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Measuring Reliability of Metacognitive Strategies in Reading Comprehension Questionnaire: A Pilot Study on First Year Engineering Students in Pakistan

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ABSTRACT

This study aimed to investigate the reliability (psychometric properties) of the metacognitive strategies questionnaire piloted on Pakistani engineering students of QUEST, Nawabshah. The questionnaire had four parts including demographic, reading comprehension, metacognition, and scaffolding having 53 questions that were tested on 37 first year engineering students. The Cronbach's Alpha reliability was measured through SPSS 17. The results showed that the Cronbach's Alpha reliability concerning reading comprehension ranged from .826-.842, metacognitive strategies ranged from.830-.839, and the reliability of scaffolding ranged from .829-.837. Therefore, the results from the pilot study showed that the questionnaire needed to be used without any modification in the actual study.

Keywords: metacognition; cognition; thought processes; meta-comprehension

INTRODUCTION

In Pakistan there was no trend of research in the field of metacognition and cognition. This study is an effort to support the trend of investigation in the field of cognition and metacognition strategies to develop reading comprehension of students. This research would be beneficial to pave the way for researchers, students of language, social, cognitive, psychology, psychology, and health sciences to work in the area of cognition and metacognition. The primary intent of this research was to recommend suggestions for developing courses, syllabus in the field of metacognitions to develop reading comprehension in Pakistan. Metacognition has been defined differently by many researchers. Some researchers like Flavell (1999), Bogdan, (2000), Metcalfe, (2000) presented very simple definitions, and stated metacognition as the study or knowledge of thinking about thinking pro-

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cesses involving the awareness to replicate the thought processes and further examine to make inferences related to the practice on already learned knowledge. Generally students of different fields, find difficulties in reading academic texts and needed to solve their reading problems, and wanted to understand how their mind works and apprehends. These students require perceiving about their performance related to their cognitive chores including remembering, learning, and problem solving tasks.

Metacognitive Strategies and Components

The term metacognition was first introduced by Flavell (1976) with the idea or knowledge related to the cognitive processes of a person which can be used to interconnect to them and their mind. Further, Metcalfe, (2000) stated that metacognition can be regarded as the control method of cognizance based on greater intellects; which can imperatively be used to control the thoughts, knowledge, and actions of a person (Weinert, 1987). This proves that metacognition can be related towards the awareness of one's individual thoughts and the control of one's personal thinking or dogmas. In addition, Akama (2006) pointed out three basic Metacognitive strategies which can be beneficial for developing reading comprehension. These strategies include:

i. Involving new knowledge with that of prior information.
ii. Going for rational strategies with intent.
iii. Thinking practices of a person that take account of individual planning, personal monitoring, and separate evaluating.

Both, Flavell (1979) and Brown (1987) theorized metacognition into two components, that include:

i. The Knowledge: This component denotes the awareness of one's personal cognitive processes. These processes can recommend individual knowledge of a person as a thinker to meditate. These processes also update about the individual features of prevailing activities suggesting certain strategies needed for the continuity of certain performances effectively.
ii. The Regulation: This component discusses that a person uses the concrete strategy independently to control one's personal cognitive processes. These processes are based on planning means a method to approach an activity, monitoring means a method to understand a task, and evaluating means a method to assess a progress and performance of a certain activity.

Moreover, Flavell's (1976, 1979, 1999) studies reported that metacognitive awareness denotes as the acquired knowledge which can support to control the cognitive processes and can be used to assess the understanding of thinking processes. Similarly, Brown (1987) asserted that meta-comprehension is considered as the most important aspect of metacognitive knowledge that enables student to understand a question clearly; however, regulation enables students to utilize that piece of knowledge in order to develop rational performance for comprehension purposes. In the same way, metacognitive awareness develops regulation effectively to be utilized for enhancing the capability of performance as discussed by Brown (1987). However, Veenman, Van Hout-Wolters, and Afflerbach (2006) stated that it is very difficult to distinguish between metacognitive and cognitive; both are considered as the two faces of one coin, depend on each other, and work together for functioning the thinking or mental performances of activities on reading comprehension.

REVIEW OF LITERATURE

The idea of metacognition was presented by (Kluwe, 1987) who asserted that thinker can easily identify about personal thought processes and others' thought as well in the one category; whereas, in other category, a thinker can attend personal thoughts and has the ability to change thinking related to the activity which is being called as the 'executive processes' of metacognition. In addition, Hacker (1998) indicated the demarcation between cognitive and metacognitive tasks. Cognitive tasks can be used in retention of knowledge learned previously and interconnect with the existing tasks; whereas metacognitive tasks can be used in monitoring the tasks and directing the process of activities involving thinking in order to acquire more knowledge. Further, Hacker (1998) reported that Metacognitive knowledge indicates the knowledge of a person; whereas metacognitive abilities refer to the task presently undertaken, and metacognitive experience is used involving affective state of a person or cognitive state of the students related to the activity. Afflerbach, Pearson, and Paris (2008) informed the fact that cognitive aspect stresses on solving any problem during learning, while, metacognitive concentrates on the process of solving any task or activity. Additionally, Veenman et al. (2006) stated that metacognition can be classified into two divergent features that include the knowledge of cognition that refers to the information related to the factors interacting in such a way that is used to affect the cognitive courses and generated outcomes; whereas the regulation of cognition (Flavell, 1979) refers to the information involving personal or independent learning and course of actions based on individual thoughts.

The three most important kinds of metacognition were identified by Cross and Paris (1988) that included as: (1) Declarative knowledge refers to the knowledge based on factors influencing human cognition, (2) Procedural knowledge is used to know by what means certain abilities function and in what manner these abilities or skills can be used, and (3) Conditional knowledge is used to know the information related to the strategies needed for solving certain tasks. Further, students can practice through the certain tasks involving individual cognitions as stated by Efklides and Petkaki (2005) for practicing a number of mental states including personal interest, and a method of judgment concerning tasks dealing out for better outcomes. Therefore, Flavell (1979) informed that knowledge and regulation are reciprocally interconnected under the umbrella of metacognition. However, Schraw and Dennison (1994) presented Metacognitive Awareness Inventory (MAI) which indicated that the knowledge and regulation are strongly interconnected in cognition development and the results of the study by Sperling, Howard, Staley, and Dubois (2004) confirmed this theory and further informed that metacognitive awareness and regulation effect provided a method of selection of strategies to be used. Therefore, this study determined the reliability of the questionnaire adopted from Fauzan (2003) and modified by the researchers.

OBJECTIVE OF THE STUDY

The specific objective of this study is to investigate the reliability (psychometric properties) of the metacognitive strategies in reading comprehension questionnaire piloted on Pakistani engineering students.

METHODOLOGY

The questionnaire was adopted from Fauzan (2003) and the researchers modified it according to the needs of engineering students. The questionnaire was finalized and evaluated by the supervisor of the study who was an expert in the metacognition field. After the permission was given by supervisor of the student, the questionnaire

Table 1: Frequency of reading comprehension

Reading Comprehension	*M*	*SD*	Cronbach's Alpha
Asking questions before, during, and after reading	1.75	.954	.832
Considering several alternatives to a problem in text	2.24	.925	.838
Brainstorming about the topics of the text	1.62	.794	.834
Finding the usefulness of the text while reading	1.86	.887	.833
Developing general and technical vocabulary	1.56	.688	.834
Reading passages/essays/textbooks from easy to difficult	2.05	.998	.834
While taking reading class, I help students to overcome barriers to understanding	1.86	.887	.833
Think aloud practices	1.56	.688	.834
Read aloud practices	2.67	1.248	.831
Rereading for deeper meaning	1.48	.692	.835
Using text coding	2.83	1.166	.842
Overcoming complexities in reading reports' text	2.35	1.033	.839
Making concepts maps	2.29	1.076	.832
Making story maps	2.40	1.257	.826
Reading through timelines	2.29	.967	.836
Building word walls	2.05	.911	.839
Making mind maps	1.75	.954	.832
Understanding self-intellectual strengths and weaknesses	1.56	.688	.835

was piloted for measuring its reliability. A total of 37 students from four engineering departments at QUEST, Pakistan were selected as respondents of this study. They were required to express their perceptions regarding metacognition in reading comprehension. The questionnaire was administered on the sample. Descriptive statistics and reliability coefficient were computed through SPSS 17 in the analysis of data in the study.

RESULTS OF THE STUDY

The responses from the 37 returned questionnaires about the metacognitive strategies in reading comprehension proficiency are presented in Table 1. The findings in Table 1 reveal that the first most frequently used strategy category was 'Using text coding' with a mean score of 2.83 displaying the highest need and regarded as the "essential" requirement to develop reading comprehension. The second strategy 'read aloud practices' with a mean score of 2.67 was regarded as essential for promoting

comprehension. Similarly, this was followed by the groups of 'think-aloud practices' with a mean score of 2.62 as the third important category for developing reading comprehension.

However, Read aloud practices, Considering several alternatives to a problem in text, and Asking questions before, during, and after reading were rated as "essential"; while the other categories were rated as "very necessary". The mean score for 'Using text coding' and 'Read aloud practices' ($\bar{x}$= 2.83 and 2.67) for all participants were considered as the highest; while the mean score for 'Rereading for deeper meaning' and 'Developing general and technical vocabulary' ($\bar{x}$ = 1.48 & 1.56) were considered as the least important for promoting reading comprehension. However, no strategy fell into a low level of use.

Metacognitive Strategies

Table 2 presents the respondents' responses about the metacognitive strategies based on the fourteen categories. Table 2 reveals the average use of the twenty one main strategy groups reported by 37 engineering students. The results showed that the most frequently used strategy category was 'I often find that I have been reading for class but don't know what it is all about' with a mean score of 3.08 was regarded as the essential need by the respondents followed by 'Reading with opposite meanings to form an opinion' with a mean score of 3.02 stood as the second most important and essential strategy for improving reading proficiency.

Similarly, 'Drawing diagrams to understand difficult text' strategy with a mean score of 2.78 was considered as the third most important category and very necessary strategy for students. However, 'Making connection of text to self', 'I try to change the way I study in order to fit the subjects of course requirement and instructor's teaching style', 'Having specific purpose for each strategy', 'Using different strategy for each text depending on the situation', 'If the materials are difficult to understand I change the strategy/way I read the materials', 'When I study, I set goals for myself in order to direct my activities in each study period', 'Before I begin studying I think about the things I will need to do to learn', and 'Rethinking misconceptions' were all considered as very necessary strategies for developing reading comprehension of the students as the order or series of strategies were found and selected by the respondents of the study. 'Reading with opposite meanings to form an opinion', 'Making connection of text to self', and 'If the materials are difficult to understand, I change the strategy/way I read the materials' were rated as "essential"; while the other categories were rated as "very necessary". In short, the mean score for 'I often find that I have been reading for class but don't know what it is all about' ($\bar{x}$= 3.08) for all participants was the highest; while the mean score for 'Focusing attention on the meaning', ($\bar{x}$ = 1.54) was the least. However, no strategy fell into a low level of use.

Scaffolding Strategy

Table 3 offers the respondents' reactions about the scaffolding strategies based on the twelve categories reported by 37 engineering students. The results showed that the most frequently used scaffolding strategy was 'When studying reading courses, I often set aside time to discuss the course material with a group of students from the class having a mean score of 2.56 as the first highest category chosen as "very necessary" by the respondents. Similarly, these respondents selected 'I try to work with other students from this class to complete the course assignments' category as the second "very necessary" category with a mean score of 2.43 to develop and support in reading comprehension. Thirdly,

Table 2: Table of descriptive statistics for memory errors

Metacognitive strategies	*M*	*SD*	Cronbach's Alpha
I ask myself question to make sure I know the material I have been studying	1.59	.762	.834
When reading a passage, I make up questions to help focus m reading	1.78	.854	.835
When I become confused about something I'm reading, I go back and try to figure it out	1.56	.688	.837
Having specific purpose for each strategy	1.56	.688	.837
using different strategy for each text depending on the situation	2.29	.996	.839
If the materials are difficult to understand, I change the strategy/way I read the materials	1.78	.854	.835
Before I begin studying I think about the things I will need to do to learn	2.67	1.248	.831
Thinking of several ways to solve a problem	2.18	1.049	.830
Reading instructions carefully before beginning a task	1.32	.579	.836
Organizing time to accomplish reading goals	2.18	1.049	.830
Slowing down and focusing attention on important information	1.64	.753	.833
Focusing attention on the meaning	1.54	.605	.833
Drawing diagrams to understand difficult text	2.05	.911	.839
Translating information into own words	2.18	1.049	.830
Making connection of text to self	1.67	.818	.829
Rethinking misconceptions	2.10	.936	.834
When studying for this course I try to determine which concepts I don't understand well	1.83	.833	.837
I often find that I have been reading for class but don't know what it is all about	1.54	.730	.837
When I study, I set goals for myself in order to direct my activities in each study period	1.32	.579	.836
Reading with opposite meanings to form an opinion	2.67	1.248	.831
I try to change the way I study in order to fit the subjects of course requirement and instructor's teaching style	1.91	1.08	.837

Table 3: Presenting frequency of scaffolding

Scaffolding	*M*	*SD*	Cronbach's Alpha
I ask students/peers for help when they/I do not understand	1.54	.730	.837
I like students helping classmates to choose text	1.81	.995	.837
I want my students finding exact meaning	2.29	.845	.833
I change strategies when students do not comprehend	2.10	.936	.834
I re-evaluate students' assumptions when they get confused	2.02	.985	.828
I stop and go back over new information that is not clear	1.86	1.03	.832
I support my students in reading difficult task	1.67	.818	.829
I like teaching/learning critical activities in reading for comprehension	1.91	1.08	.837
I try to work with other students from this class to complete the course assignments	2.43	1.01	.835
When studying this course, I often set aside time to discuss the course material with a group of students from the class	2.56	1.28	.834
I ask students/peers for critical thinking and problem solving based reading	2.35	1.31	.835
when studying for this course, I often try to explain the material to a classmate or a friend	1.81	.775	.834

these respondents asserted for 'I ask students/peers for critical thinking and problem solving based reading' category with a mean score 2.35 to enhance critical thinking and problem solving with their teachers' or peers' collaboration in reading activities; hence, this scaffolding strategy was considered as very necessary for developing reading comprehension.

However, the other categories including 'I want my students finding exact meaning', 'I change strategies when students do not comprehend', 'I re-evaluate students' assumptions when they get confused', and 'I like teaching/learning critical activities in reading for comprehension' were important and were regarded as "necessary" for promoting support in reading and metacognitive proficiency of students. In short, the mean score for 'When studying reading courses, I often set aside time to discuss the course material with a group of students from the class' ($\bar{x}$ = 2.56) category was the uppermost; while the mean score for 'I ask students/peers for help when they/I do not understand' ($\bar{x}$= 1.54) was the least. However, no strategy fell into a low level of use.

DISCUSSION AND SUMMARY

This study was conducted to determine metacognitive strategies used by engineering students for measuring the reliability of

the questionnaire adopted from Fauzan's (2003) study. The results suggested that the metacognitive strategies can be the most effective tools for engineering students in developing their reading proficiency and comprehension needs. There are different reading theories and models which help to develop comprehension proficiency of readers. The cognitive theories in terms of reading and comprehension focused on different approaches. Reading comprehension needed readers to understand the text which they read. Cohen (1998) asserted that metacognitive strategies partially played a part as the operational strategies to boost up students' reading ability. Similarly, Hammadou (1991) stated that students can upgrade their reading comprehension ability by means of incorporating their former awareness, reading ability, and metacognitive strategies through comprehension of words and sentences in a text to be capable to read efficiently and perceptively. The results of the analysis of the data obtained from the questionnaire can be summarized below.

The present study investigated the important categories in the reading comprehension variable. The highest mean score was for read aloud practices category ($\bar{X}$ = 2.67) rated by all respondents; while the mean score for asking questions before, during, and after reading ($\bar{X}$ = 1.75) was the lowest. Similarly, this research also revealed the average uses of important categories on metacognitive strategies as reported by engineering students. The mean score for 'I often find that I have been reading for class but don't know what it is all about' category ($\bar{X}$ = 3.08) was rated by the respondents of this study as the highest; while the mean score for 'When I become confused about something I'm reading, I go back and try to figure it out' ($\bar{X}$ = 1.56) was the least. Conversely, the findings revealed that the scaffolding strategy is the most important for developing reading comprehension. So, the mean score for 'When studying reading courses, I often set aside time to discuss the course material with a group of students from the class' ($\bar{X}$ = 2.56) category was the highest; while the mean score for 'I ask students/peers for help when they do not understand' ($\bar{X}$ = 1.54) was the least. However, no category of reading comprehension, metacognitive strategies, and scaffolding fell into low level of use. Therefore, the findings from the pilot study revealed that the questionnaire needed to be used without any modification in the actual study as its reliabilty was already proven and was used in Fauzan's (2003) study on metacognition.

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