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## Effectiveness of Cognitive and Metacognitive Strategies in Scaffolding based Self-Regulated Learning System and Formal Learning System

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### Abstract

This study aimed at investigating the effectiveness of the cognitive and meta-cognitive strategies in both learning systems assessed by students at higher education level. This research was descriptive in nature. Population of the study comprised 264 BCS & MCS/MS students from four selected Public Sector Universities and four selected Virtual University campuses of Khyber Pakhtunkhwa. Total 200 students were selected as sample of the study, 65 from scaffolding based self-regulated learning system and 135 students from formal learning system. Motivated Strategies for Learning Questionnaire (MSLQ) originally designed by Pintrich, Garcia & Mckeachie (1993) was used as research tool of the study. The collected data were entered in SPSS-16 and Cross-tab and Chi-square were applied to analyze the data. There were no significant merits and demerits of Scaffolding based self-regulated learning system and formal learning system at university level was assessed by the students. It was recommended that try to encourage cognitive and meta-cognitive skills in which we are lacking behind like concentration, making questions while reading, reading with understanding, skimming, etc. There should be proper time management and study schedule in both learning systems for weekly studying, assignments and notes reviewing. Further researches can be conducted in other situation to compare the results of two different learning systems and to find results in different context.

**Keywords:** Scaffolding-based Learning, Self-regulated Learning, Formal Learning, Cognitive, Meta-cognitive Strategies.

### Introduction

The word "Scaffolding" is a symbol given to a type of assistance by a teacher or a capable peer. The teacher helps the student to complete the given task or get mastery over the concept

which he is unable to grasp at the beginning. The teacher gives him chance to complete most of the task unassisted but help in those parts in which he is primarily unable to take hold of independently.

It is an instructional approach which supports beginners by limiting the complexities gradually and learners gain the knowledge, skills, and confidence to handle complexities (Young, 1993).

Bruner (1976), a Cognitive Psychologist presented scaffolding Theory at first in 1950s. He explained the word in the context of young children's oral language acquisition. The first tutors are their parents who help them to speak and provided with natural structures to learn a language in traditional way.

Formal learning is an organized, systematic, structured system having set of definite norms and rules, with fixed curricula, methodology and evaluation procedure regarding objectives. It involves a triangular relationship of teacher, the students and institution. It requires students' classroom attendance. This learning involves both formative and summative evaluation. Usually punitive and mono-directional methodology is applied which fails to stimulate students and to provide their active participation in the learning process. This system is not learner centred and usually ignores the students' standards, values and attitudes and for most of the time, teachers pretend to teach and students pretends to learn (Dib, 1987).

Foreign language (English) is used in our courses at higher level and its content reading with comprehension requires cognitive and meta-cognitive strategies. It may range from lower level to higher level processing. Lower level processing includes word meanings, syntactic structure and part of speech (Alderson, 2000; Kinstch, 1998; Pressley & Afflerbach, 1995). Reading with word decoding skills i.e. to understand the gist and important details presented in the text have more mental capacity to use (Gagne et al., 1993).

Higher level processing includes assessing situations and monitoring current comprehension. Meta-cognitive strategies may slow down reading speed, it helps increase reading achievement. Carrell, Gajdusek and Wise (1998) further pointed out that important thing is to have knowledge about when, how and why a strategy is to be used. Some of the meta-cognitive processes are goal setting, planning how to achieve goals, monitoring goal attainment and revising plans.

Cognitive and meta-cognitive strategies have been regarded as closely related and meta-cognitive strategies have a direct impact on cognitive strategies in learning, use or performance (Anderson, 2005). Cognitive strategies e.g. comprehending, memory and retrieval and meta-cognitive strategies e.g. planning, monitoring and evaluating in learning are used in context for making sense of task (Alderson, 2000).

To understand the nature of cognitive and meta-cognitive strategies that influence learning, Purpura (1999) examined their relationship. He found that cognitive processing was a multi-dimensional construct while meta-cognitive strategy use was a uni-dimensional construct consisting of a single set of assessment processes i.e. goal setting, planning, monitoring, self-evaluating and self-testing. Meta-cognitive strategies had significant, direct and positive effects on cognitive strategies.

O' Malley's and Chamot's (1990) defined cognitive strategies as follows:

1. Repetition: "imitating or repeating a sample in order to learn it."

2. Recombination: “combining the existing data in order to make a meaningful sentence.”
3. Deduction: “applying the rules to make correct examples.”
4. Elaboration: “relating new information to prior knowledge, relating different parts of new information to each other, or making meaningful personal associations with the new information.”
5. Translation: “translating the material from the second language to the first one to avoid misunderstanding.”
6. Transfer: “using previous linguistic knowledge or prior skills to assist comprehension or production.”

Meta-cognitive strategies are divided into three groups: planning, monitoring and evaluation. In O’Malley’s and Chamot’s (1990) classification, planning includes advance organizers, directed attention, functional planning, selective attention and self-management.

The monitoring engaged the learners’ minds before and during teaching. Self-monitoring is the process of “correcting one’s speech for accuracy in pronunciation, grammar, vocabulary, or for appropriateness related to the setting to the people who are present.”

The evaluation was carried out during and after teaching to judge the teaching and learning strategies and suggest improvement for the next time to select and develop appropriate and effective strategies.

Motivated Strategies for Learning Questionnaire (MSLQ) originally designed by Pint rich, Garcia, and McClatchy (1993) was modified for BCS and MCS students of both Public Sector Universities of Khyber Pakhtunkhwa and Scaffolding based self-regulated learning system to determine the cognitive and meta-cognitive strategies as merits and demerits of both learning systems at higher education level.

Basically this study proposed a better learning system that involves the self-study by using cognitive and meta-cognitive strategies to sustain their interest in self-learning. Further research in different situations and contexts can be conducted to get different results.

### **Objectives of The Study**

Following were the objectives of the study.

1. To determine the effectiveness of cognitive and meta-cognitive strategies in Scaffolding based self-regulated learning system at university level as assessed by the students.
2. To determine the effectiveness of cognitive and meta-cognitive strategies in formal learning system at university level as assessed by the students.
3. To give recommendations for the better learning of students at university level.

### **Hypotheses of the Study**

Following were the null hypotheses of the study.

- Ho1.** There is no significant difference among the views of students about cognitive and meta-cognitive strategies of scaffolding based self-regulated learning at higher education level.
- Ho2.** There is no significant difference among the views of students about cognitive and meta-cognitive strategies of formal learning system at higher education level.

### **Research Methodology**

This research was descriptive in nature and was conducted using survey method.

### **Population and Sample**

For survey, all BCS and MCS students studying the subject of Database System in four selected Public Sector Universities of Khyber Pakhtunkhawa, Pakistan and four selected campuses of Virtual University, Pakistan constituted the population of this study.

For survey, the sampling frame for the study was IT students enrolled to study Database subject in which 135 out of 185 students in selected Public Sector Universities of Khyber Pakhtunkhawa and 65 students out of 79 students studying in previously mentioned four selected Virtual University campuses were randomly sampled.

### **Instrumentation**

Motivated Strategies for Learning Questionnaire (MSLQ) originally designed by Pintrich, Garcia & McKeachie (1993) was adapted and permission was sought from the developers.

The following 5- point Likert rating scale was applied to this study. The scale was adopted from Pintrich et al (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ), National Centre for Research to Improve Postsecondary Teaching and Learning. Ann Arbor: University of Michigan.

Questionnaire in its original form is already standardized, having high validity. However, suggestions and expert opinion were also taken from experts working in different Universities of Khyber Pakhtunkhawa and were incorporated.

Moreover, for reliability and validity, Questionnaire was personally administered to 10 subjects as a pilot run. The subjects were part of the population but were not included in the selected sample of the study. The data were analyzed through SPSS-16. The reliability of thirty one items at Cronbach's alpha obtained was .78 which was quite reasonable.

### **Analysis and Interpretation of Data**

Keeping in view the objectives of the study, the collected data were entered in SPSS-16 and Equal probability Chi-square test of Goodness of fit were used to measure the students' views regarding merits and demerits of both learning systems i.e. Scaffolding based self-regulated system and formal learning system. Chi Square test of independence was used to compare the students' cognitive and meta-cognitive strategies of both learning systems at university level.

**Table 1: Students' views about Cognitive and Meta-cognitive Strategies: Meta-cognitive Self-regulation in scaffolding based self-regulated learning system (N = 65)**

S. N	Statement	f	SDA	DA	UD	A	SA	$\chi^2$	P
1.	During class time I often miss important points because I'm thinking of other things.	O	1	12	13	27	12	26.31	.00
		E	13	13	13	13	13		
2.	When reading for this course, I make up questions to help focus my reading.	O	0	10	12	23	20	7.185	.07
		E	13	13	13	13	13		
3.	If course readings are difficult to understand, I change the way I read the material.	O	0	10	21	24	10	9.89	.02
		E	13	13	13	13	13		
4.	When I become confused about something I'm reading for this class, I go back and try to figure it out.	O	2	8	22	20	13	21.23	.00
		E	13	13	13	13	13		
5.	Before I study new course material thoroughly, I often skim it to see how it is organized.	O	2	10	12	22	19	19.1	.00
		E	13	13	13	13	13		
6.	I ask myself questions to make sure I understand the material I have been studying in this class.	O	2	8	14	26	15	24.62	.00
		E	13	13	13	13	13		
7.	I try to change the way I study in order to fit the course requirements and the instructor's teaching style.	O	5	14	17	24	5	20.46	.00
		E	13	13	13	13	13		
8.	I often find that I have been reading for this class but don't know what it was all about.	O	11	12	13	20	9	5.385	.25
		E	13	13	13	13	13		
9.	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.	O	6	15	10	22	12	11.07	.03
		E	13	13	13	13	13		
10	When studying for this course I try to determine which concepts I don't understand well.	O	3	8	7	32	15	40.46	.00
		E	13	13	13	13	13		
11	When studying for this class, I set goals for myself in order to direct my activities in each study period.	O	1	13	14	22	15	17.69	.00
		E	13	13	13	13	13		
12	If I get confused taking notes in class, I make sure I sort it out afterwards.	O	1	10	9	27	18	30.0	.00
		E	13	13	13	13	13		
	<b>Overall</b>	<b>O</b>	<b>34</b>	<b>130</b>	<b>164</b>	<b>289</b>	<b>163</b>	<b>22.51</b>	<b>.49</b>
		<b>E</b>	<b>156</b>	<b>156</b>	<b>156</b>	<b>156</b>	<b>156</b>		

Table 1 shows that there is no significant difference between the observed and expected frequencies with  $\chi^2 = 22.51$  and p-value = .49. Therefore the null hypothesis "There is no significant difference among the views of students about cognitive and meta-cognitive strategies

of scaffolding based self-regulated learning at higher education level” is accepted at 0.05 level of significance.

**Table 2: Students’ views about Cognitive and Meta-cognitive Strategies: Meta-cognitive Self-regulation in formal learning system (N = 135)**

S. N	Statement	f	SDA	DA	UD	A	SA	$\chi^2$	P
1.	During class time I often miss important points because I’m thinking of other things.	O	22	23	19	38	33	9.7	.04
		E	27	27	27	27	27		
2.	When reading for this course, I make up questions to help focus my reading.	O	1	7	21	76	30	1.3	.00
		E	27	27	27	27	27		
3.	If course readings are difficult to understand, I change the way I read the material.	O	1	16	25	55	38	63.	.00
		E	27	27	27	27	27		
4.	When I become confused about something I’m reading for this class, I go back and try to figure it out.	O	6	10	22	58	39	68.	.00
		E	27	27	27	27	27		
5.	Before I study new course material thoroughly, I often skim it to see how it is organized.	O	5	10	38	61	21	77.	.00
		E	27	27	27	27	27		
6.	I ask myself questions to make sure I understand the material I have been studying in this class.	O	6	17	16	60	36	67.	.00
		E	27	27	27	27	27		
7.	I try to change the way I study in order to fit the course requirements and the instructor’s teaching style.	O	8	15	28	60	24	59.	.00
		E	27	27	27	27	27		
8.	I often find that I have been reading for this class but don’t know what it was all about.	O	26	32	31	36	10	15.	.00
		E	27	27	27	27	27		
9.	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.	O	6	20	25	59	25	11.	.03
		E	27	27	27	27	27		
10.	When studying for this course I try to determine which concepts I don’t understand well.	O	2	6	17	74	36	1.2	.00
		E	27	27	27	27	27		
11.	When studying for this class, I set goals for myself in order to direct my activities in each study period.	O	1	13	14	22	15	79.	.00
		E	27	27	27	27	27		
12.		O	3	14	31	55	32		

	If I get confused taking notes in class, I make sure I sort it out afterwards.	E	27	27	27	27	27	58.15	.00
	<b>Overall</b>	O	90	178	306	694	352	76.67	.00
		E	324	324	324	324	324		

Table 2 shows that there is significant difference between the observed and expected frequencies with  $\chi^2 = 76.67$  and  $p\text{-value} = .00$ . Therefore the null hypothesis “There is no significant difference among the views of students about cognitive and meta-cognitive strategies of scaffolding based self-regulated learning at higher education level” is rejected at 0.05 level of significance.

### Conclusions

From the analysis and interpretation, it can be concluded that:

1. According to students’ views of scaffolding based self-regulated learning system, there is no significant difference about cognitive and meta-cognitive strategies of scaffolding based self-regulated learning system at higher education level.
2. According to students’ views of formal learning system, there is significant difference about cognitive and meta-cognitive strategies of formal learning system at higher education level.

### Recommendations

On the basis of the conclusions, the following recommendations can be made:

1. At higher education level, usually self-study is needed and must be encouraged to enhance cognitive and meta-cognitive skills in which we are lacking behind like concentration, making questions while reading, reading with understanding, skimming, etc.
2. More focus should be given on meta-cognitive strategies like self-management, self-planning and self-evaluation etc.
3. Further researches can be conducted in different situations and contexts to compare the results of both learning systems.

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