There is no significant difference among prospective teachers of Physical Science from Boys, Girls and Co-education Colleges of Education in their academic achievement.
1.5 There is no significant relationship between metacognition and academic achievement of prospective teachers of Physical Science with respect to total samples and subsamples of gender.

VI. POPULATION AND SAMPLE OF STUDY

The population for the present study includes the Bachelor of Education students whose Major pedagogical subject is Physical Science in the government aided and self-financing colleges of Education affiliated to the Tamilnadu Teachers Education University, Chennai from Thoothukudi, Tirunelveli and Kanyakumari districts.

Sample was selected from the population by adopting stratified random sampling techniques. The present sample consists of 793 prospective teachers of Physical Science from Government aided and self financing colleges of Education.

VII. TOOLS EMPLOYED

METACOGNITION SCALE

The Metacognition scale was prepared and validated by the investigator, to measure the Metacognition of the subjects. The final scale is of Likert type, consisting of 63 positive statements. Each statement is set against a five point scale of 'Strongly Agree', 'Agree', 'Undecided', 'Disagree', 'Strongly Disagree' and they get a weight of 5, 4, 3, 2, 1 scores respectively. The reliability of the validated tool on Metacognition was found to be 0.86.

ACADEMIC ACHIEVEMENT TEST

An objective question paper was prepared and validated by the investigator, to measure the Academic Achievement of the prospective teachers of Physical Science in the three Core Courses and one Optional Course. They were namely: Core I: Education in the Emerging Indian Society, Core II: Psychology of Learning and Human Development, Core III: Educational Innovations and Curriculum Development, Optional I: Content and Methods of Teaching of Physical Science. There were totally 80 questions with 20 items in each course paper. Each item had four alternatives among which one is the correct answer. Each correct answer is given a score of one and wrong answers zero. The reliability of the validated test tool on Academic Achievement was found to be 0.85.

VIII. ANALYSIS OF DATA

TABLE 1.1
Difference between male and female prospective teachers of Physical Science in their metacognition

Gender	N	Mean	S.D	t-value	Remarks at 5% level
Male	76	254.43	22.930	0.344	Not Significant
Female	717	253.48	24.630		

From the above table 1.1, it is evident that the t-value 0.344 is not significant at 5% level. Thus the null hypothesis that 'there is no significant difference between male and female prospective teachers of Physical Science in their metacognition' is accepted.

TABLE 1.2
Difference between male and female prospective teachers of Physical Science in their academic achievement

Gender	N	Mean	S.D	t-value	Remarks at 5% level
Male	76	36.17	11.74	3.001	Significant
Female	717	40.41	11.358		

From the above table 1.2, it is evident that the t-value 3.001 is significant at 5% level. Thus the null hypothesis that 'there is no significant difference between male and female prospective teachers of Physical Science in their academic achievement' is rejected.

TABLE 1.3
Difference among prospective teachers of Physical Science from Boy's, Girls and Co-education Colleges of Education in their metacognition

Type of institution	Source of variation	Sum of Squares	df	Mean square variance	Calculated F-value	Remarks at 5% level
Metacognition	Between	4504.693	2	2252.346	3.791	Significant
	Within	469331.948	790	594.091		

From the above table 1.3, it is inferred that the F-value 3.791 is significant at 5% level. Thus the null hypothesis that 'there is no significant difference among the prospective teachers of physical science from boys, girls and co-education colleges of education in their metacognition' is rejected.

TABLE 1.3.1
Post ANOVA (Waller Duncan)
Metacognition

Type of institution	N	Subset for alpha = 0.05	
		Mean 1	Mean 2
Co-education	607	252.55	
Girls	166	255.81	
Boys	20		265.90

From the above table 1.3.1, it is inferred that while comparing the mean scores of the prospective teachers of physical science from Co-education (252.55), Girls (255.81) and Boys (265.90) colleges of education in their Metacognition, the prospective teachers of physical science from Boys colleges are better than the prospective teachers from co-education and Girls colleges of education.

TABLE 1.4
Difference among prospective teachers of Physical Science from Boy's, Girls and Co-education Colleges of Education in their academic achievement

Type of institution	Source of variation	Sum of Squares	df	Mean square variance	Calculated F-value	Remarks at 5% level
Academic Achievement	Between	6450.320	2	3225.160	26.134	Significant
	Within	97493.675	790	123.410		

From the above table 1.4, it is inferred that the F-value 26.134 is significant at 5% level. Thus the null hypothesis that 'there is no significant difference among the prospective teachers of physical science from boys, girls and co-education colleges of education in their academic achievement' is rejected.

TABLE 1.4.1
Post ANOVA (Waller Duncan)
Academic Achievement

Type of institution	N	Subset for alpha = 0.05	
		Mean 1	Mean 2
Boys	20	28.50	
Girls	166		36.10
Co-education	607		41.45

From the above table 1.4.1, it is inferred that while comparing the mean scores of the prospective teachers of physical science from Boys (28.50), Girls (36.10) and Co-education (41.45) Colleges of education in their Academic Achievement, the prospective teachers of physical science from Co-education colleges are better than the prospective teachers from Boys and Girls colleges of education.

TABLE 1.5
Test of significant relationship between metacognition and academic achievement of prospective teachers of Physical Science

Back ground variables	Categories	N	df	r - value	Table value	Remarks at 5% level
	Total Sample	793	791	0.007	0.062	NS
Gender	Male	76	74	0.109	0.088	S
	Female	717	715	0.004	0.062	NS

It is inferred from the table 1.5 that that there is no significant relationship between metacognition of the prospective teachers of physical science and their academic achievement at 5% level.

It is inferred from the table 1.5 that there is significant relationship between metacognition of the male prospective teachers of physical science and their academic achievement. But there is no significant relationship between metacognition of the female prospective teachers of physical science and their academic achievement at 5% level.

IX. MAJOR FINDINGS AND DISCUSSIONS

The results obtained from the analysis of tables from 1 to 5 are discussed in the context of hypotheses formulated earlier. The results already arrived at by various related studies have also been compared with the

results of the present study. This has been done to make the study more meaningful.

1.1 It was found that both male and female prospective teachers of physical science have equal level of metacognition. This shows that both male and female prospective teachers use their metacognitive knowledge and skills in the learning process in the same way. Meta-analyses have consistently shown that there were no significant gender differences in general cognitive abilities. Suman (2009), Fazal ur Rahman (2011), Sridhar and Omidi (2012), Rani and Punita Govil (2013), Mai (2015) supported this findings. But this was contradicted by Mahesh (2011), Sheeja and Annaraja (2011), Kapadia and Garg (2012) Divya and Sarita (2013) and Sukla and Susanta (2015) who pointed out that there was a significant difference between male and female in their Metacognition.

1.2 Female prospective teachers of Physical Science are better than male prospective teachers of Physical Science in their academic achievement. Past researches suggest that girls are in general more successful than boys. Moreover boys develop gender stereotypes according to which girls are perceived as academically superior with regard to motivation, ability, performance, and self-regulation. Girls want to please adults to a higher degree than do boys, which leads to girls' higher grades. However, a rarely considered explanation for gender differences in academic achievement from a developmental point of view is self-regulation.

Researches done earlier in the field of academic achievement have shown that metacognition have significant effect on the academic achievement of prospective teachers. It is evidenced by the research studies conducted by Suman (2009), Emine et al. (2011) and Delvecchio (2011). Jebraj and Mohanasundaram (2008), Shikha and Praveen (2009), Narendra and Rajive (2011), Anjali (2014), Krishan (2014), Madhvi and Anil Kumar (2015), Avanish (2015), Archana and Chamundeswari (2015) found that there exists significant difference between male and female achievers in terms of academic achievement. But Andrabi (2015) contradicted it.

1.3 The prospective teachers of physical science from Boys colleges are better than the prospective teachers from co-education and Girls colleges of education in their Metacognition. Boys college prospective teachers may be reflective thinkers who are aware of their learning processes and products as well as how to regulate those processes for more effective learning. Their knowledge of cognition and self awareness skill helps them to improve compared to their counterparts, thus leading to learning that is self directed, goal oriented and self evaluated.

1.4 The prospective teachers of physical science from Co-education colleges are better than the prospective teachers from Boys and Girls colleges of education in their Academic Achievement. Co-educational institutions are better as the presence of girls in the class calm boys and improve their academic performance and lead to less violent outbursts. Girls add positive influences to the classroom environment. Males innately prefer competitive learning activities and they try to excel their female counterparts. Females learn better in a co-operative learning community. Co-education provides equitable learning opportunities for male and female students. Majority of teachers also actively address stereotypes and encourage gender equity in their classrooms.

1.5 There is no significant relationship between metacognition of the prospective teachers of physical science and their academic achievement. This is because Academic achievement is a multi-dimensional phenomenon and may be affected by two main types of factors viz. subjective or personality factors that are related to the individual himself, and objective factors that are related to the environment and educational system. So Metacognition is one of the factors that influence academic achievement. The above result was contradicted by Suman (2009), Shirish and Priya (2011), Mahesh (2011), Poonam (2013), Jayapraba (2013), Narang and Saini (2013) who revealed that there is a significant and positive relationship between Metacognition and academic achievement of students.

But there is significant relationship between metacognition and academic achievement of male prospective teachers alone, compared to females. The metacognitive processes can improve learning by guiding male students' thinking and help them to follow a sensible strategy as they think through a problem, make decisions or attempt to understand a text. Male prospective teachers use metacognitive approaches to review their progress and accomplishments compared to females.

X. IMPLICATIONS OF THE STUDY

The findings of the present study may be utilized by educational planners, curriculum designers, administrators, Counsellors and teachers in order to assess and modify their schemes and teaching methodologies.

1. Female prospective teachers of Physical Science are better than male prospective teachers of Physical Science in their academic achievement. Hence necessary steps may be taken to motivate the male prospective teachers towards the profession by giving them required training or orientation programs.
2. Boy's colleges are better than the prospective teachers from co-education and Girls colleges of education in their Metacognition. Even in co-education colleges of education, the strength of the females is more than males. The task of teacher educators is to acknowledge, cultivate, exploit and enhance the metacognitive capabilities of female prospective teachers and females must be motivated to develop professionally.
3. Co-education colleges are better than the prospective teachers from Boys and Girls colleges of education in their academic achievement. Single sex college students must be trained in Constructivist and Collaborative approaches of education and in ICT. More brain based activities, peer group activities and discussion techniques may be provided to Single sex college students to improve their academic achievement.
4. The Metacognitive process helps students to analyze the learning tasks. Hence practice in Mindfulness is essential to activate metacognitive knowledge, monitoring, and control.
5. Metacognition is an important quality required by teachers for their professional growth and self-development concerning quality teaching and efforts should be taken to enhance them.
6. The teacher education curriculum should be revised from time to time keeping in view the needs and requirements of both secondary school students in particular and society in general.
7. Metacognitive teaching strategies must be included in the teacher education programmes.
8. Metacognition helps in experiential learning. So give training in experiential learning where the learner gains insights from direct experiences encountered by him/her.
9. A demanding curriculum must be included in the teacher education programmes and a focus on extracurricular activities should be given equal importance. Likewise problem- based and project-based methods must be given due importance.
10. The test of reasoning and comprehension can be conducted in classrooms to analyze the learner's cognitive processes. So content pedagogy must be given importance in teacher education program.
11. A positive attitude towards the teaching profession may be developed among the prospective teachers so that they have actual passion for the profession.
12. The current teacher education program is dominated by theory with hardly any emphasis on practice. Hence it must be made more performance and task-oriented.

XI. CONCLUSION

Metacognition, or awareness of the process of learning, is a critical ingredient to successful learning. Hence it is important to focus one's attention on developing multiple competencies and applying and executing strategies for controlling the thinking styles of prospective teachers. It can be concluded that the prospective teachers who are resourceful agents of transformation of the young generation have to concentrate on accelerating their cognitive capabilities. Metacognition does away with surface learning and helps learners go through various loops of learning thereby leading to deeper understanding. Students, who are used to metacognitive thinking, assume greater responsibility for their own learning. They are aware of their own strategies and are open to modifications in their thought processes if the situation demands. Training in Metacognitive skills would help students plan their tasks and activities more effectively. Most students drop out or do not take up further studies, as they lack the skills that are required to be self directed learners. A practice of Metacognitive skills would help in lifelong learning as they get accustomed to goal setting and strategizing their learning.

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