Development and Psychometric Properties of the Metacognitive Skills Scale among Primary Schools Students in Egypt

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Abstract--- *The current study attempts to examine the structure and psychometric properties of metacognitive skills scale for primary school students in Egypt. The study questions addressed were: What is the factorial structure of the metacognitive skills scale among a sample of primary school students? Is the metacognitive skills scale have appropriate psychometric properties? A total of 120 students from Egypt completed the scale of metacognitive skills, including males (N= 44) and females (N= 76).The students ranged in age from 11.2 to 12.3 with an average age 11.7 and S.D. 0.84. Confirmatory factor analysis (CFA) was used. The results indicate that the structure of metacognitive skills scale is fit and the scale has appropriate psychometric properties.*

Keywords--- *Metacognitive Skills Scale, Reliability, Construct Validity.*

I. INTRODUCTION

The term metacognition or the concept of thinking about thinking appeared by (Flavell, 1979) to add a new dimension in cognitive psychology, and empirical studies and theoretical discussions on the topics of intelligence, thinking, memory, comprehension and learning skills.

Metacognition refers to knowledge about knowledge, and available data and information that is given to the individual, metacognition refers to internal knowledge and how to process information internally, metacognition indicates how the individual thinks and controls his or her operations (Zachary, 2000, 143).

Metacognition "thinking about thinking", "knowledge about knowledge", becoming "aware of one's consciousness" and higher thinking skills. The term comes from the word meta root, which means "beyond", or "above". Metacognition can take many forms, including knowledge about when and how to use specific learning or problem solving strategies. Metacognition is the concept of cognitive psychology that focuses on the active participation of the individual in his thought process (Djudin, 2017, 124).

Metacognition includes the knowledge of the individual or his beliefs about three factors: the nature of his knowledge, his tasks and his own needs, , the use of strategies necessary to perform the task or strategy that leads to achieving the goals, the use of metacognitive strategies that monitor the progress of cognitive strategies, and metacognition also includes the individual's thinking in his own thinking, and includes his knowledge of himself, such as determining what he knows and what he has learned, and determining what an individual can do to improve

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his learning, and his achievement as Included beyond the knowledge also cognitive skills and a sense of problems and identify elements of problems and planning for what to do to solve problems and monitor progress and evaluate the results of his own mind or problem-solving activity (Hacker, 2005,132).

The concept of metacognition was used to denote a variety of cognitive and intellectual processes; metacognition was seen as one's knowledge of a number of characteristics of thinking, then the concept expanded to include psychological aspects, as well as emotional aspects that include knowledge or perception about personal emotions or Intentions with regard to cognitive aspects; cognitive perception holds two vital attributes: self-evaluation and self-management of cognition. "Self-assessments refer to individual images of learners about their own circumstances and their cognitive abilities, and their emotional conditions in relation to their knowledge and abilities. These thoughts relate to questions related to what you know, how to think, when and why to apply knowledge policies, and self-knowledge beyond work denotes the mental procedures involved in "coordinating aspects of problem solving" This includes pre-mission planning, adjustment during the task, and review after Mission (Ghaith & El-Sanyoura, 2019,22).

It is defined by (Sudhir, Prathyusha & Thirthalli, 2020,148) as knowledge of activities, mental processes, and methods of learning and self-control that are used before, during and after learning to remember, understand, plan and manage.

It is a set of skills needed to develop structured thinking and use appropriate learning strategies, which are self-organizing and appropriate skills to perform academic tasks and procedural control skills so it is a mental treatment of sensory inputs, leading to the identification and judgment of things (Bellon & De Smedt, 2020, 3).

The present study tries to shed more light on the study of metacognition among a sample of primary school pupils by preparing a metacognitive skills scale and calculating its psychometric properties.

Gupta & Bashir (2019) studied the psychometric properties of the metacognition questionnaire by Wells & Cartwright-Hatton (2004) in Indian context especially for university students. The CFA and Cronbach's Alpha was carried out in order to examine the validity and reliability of the questionnaire in Indian context. Based on a sample of 275 respondents empirical evidence determine an excellent fit of multidimensional structure of 22 items metacognitive beliefs questionnaire in the Indian context and the internal consistency indices, alpha coefficient (α= 0.761) is adequate for the entire metacognitive beliefs questionnaire. Present scale provides direct evidence for the unique identification and psychometric properties of the metacognitions questionnaire in the Indian context. This study has proved the suitability of the metacognitions to measure metacognitive beliefs of university students.

Klusmanna, et al., (2011) examined the psychometric properties of brief 9-item questionnaire assessing metacognition , Results: Subscales were confirmed to have factorial validity. While objective cognitive test performance did not predict self-reported everyday functioning, metamemory and metaconcentration accounted for a substantial amount of its variance. The newly developed instrument was shown to be predominantly characterized by latent trait variance components.

OÕNeil, & Abedi (1996) examined the psychometric properties of alternative assessments is that they result in

more higher level thinking or metacognitive skills. The measures of metacognitive skills (planning, monitoring, cognitive strategies, and awareness). The sample from 12th graders, alpha reliability estimates and factor analysis indicated that our metacognitive subscales are reliable (alpha above .70) and unidimensional (one factor per subscale). Because the subscales have only 5 items each, they meet brevity standards. Construct validity of our state of metacognitive skills inventory is acceptable. Results indicate that our state of metacognitive skills inventory yields useful information about both the assessment and students.

Through previous studies, there had been multiple measures of metacognitive skills and dealt with multiple age groups and multiple cultures, researchers attempts to preparation an appropriate measure of metacognitive skills among primary students, characterized by a good psychometric properties. The present study attempts to examine the structure of metacognitive skills among primary students on the Egyptian environment, and the study problem can be formulated in the following questions:

What is the structure of the measure of metacognitive skills for primary students in Egypt?

Is the metacognitive skills scale have has appropriate psychometric properties?

II. METHODOLOGY

To answer the study questions for this study, it was necessary to prepare an appropriate scale of metacognitive skills, participants were identified, and completed the instrument during 2019-2020. Finally, the data collected were combined and analyzed.

Participants

A total of 120 students from primary schools in egypt completed the scale of metacognitive skills, including males (N= 44) and females (N= 76).The students ranged in age from 11 to 12 with an average age 11.67 and S.D. 0.34

Instrument

The scale consists of 30 items and measure the three strategies for metacognition, the planning strategy included (12) items, the monitoring strategy included (10) items, while the evaluation strategy included (8) items, which are responded to according to a three- Likert scale "always, sometimes, rarely" taking grades "3, 2, 1".,

The scale was perrpared depending on measures in metacognition, such that metacognition scale (Zhang& Seepho,2013), Al–Dawaideh & Al-Saadi,2013)

III. RESULTS

Confirmatory Factor Analysis of Metacognitive Skills

Confirmatory factor analysis (CFA) is used to study the relationships between observed values and latent constructs and comprises the measurement model portion of a structural equation model. CFA additionally, examine the stability of the theorized factor structure, to provide information for measure refinement and to establish the uni-dimensionality of the construct.

Confirmatory factor analysis was conducted in order to further evaluate the items and their structure. The confirmatory factor analysis was done using Analysis of AMOS) software to Metacognitive skills. The measurement model for constructs was examined. For approximate fit indexes, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed fit index (NFI), Relative Fit Index (RFI), Incremental Fit Index (IFI), Tucker-Lewis fit index (TFI) and Comparative Fit Index (CFI) of above 0.9 would indicate model fit. More specifically, for Chi-square/df, a value close to 1 is ideal where however values below 5 are considered acceptable. For RMSEA (Root Mean Square Error Approximation), its value should be less than 0.05 although less than 0.1 is suggested to indicate good fit, for NFI, RFI, IFI, TLI and CFI, their values range along a 0–1 continuum, where values above 0.9 typically correspond to good fit .

It is recommended to use multiple and different fit indices where it is suggested to use at least three indexes to assess the model fit. It is suggested to involve at least one absolute fit index and one incremental fit index in addition to ratio of chi-square to degrees of freedom (normed chi-square) to define the fit of the model. In this research, RMSEA was used as the absolute fit index as it is one of the most informative criteria as to an absolute fit, CFI (Comparative Fit Index) was used as the incremental fit index as it has the ability to adjust for model complexity, in addition to NFI and RFI.

Confirmatory Factor Analysis was used to confirm one factor model of Metacognitive skills in a sample of primary students of Egypt.

Table 1: Model Fit of Metacognitive Skills in a Sample of Primary Students of Egypt

	Stats	One factor model
	Chi-square	1.53
	Probability level	0.64
Model Fit Summary (CMIN)	NPAR	119
	CMIN	1.53
	DF	1
	CMIN/DF	1.53
Baseline Comparisons	NFI	0.98
	RFI	0.94
	IFI	0.97
	TLI	0.96
	CFI	0.95
RMSEA	RMSEA	.04
	PCLOSE	0.000

First, the measurement model showed a good fit to the data with CMIN/DF of 1.53, CFI of 0.95, NFI of 0.98, RFI of 0.94, IFI of 0.97, TLI of 0.96 and RMSEA of 0.04. Second, all factor loadings of the measurement model were examined. They all were above 0.4 and statistically significant ($p < 0.05$).

Table 2: Regression, Std. Regression of Metacognitive Skills

factor			Std. Estimate	Estimate	S.E.	C.R.	P
Planning	<---	Metacognitive skills	0.63	1			0.00
monitoring	<---	Metacognitive skills	0.52	0.41	0.12	3.41	0.00
Evaluation	<---	Metacognitive skills	0.76	0.59	0.14	4.21	0.00

All of the path coefficients were statistically significant, and all paths loaded well above 0.4.

Constructs Reliability

After conducting confirmatory factor analysis, reliability of items was estimated by calculating Cronbach's alpha value. The Cronbach's alpha value for scale was 0.81.

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