



## Understanding Pakistani Science Students' Memorization Cognitive Processing Strategies in the Context of Their Culture, Socio-Economic Class and Education System

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### Abstract

*Students use cognitive processing strategies (CPS) to learn from learning content. Each kind of CPS leads to specific kind of learning outcomes. The CPS may be broadly grouped into rehearsal, organization and elaboration. The culture, teaching learning situations and students' conceptions limit choices to use different CPS. Because of contextual nature of students' CPS, qualitative approaches appeared advantageous to explore students' CPS. In this study, focus group interviews were used to discover Pakistani students' opinions of their CPS. The public-e school students of Punjab were the population of the study. Purposive sampling was used to select sample to conduct focus group interviews. Students' views were analysed by implying applied thematic analysis. Rehearsal in its passive form was the sole CPS recognisable in students' views. Different aspects and characteristics of rehearsal behaviour were discussed in the context of Pakistani science students' culture, teaching methods, parallel education systems and social class.*

### Key Words:

Cognitive processing strategies, memorization, rehearsal, social class reproduction, Applied thematic analysis.

### Introduction

Learning strategies facilitate students to learn from any learning activity, and these might be of cognitive, metacognitive, motivational behavioural nature (Weinstein *et al.*, 2010). Among these different types of learning strategies, cognitive strategies involve direct dealings with textbook material and these strategies assist students to acquire deep understanding of content and retrieval of information when required at assessment stage of learning (Oxford, 2003). The cognitive strategies bridge students existing knowledge to the knowledge they strive to learn. Suitable human cognitive resources such as attention, short term, long term memory, perception, intuition, and reasoning assist to learn from any learning activity, and these parcel together to form the structure of any cognitive strategy (Weinstein & Meyer, 1991).

Students use these diverse cognitive resources in their own ways as different cognitive strategies to actively or passively learn from the learning material. Active learning involves such cognitive strategies that end in achieving deep understanding of information, creating new knowledge from the existing one, help in application of knowledge etc. Passive learning comprise passive cognitive strategies which result reproduction and cramming of learning content (Weinstein *et al.*, 2012). The quality and quantity of students' learning outcomes in any learning task depend on their cognitive strategies (Vermunt, 2011). Unrelated and passive cognitive strategies students use to learn at schools cause them fail to learn something at schools. Effective and appropriate cognitive processing strategies safeguard students' goals to understand and analyse large volumes of information to craft new knowledge in educational environments.

### Classification of Cognitive Processing Strategies (CPS)

The cognitive strategy literature proclaims an overburdened plethora of similar and vague classifications of cognitive processing strategies. Experts of the field have differently labelled similar CPS having similar cognitive

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tactics (Biggs *et al.*, 2001). Most common classification of CPS includes memorization and rehearsal, organization and elaboration.

### **Memorization Cognitive Processing Strategies**

Memorization strategies consist common tactics of repetitions of names, items, and copying textbook material that students have read, and heard. Usually, students use these with a purpose to reproduce information. Among memorization CPS, rehearsal is the most simple (Oxford, 2003). Students use and can use rehearsal strategies in variety of ways. In passive rehearsal, students repeat words, or the sentences; they memorize whole passages without acquiring any understanding of textbook information (Weinstein *et al.*, 2010). In a bit interactive level, students might draw outlines or make lists of important points and they rehearse these to pass examinations with no or little understanding. In active forms of rehearsal, students use rehearsal before applying much sophisticated CPS of elaboration or rehearse textbook content after developing an understanding of content (Biggs, 1998).

Organization CPS demand active role of students in their learning. Students use these strategies to develop new and modified outlines, structures, compare differences and similarities of information in place of those in textbooks. These strategies appear humanistic allowing students' freedom and self-expression in knowledge building process. Elaboration strategies involve different cognitive processing tactics such as paraphrasing, summarization, developing analogy, questioning and explaining textbook information in own words, which make information meaningful for the students, and connect new information to students' existing knowledge (Weinstein *et al.*, 2000). Students using these strategies, have high motivation, deep interest and self-engagement in their learning, and they feel a transformation in their cognition and affective behaviour, which root unforgettable information easily useable in future learning.

### **Cognitive Processing Strategies and Academic Performance**

The active CPS (organization and elaboration) help students to acquire understanding, application, and analysis of textbook information and creation of new knowledge (Kim *et al.*, 2008). However, passive CPS (memorization and rehearsal) are negatively linked to academic attainments (Marton & Saljo, 2005). Students who use elaboration and organization CPS own personal attributes positively associated to academic performance such as self-regulation, self-interest, and intrinsic motivation. Lack of regulation of learning, extrinsic motivation or lack of motivation to learn associated to poor academic performance showed their presence in students who use simply rehearsal CPS (Vermunt, 2005).

### **Measurement of Cognitive Processing Strategies**

Self-reported questionnaires were preferred as instruments to investigate students' CPS. However, self-reported measures considered the CPS as a much more stable state, which might mislead and distort the idea of CPS because of its changing and a contextual nature in popular literature (Winne, 2013). Qualitative measures appear expedient to investigate students' CPS with reference to a context. Regardless to the issues associated to limited generalization, interviews appear a trustworthy tool for indepth understanding of students' CPS (De Groot, 2002).

### **Personal, Cultural and Social Grounds for Opted Cognitive Processing Strategies**

Chinese and Western cultures shaped different conceptions of learning among students (Kember, 2016), which lead to a different pattern in use of CPS. In Western culture, categorically, poor performers use memorization, and high performers use active CPS. (Biggs *et al.*, 2001). Asian literature, revealed somewhat different patterns; Chinese outstanding students used both types of CPS, memorization as well as elaboration and organization (Biemans & Van Mil, 2008). Low performers similar to the west use rehearsal and memorization.

Collectivistic cultures, like Chinese culture encourage students to memorize ancient knowledge, promote sharing, helpfulness, agreeableness to social norms which is different from western individualistic cultures of United Kingdom and United States of America, which focus individualism and creation of new knowledge, feeling of personal property, independence, and praise, and cognitive skills (Trumbull *et al.*, 2000). Diversity in

schooling cater diversity in social classes. There comes the role of contextual factors. School facilities, teaching learning practices, choice of subjects, behaviours and CPS in schools (Leary, 2012), which in turn promote and strength students' repertoire of certain CPS. Within a culture, the education system might be a mean to reproduce social classes in the society (Nesbit, 2005).

### **Pakistani Context of the Study: Education System, Social Classes and Culture**

Islam is recognized as the state religion of Pakistan (Niazi, 2012), and it differentiates Pakistan from non-Muslim collectivistic cultures, however, it is dissimilar from Islamic cultures in the Middle East and rest of the world because of its peculiar social class structure. Education system was a vehicle to maintain class system in Pakistan (Malik, 2012). Three different parallel systems of schooling accommodate the demands of three social classes of the society; religious people look for Madrassa education, working and lower middle class parents have public schools for their children and elite class, who rule and lead the nation has elite private schools for their children (Rahman, 2004). Three systems of education provided three different types of teaching approaches, syllabus, teachers and learning outcomes.

In Madaris, qur'anic education includes reading and memorizing Quran and religious information in Arabic (Ali, 2008). After this initial educational experience, students enter into public schools after learning specific Qur'anic knowledge through using CPS of memorization. Public schools have teacher centred approach but their syllabus is not limited to religious education. The Pakistani public school system become incapable to fulfill the demands of the current modern economic challenges, consequently, the demand for private schools increased in Pakistan. Two types of private schools developed; non-elite private schools for low cost families (Barakat *et al.*, 2012), and elite private english medium schools for elite families.

Children in low cost private schools perform a bit better than public schools. However, children in these two types of schools have poor learning outcomes. Low cost private schools hire untrained, young, unmarried, moderately educated female teachers at low salary from low income families (Rahman, 2004). Elite private english medium schools have highly qualified and trained teaching staff, and specialist teachers and supporting staff provide the teaching learning environment par to the modern western schools (Malik, 2012).

Few quantitative studies indicated presence of memorization CPS in Pakistani students at different levels of education. The lack of qualitative studies on this issue demanded an in-depth understanding of students' learning behavior in their own views. Present study adopted qualitative approach to study the problem of Pakistani students' at Public schools. Researchers in this study focused to explore CPS of male secondary school science students in punjab, Pakistan. The present qualitative approach was outlined to answer following question: "What cognitive processing strategies male science students use to learn in Pakistani public schools?"

## **Materials and Method**

### **Epistemological Standpoint**

This study has the objective to reveal students' CPS in context to their gender, social class, culture and education system. Male students of lower middle class studying in public schools were taken as a specific group because of their distinctive treatment in homes and schools by parents and teachers than students of elite English medium and madrassa schools. Applied thematic analysis (Guest *et al.*, 2012) was adopted to extract students' views about their CPS.

### **Population and Sample Selection**

The male science students of public schools are the population of the study. Ethnographic research design (Creswell, 2012) facilitated researchers to limit this study to Punjabi students from south Punjab; less developed as compared to other parts of the Punjab. Researchers choose purposive sampling technique and selected 48 students for this study.

### **Data Collection**

Focus group interviews deemed suitable to reveal students' shared views of their CPS. Students' pilot testing session of the interview schedule was conducted that helped to calculate time required for interview sessions and

06 students participated in each interview session. In this way, 48 students participated in 08 interview sessions. Each interview session lasted for about 35 minutes on an average. Students shared their views in Urdu language. For international audience, Urdu verbatim were translated into English.

### **Data Analysis**

Qualitative data analysis software NVivo 10 helped to recognize, review and classify recurrent categories and themes in students' interview data. Sequence of different steps in thematic analysis (Guest *et al.*, 2012) were; data familiarization, generating codes based on the specified theoretical reference, viewing and reviewing themes, cross checking themes definition with pre-specified theoretical reference. Researchers identified codes and reviewed coded interview data by choosing template Coding (Blair, 2015) technique.

Table 1 shows coding key which was developed to classify different concepts and themes in students' opinions related to use of different CPS.

**Table 1.** Summary of Coding Template for Students' Cognitive processing strategies

<b>Sample Phrases and Concepts</b>	<b>Themes</b>
1) Read books, 2) read and re-read, 3) Rehearse or drill that information 4) rehearse word to word 5) enhance understanding by repeated readings, repeat the things in book until I know I have memorized it very well.	Memorization
1) Make outline, 2) Make Headings, 3) Make Charts, 4) Make Table, 5) Draw Concept Maps, 6) Making diagrams	Organization
1) To use the knowledge in practical situations, 2) acquiring knowledge that you can use in everyday life, 3) Acquiring skills to level to apply in practice. 4) Drawing meaning from the experience, 5) Describe the knowledge one's own words, 6) Try to do practically apply the information we read in book, 7) Explain things according to our own experience and understanding. 8) Summarize information.	Elaboration

### **Results**

Pakistani science students' views showed that they use passive rehearsal a form of memorization as CPS to process information. They rehearse information in books to memorize and copy this information in examinations. Consequently, these students have the tendency to rote learn information in science textbooks. However, rehearsal was the usual cognitive strategy of memorization in these students.

In students' views, in following excerpt suggested wholehearted repetitions of the textbook information which means rehearse information devotedly and enthusiastically without any pause; until you become certain to reproduce it vocally as precise as in the book.

"... If we find anything difficult to understand, we request teacher to explain these to us. Following, whatever information teacher assigns us to memorize, we memorize it wholeheartedly. For memorization, we recite that information repeatedly. In a case, we cannot memorize assigned information by a verbal rehearsal. We start writing information again and again which we failed to memorize in a verbal rehearsal (B01)."

In above verbatim, student visualised just following those passive steps, he can impulsively learn textbook information. He believed teachers expect him to memorize information, and through rehearsal he can memorize information. By rehearsing, he develops particular understanding of the textbook information. A dispirited aspect of memorization behaviour in Pakistani students was rehearse textbook information for a fixed number of times. In this case, they passively rehearse information without testing ability to remember it. Students might have fantasy and misconceptions about product and process of memorization as mentioned in following opinion:

Consciously, we would read the textbook information just for five times, and we would memorize it by this act (A03).

Students might not be worried about difficulty level of any information. Erratically, they fixed number of repetitions, they would require to memorize any form and type of content. This conception of Pakistani science

students 'fixed/universal effort for learning belief' is unique to the sample in our study. In our case, Pakistani students used rote type rehearsal because they rehearsed item by item and do not rehearse in the cumulative way. The following verbatim is an example of above notion. The student suggests how someone can learn from a textbook:

"In first step, you should rehearse small quantity of information, small parts of information such as rehearse words, then gradually rehearse sentences. Afterwards you should focus yourself on what you have memorized and try to recall all information at once. If we will do in small parts, then gradually we can memorize whole information (C01)."

Evidently, Pakistani students believe in knowledge as a collection of isolated bits of information. They do not suggest linking packets of information to develop a larger and broader picture of information. The following verbatim gives a picture of the above case:

"If, someone have to study too much. We advise him; limit himself/herself to rehearse smaller section of the lesson; such as two lines. To memorize, he/she should repeat those lines. When he/she recognises to have memorized those lines, we advise him/her to write those lines. If he/she would exactly write those lines, he should rehearse next two lines." D

In some cases, initially, students rehearse English version of information, and subsequently, they rehearse the translated Urdu version. Viewed students do not connect English and Urdu versions of information.

"Initially, we read the lesson. Then, we memorize translation of the lesson. We memorize meanings of one word at a time, and then we write, and show these remembered meanings and translation someone for assessment." E

In another manifestation of obvious passive rehearsal; students memorise textbook information in the same wording and sequence as these were in their books. One student opines as follows:

".... After becoming certain of memorization, we recall information through writing. Wherever in our writing, we find mistakes, we again write those difficult words. After this, we write again assigned information by heart, and check mistakes in re-written. If, our re-written would be correct, then we will stop writing rehearsal, and we start reading another subject." (A).

Because they cannot understand the question, they also memorize the question so that they may give the same memorized answer to the same memorized question. Memorization by Rehearsal appears to be rooted in distal societal factors. The following excerpt affirms the above narrative:

".... we read the introduction of the lesson to know about what lesson is, and what will we learn from this lesson. Afterwards, we memorize teacher's assigned questions (information). During process, friends, elder family members listen from us this lesson. If we feel mistakes and difficulties in recalling this lesson (information), then we again rehearse this lesson." C

In the above scenario, unlike, rehearsal for a fixed and limited number of times, students kept on rehearsing information until they become self-assured to have memorised textbook information. They cannot decide for themselves whether they have or have not memorized some information. The following selection indicates the said interpretation:

"The method to remember a lesson is like that; you should knowingly read a lesson to be familiar with words in a lesson. You should rehearse the lesson three or four times." C

Ostensibly, sample students were unable to figure out that information and titles in textbooks are in succinct and logical order. Under an ambition to memorise textbook information, they select brief and short units of information for memorization, regardless whether this information is in start, middle or end of the book. In following excerpt, student opines about ideal method to effectively learn from textbook and it depicts tenets of above description.

".... You should read the entire lesson to know about what it is? Throughout your reading when you come across difficult words, you should question teacher for their meanings. You should memorize the easy and short questions and paragraphs before you memorize the difficult ones." B

Students' concepts about text difficulty were somewhat illogical. Their so-called criteria of text learnability and difficulty is length of a text. Simply, they think the lengthier a text is, the more difficulty it is to learn. The shorter text appears easier and appealing to students than the longer ones. Because they lack a motive to

understand and comprehend the text, and their exclusive motive is cramming the text.

"... We should slowly read every word with a pause. We should understand meanings of difficult words and should rehearse those difficult words' meanings." F

"Some questions are too long, as long as of half page. It is quite difficult to memorize those questions, and these takes too much time.

It is easier to read and understand short text." D

Active cognitive processing strategies such as organization and elaboration, helpful to store information in long term memory and understand any textbook information were invisible in their verbatim. An example is following:

"To be appreciated by teachers, we consider; we have to quickly memorize a lesson, and we have to narrate it in time to the teacher before other students." A

There are various cognitive processing strategies such as concept mapping, paraphrasing, summarizations, or acronyms, outline, questioning etc., but Pakistani students only know rehearsal strategy of memorization. Although, students recurrently used Urdu word "SAMAJHNA" meaning to understand, unable to comprehend what means by understanding, they think that repetitions can enhance understanding.

## **Discussion**

Pakistani secondary school science students use rehearsal; a form of memorization CPS in their routine learning tasks to understand textbook information. In its nastiest form, 'Passive rehearsal' might be customarily cultured among Pakistani secondary school science students. Behaviour of teachers, family members and nature of annual examination system, teaching method, naive learning and epistemological beliefs co-occurred with their passive rehearsal strategies. Most of the time, students were confident to improve their understanding of textbook information through rehearsal strategy. In our case, idea of active rehearsal was absent in students' excerpts. It was noticeable that students' knowledge of CPS was limited to rehearsal strategies.

Pakistani society has a collectivistic culture (Hofstede et al., 2010), and an information testing examination system. These features of Pakistan might corroborate memorization CPS and rote learning among students (Kember, 2016). Particularly, Pakistani public schools have teacher centred education system. Affirmatively, our study unveiled teachers' incompetence to guide students in issues related to their learning process and CPS. In this way, Pakistani secondary school science students comply demands of examination system and teaching learning practices in schools and habituate memorization CPS.

Because, the use of rehearsal and cognitive processing strategies among students is negatively associated to their academic performance (Zimmerman & Pons, 1986), existence of rehearsal CPS among Pakistani students appear as a plausible cause for students' poor performance in state held examinations (*Punjab Development Statistics*, 2016). Results of this study supported international and Pakistani literature. Prior studies in Pakistani context have affirmed presence of naive epistemological beliefs among samples of Pakistani students from the same population (Bakar et al., 2017). Remarkably, lack of variation revealed through our study among Pakistani students with regard to their memorization behaviour affirmed results of prior studies. In this way, there is an array of misconceptions among Pakistani students about memory, learning process, teaching process, epistemology, role of learner in learning at school, product of learning, which coexisted with their rehearsal learning behaviour.

Students' age is linked to their ways to rehearse information. Mature students are likely to use active rehearsal strategies, while immature students tend to passively rehearse information. However, the sample in this study were 10<sup>th</sup> grade science students of high school. Contrary to age level, they passively rehearsed textbook information. Apparently, Pakistani students failed to progress from lower level CPS use namely the single item passive rehearsal of information to the use of very advanced higher-level CPS such as organization and elaboration. This failure of Pakistani secondary school science students appears inconsistent to the findings of Schneider and Sodian (1997). The possible key causes might be teacher centred education system, lack of skill and will to use diverse and higher order cognitive processing strategies, social system and population.

Next in the line of inconsistency, Pakistani secondary school science students' use of rehearsal strategy is somewhat different from Chinese students. Chinese students of Asian countries exercised repetitions with an

intent to discover new meanings (Dahlin & Watkins, 2000), whereas most of Pakistani students' sample in this study do repetitions with an intent to reproduce textbook information.

Pakistani society is a collectivistic society and it has different systems of education such as public, private and madrassa system to fulfill needs of different social classes of the society. Students of these different systems of education have different class bound beliefs about themselves and the world around; they do not see their future beyond the professions of their inherited social classes they belong (Malik, 2012). Students of public schools come from lower middle and lower social and economic background, and they lack a goal and motive to find new meanings and develop an understanding of information presented to them in schools.

In a nutshell, Pakistani public schools become centers of reproduction of knowledge rather than creation of knowledge (Ali *et al.*, 2018). Teachers, school activities and assessment practices appear a tool to promote reproduction of knowledge behaviour among students. In Pakistani society, public schools look like a tool to reproduce specific social class. The use of elaboration and organization strategy appears a matter beyond the choice of secondary school science students of Pakistan. The aspirations to use organization and elaboration strategies by students of public schools cannot met without radical reforms in educational, social, and economic systems of Pakistan.

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