CHAPTER-3

PRACTICAL ASPECTS OF THE PREVIOUS STUDIES

3.1 Introduction

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3.1 INTRODUCTION

This chapter deals with review of past studies carried out in the field of psychological testing and studies related to metacognition. Such review can provide guideline for planning and execution of the present research work.

3.2 IMPORTANCE OF THE REVIEW OF THE RELATED STUDIES

The search for related material is a time consuming but fruitful phase of any research programme. It helps research worker to find what is already known, what others have attempted to find out, what methods of attack have been promising and what problems remain to be solved.

The importance of the review of the related literature according to Singh & Bajpal \(^1\) (2007),

"For any specific research project the researcher must be thoroughly familiar with both previous theory and research. To assure this familiarity, every research project has as one of its early stage, a review of the theoretical and research literature"

According to Brog & Gall \(^2\) (1963)

"The literature in any field forms the foundation upon which all further work will be built."

Wiersma \(^3\) (1976) states that,

"Educational research is not or at least should not be, carried out in an informational vacuum."

Purposes of the survey of related literature according to Good, Barr and Scats \(^4\) (as cited in Sukhia & Mehrotra, 1996) are as follows:

1. To show whether the evidence already available solves the problem adequately without further investigation and thus to avoid the risk of duplication.

2. To provide ideas, theories, explanations or hypotheses valuable in formulating the problem.
3. To suggest methods of research appropriate to the problem.

4. To locate comparative data useful in the interpretation of results.

5. To contribute to the general scholarship of the investigator.

A review of related literature not only helps researcher for planning of research work, but also provides a degree of familiarity to the researcher with past work done, as well as inputs to the research the vast knowledge pool that has already been tapped. Hence, it becomes extremely crucial to locate, reveal and evaluate the past research reports.

3.3 GENERAL GUIDELINES FOR THE SOURCE OF THE PREVIOUS STUDIES

The concept of Metacognition is in its infant stage in the field of Psychological testing. In developing country like India, researches regarding Metacognition are very few in numbers. Specifically in Gujarat State there is not any standardized tool available to measure the construct metacognition. In such situation, the investigator has to depend upon the international resources available from the internet for the reviews of the past research done in this field.

The investigator has downloaded the scholarly articles and research papers from the internet with the help of INFLIBNET center, Ahmedabad.

INFLIBNET - Information and Library Network Centre (www.Inflibnet.ac.in or mirror at www.Inflibnet.ernet.in) is an Autonomous Inter University Centre (IUC) of University Grants Commission (UGC) involved in creating infrastructure for sharing of library and information resources and services among Academic and Research Institutions. INFLIBNET works collaboratively with Indian university libraries to shape the future of the academic libraries in the evolving information environment.

Further more, some articles and research papers which are not freely downloadable from the INFLIBNET centre were purchased online from their publishers.
3.4 DESCRIPTIONS OF THE PREVIOUS STUDIES

3.4.1 Study-1

Title: Adaptation, validity and Reliability of the Metacognition Questionnaire-30 for the Turkish Population, and its Relationship to Anxiety and obsessive compulsive symptoms

Researcher: Ahmet TOSUN, Metehen IRAK

Year: 2008


Metacognition Questionnaire (MCQ) was developed and psychometrically studied by Cartwright-Hatton and Wells in 1997, which consists of five factors that were conceptually dissimilar but interrelated.

The purpose of the study was to translate Metacognition Questionnaire into Turkish sample, thereby bringing into use a questionnaire that assesses metacognition in psychopathologic as well as in normal sample populations for research and clinical implementation. The study included 850 university students from 15 Turkish universities. Mean age of the participants was 21.22 years, 282 were female and 568 were male. In the first step the items of the questionnaire were translated from English to Turkish and evaluated by seven experts with Ph.D. in psychology and advanced English language skills. In the second step three specialists translated the questionnaire in to English and latest version of the questionnaire was consequently formed.

Metacognitive Questionnaire 30, Trait Anxiety Inventory and Maudsley Obsessive Compulsive Inventory were administered on the sample students. The MCQ-30 was re-administrated to a group of 49 students 20 days later, for assessing test-retest reliability. Construct validity was evaluated by exploratory and confirmatory factor analysis, exploratory
factor analysis revealed that the Turkish version of MCQ-30 has five components, which is same factor structure as the original form. In addition, the fit indices of confirmatory factor analysis suggested an acceptable fit to a 5-factor model consistent with the original MCQ-30.

The Turkish MCQ-30 showed acceptable good test-retest reliability, internal consistency and convergent validity.

Significant positive relationship between the subscales of MCQ-30 and measures of anxiety and obsessive-compulsive symptoms provided further support for the convergent validity of the Turkish version. Moreover, significant negative correlations were observed between age and MCQ-30 subscales, and the effect of gender was significant on some of the subscales.

3.4.2 Study-2

Title: Development of an Instrument Designed to Investigate Elements of Science students' Metacognition, Self-efficacy and Learning Processes: The SEMLI-S

Researcher: Gregory Thomas, David Anderson and, Samson Nashon

Year: 2008

Place: University of Alberta, Canada & University of British Columbia, Canada


DOI: 10.1080/09500690701482493

URL: http://dx.doi.org/10.1080/09500690701482493

The main objective of the study was the development of an empirical self-report instrument for providing a measure of students' metacognition, self-efficacy and constructivist science-learning processes.

A review of the range of literature related to metacognition, self-
regulation and constructivist learning processes resulted in the development of an initial bilingual (English and Traditional Chinese) instrument.

The items were reviewed by colleagues, including readers of both English and traditional Chinese, from Hong Kong, Canada, the USA and Australia, who had expertise in metacognition, science learning and scale construction. Such scrutiny of the items and their face validity led to the deletion, modification and inclusion of some items prior to field testing. The resulting 72 item initial instrument utilized a five point likert scale. Prior to the large scale field testing of the instrument, advice from a sample of 40 students on the nature of the items and their comprehension of the items was sought. The initial instrument was administered to 465 students across 19 classes of forms two to seven (13-18 years of age) during their science classes of this sample 163 were from form two, 154 were from form four and 148 were from form six and seven.

The data were subjected to analysis which employed exploratory factor analysis and Rasch analysis in an iterative manner.

The subsequent refinement process resulted in a final version of the self-efficacy and Metacognition Learning Inventory-Science (SEMLI-S) consisting of 30 items, and 5 subscales. These five subscales, each reflecting a dimension of students' self-perceived Metacognitive science learning orientation, were named.

1) Constructivist Connectivity (CC)
2) Monitoring, Evaluation and Planning (MEP)
3) Science learning Self-efficacy (SE)
4) Learning Risk Awareness (AW); and
5) Control of concentration (CO)

The value of Cronbach alphas for different subscales were 0.77 to 0.85 which suggests there is an acceptable level of internal consistency among the items for reach of the subscales.
The discriminant validity for each of the subscales indicated that, while there is some overlap between the dimensions, they each measure distinct aspects of Metacognitive learning orientation. According to Rasch analysis the Real item reliability is .97, suggesting high internal consistency and Real Person Rasch reliability is .92. The person separation index is 3.33, well above the .7 threshold criterion. The point bi-serial correlations are generally high and this suggests that all of the SEMLI-S items are good indicators of a unified construct.

3.4.3 Study-3

Title : Metacognition as a Mediator of the Effect of Test Anxiety on a Surface approach to studying

Researcher : Marcantonio M. Spada, Ana V. Nikcevic, Giovanni B. Moneta, and Judy Ireson

Year : 2006

Place : Roehampton University, London, UK

Source : Educational Psychology, Vol. 26, No. 5, pp. 615-624

DOI : 10.1080/01443410500390673

This study investigated the role of metacognition as a mediator of the effect of test anxiety on a surface approach to studying.

The approach students use in their study has a significant impact on both the quality of their learning and their academic success. Marton and Saljo first introduced the idea of contrasting "deep" and "surface" approaches of studying. A deep approach requires the cognitive capacity to analyze, re-interpret and give personal meaning to the material being studied. Conversely a surface approach is mainly characterized by rote-learning strategies that do not involve significant interpretation and deep understanding of the material being studied. In later work, Tait and Entwistle identified a further orientation to studying: the strategic approach. This is characterized by a target oriented attitude towards academic work.
Test anxiety refers to the set of phenomenological, physiological and behavioural responses that accompany concern about possible negative consequences or failure on an exam or similar evaluative situation.

A convenience sample of 109 social science undergraduate students (79 female, and 30 male) from two London universities participated in the study. Participants were administered following questionnaires.

1) The Metacognition Questionnaire (MCQ: Cartwright-Halton & Wells, 1997). This measure was developed to assess individual differences in metacognitive beliefs, judgments, and monitoring tendencies. The MCQ was also validated in both normal and clinical groups. Scale reliabilities (alpha coefficients) range from .72 to .89

2) The Approaches and Study skill Inventory for students (ASSIST) - short version (Tait, Entwistle & M. Cune, 1998). This measure was developed to assess individual differences in approaches to studying. Scale reliabilities range from .75 to .87

The hypothesized mediation model was tested using structural equation modeling. The aim of the present study was to investigate the role of metacognition as a mediator of the effect of test anxiety on a surface approach to studying. The results of structural equation modeling supported the meditational hypothesis and suggested that the mediation is complete. Findings suggest that metacognition appears to play a central role in determining whether or not test anxiety leads to a surface approach to studying. The key implication of this finding is that without intervening on a metacognitive level, efforts at reducing test anxiety aimed at minimizing the adoption of a surface approach to studying may well be fruitless.

3.4.4 Study-4

Title : The relation between intellectual and Metacognitive skills in early adolescence
The first objective of this study was establishing to what extent Metacognitive skill is associated with intelligence. As a second objective, the impact of hints on the execution of Metacognitive skill was investigated.

Forty-one secondary school students in the age of 12-13 years from a small middle class town in the Netherlands (Delft) participated in the experiment. First a standardized intelligence test (Groninger Intelligence test) was administered on school students. Next, these students solved six Math word problems, three without Metacognitive hints and three including these hints. Metacognitive skillfulness was assessed through systematical observation, while learning performance consisted of performance on a math task and grade point average (GPA).

A major finding of the study was that Metacognitive cueing triggers a higher level of metacognitive activities that are explicitly addressed by such cues, as well as other metacognitive activities that implicitly prosper by cueing. Moreover, metacognitive cueing yielded better learning outcomes. With regard to the relation between intelligence and Metacognitive skillfulness, results clearly reflect that metacognitive skills have their own virtue in learning, partly independent of intellectual ability, even for young adolescents who are in an early stage of metacognitive skill development.

3.4.5 Study-5

Title : The Construct Validity of an Inventory For the Measurement of Young Pupils’ Metacognitive Abilities in Mathematics
The major purpose of the study was to develop an inventory for the measurement of young pupils' Metacognitive ability in mathematics and the examination of its construct validity.

Sample: Participants included all 246 children in grade four to six of an elementary school.

Procedure: The questionnaire was consisted of two basic parts. The first part measured Metacognitive abilities in mathematics. The initial scale was made up of 30 items. The second part was about their cognitive ability in problem solving in mathematics.

The 30 items were checked with respect to skewness and kurtosis and all items were found within normality criteria. The inventory demonstrated an overall high reliability. The value of Cronbach's alpha was .8298.

Firstly, exploratory factor analysis was done. Then confirmatory factor analysis and structural equation modeling was used to test hypothesis on the existence of the two first order factors and a second order factor. Fifteen items were dropped depending on their low loading on the hypothesized factors and three items were connected with both the factors. As a result of factor analysis a first order factor contained items
for the knowledge of cognition and a different first order factor contained items for the regulation of cognition, the existence of the three common items for both the factors indicated the high correlations between the two factors because of the high correlation between the two basic dimensions of metacognition: knowledge of cognition and regulation of cognition.

3.4.6 Study-6

Title : Conceptualisation, Development and validation of an Instrument for Investing the Metacognitive Orientation of Science Classroom Learning Environments: The Metacognitive Orientation Learning Environment Scale-Science (MOLES-S)

Researcher : Thomas Gregory P.¹⁰

Year : 2003

Place : Department of Science, The Hong Kong institute of Education, China

Source : Learning Environments Research 6: pp 175-197

URL : www.springerlink.com/index/p227761431136480.pdf

This study was about the conceptualization, design and validation of an instrument for evaluating the metacognitive orientation of science classroom learning environment. The metacognitive orientation of a learning environment was the extent to which that environment supports the development and enhancement of students' metacognition.

The first step of this research was the conceptualization of the dimensions of learning environments that characterize meta cognitively oriented learning environments. This conceptualization involved identifying characteristics of classroom learning environments that, on the basis of available research, have been found to influence the development and improvement of students' metacognition, and that guide and support students to participate in a learning community where such meta
cognitively oriented learning and practices are valued. Accordingly, an extensive review of research into metacognition across science education and in other subject areas was undertaken.

The characteristics of metacognitively oriented learning environment were reflected in eight dimensions. Items were written that were salient for each of the eight dimensions. The items were written in English and translated in Cantonese because Cantonese was the mother tongue of the student participants.

Peers, both English and Cantonese speakers and readers, including bilingual speakers and readers, with expertise in psychology, metacognition and scale construction evaluated the face validity of the dimensions, the items and the instrument in general. Further, 24 practicing science teachers from Hong Kong secondary schools reviewed the items and provided feedback on their salience in terms of suitability for the age levels concerned and the appropriateness of the language used. Such scrutiny of items in both a linguistic and conceptual sense led to the deletion, modification and inclusion of some items prior to field testing. The result of this process was the Metacognitive Orientation Learning Environment Scale-Science (MOLES-S), a 67-item instrument consisting of eight scales. The instrument employed the use of a five point Likert scale. The initial instrument was administered to 1026 students across 29 science classes of Forms 3 to six (14-17 years of age) students in 16 Hong Kong schools, roughly equal numbers of students from each grade level were sampled. The data were subjected to principal components factor analysis followed by varimax rotation and estimation of the internal consistency. These analyses resulted in a refinement of the initial instrument through the deletion of items and reduction of the scales from eight to seven. Each of the remaining seven scales was further reduced to five items. These seven scales were: (1) Metacognitive demands, (2) Student-Student discourse, (3) Student-Teacher discourse, (4) Student voice, (5) Distributed control, (6) Teacher encouragement and support, (7) Emotional Support.
The Cronbach Alpha suggested that there is an acceptable level of internal consistency among the items for each of the scales. For the seven scales, the discriminant validity suggests that while there is some overlap between the dimensions, they measure distinct aspects of the psychological environment. Further, the instrument's ability to differentiate between classes was measured using a one way analysis of variance (ANOVA) with class membership as the main effect. The results show that each of the scale did significantly discriminate between classes. Support for the independence of the seven refined scales was found in the result of the factor analysis on the items.

3.4.7 Study-7

Title : Assessing Students' Metacognitive Awareness of Reading strategies

Researcher : Kouider Mokhtari and Carla A. Reichard

Year : 2002

Place : Oklahoma State University

Source : Journal of Educational Psychology 2002, Vol. 94, No. 2, pp 249-259

DOI : 10.1037/0022-0663.94.2.249

URL : http://psycnet.apa.org/journals/edu/94/2/249/

The main objective of the research was to develop and validate a new self-report instrument, the metacognitive awareness of reading strategies inventory to assess adolescent and adult readers' metacognitive awareness and perceived use of reading strategies while reading.

Initially, a pool of nearly 100 items was generated from which the final set of items was constructed. Afterwards, these items were sent to three expert judges. These judges were instructed to review the initial pool of items for clarity, redundancy, and readability. The initial review resulted in the elimination of 40 items due mainly to redundancy among the items used.
They field tested the inventory with a large sample of students (N=825) in Grades 6-12 drawn from 10 urban, suburban and rural school districts in five Midwestern states. In addition to completing the inventory students were asked to mark the items that were unclear or confusing to them.

Exploratory Factor Analysis using common factor model was used to identify potential factors or subscales for the 60 item instrument and to help identify any items that might need to be refined or deleted.

The scree plot from the first factor analysis suggested that three factors should be retained 1) Global Reading Strategies, 2) Problem Solving strategies, 3) Support Reading strategies.

Cronbach's alpha was calculated for each subscale and for each grade level, coefficients ranged from .89 to .93 and reliability for the total sample was .93.

A number of other items were reworded or considered for deletion owning to a combination of (a) low factor loading (b) loading on more than one subscale (c) reduced reliabilities or (d) duplication with other questions. The resulting instrument contained 30 items that were reviewed for readability, response format and completeness. These remaining 30 items were reviewed by three raters (expert judge). After some revisions in wording, the inventory was administered to a small pilot group of students. The feedback was used to produce final version of the inventory. This final instrument was administered again to a sample of N=443 students in Grades 6-12.

Factor analysis yielded the same result, three factors or subscales. Cronbach's alpha was calculated for each subscale and for each grade level. Reliability for the total sample was .89. The relationship between self reported reading ability and strategy usage provided preliminary evidence of construct validity.
3.4.8 Study-8

Title : Assessment of Metacognition and its Relationship with reading Comprehension, Achievement, and Aptitude

Researcher : Pelin Cetinkaya and Emine Erktin

Year : 2002

Place : Bogazici University, Istanbul


The main purpose of the study was to construct an assessment tool for metacognition for Turkish regular and gifted preadolescents. The study was composed of two phases. In the first phase, a metacognition inventory was developed. The inventory consisted of four subscales, namely evaluation, self-checking, awareness and cognitive strategies. In the second phase of the study, correlations of metacognition with reading comprehension, achievement, and aptitude were tapped.

The first form of the self-report inventory was consisted of 53 items and seven experts evaluated it and rated the items. As a second step, 60 students consisting of 39 males and 21 females, from the Department of Secondary school science and mathematics education of the faculty of education of Bogazici University were administered the inventory. The alpha coefficient was found to be .91. Items with item-total correlation coefficients lower than .15 were eliminated from each domain. Items were then reviewed for face validity. Wordings and grammatical structures were improved. The inventory, after undergoing these processes ended up with 32 questions.

In order to measure the reliability and validity of the metacognition inventory a pilot study on 111 sixth grade students, consisting of 60 males
and 51 females was conducted. For the internal consistency of the scale, Cronbach alpha and item total correlation coefficients were computed. The value of alpha coefficient was found .87. Results of factor analysis showed that the inventory had adequate construct validity.

In the second phase of the study total 206 students of sixth grade were selected based on convenient sampling. A standardized reading comprehension test and metacognition inventory was administered on the students. Students' average grades in Turkish, Mathematics and Science courses obtained by the end of the academic year were used as achievement scores.

The result showed that the awareness and cognitive strategies subscales of the inventory were significantly and positively correlated with reading comprehension, self-checking and evaluation. Subscales of the inventory were significantly and positively correlated with science course grades of the gifted students.

No significant correlations were found between the metacognition scores and the achievement in the Turkish, Science and Mathematics courses.

3.4.9 Study-9

**Title**: Metacognitive Awareness Assessment in Self-Regulated Learning and performance measures in an introductory Educational Psychology Course

**Researcher**: Hammann Lynne A.; Stevens, Robert J. 13

**Year**: 1998

**Place**: The Pennsylvania State University

**Source**: Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998) (pp. 1-8)

This study had two objectives (a) to expand on the previous
research of the metacognitive Awareness Inventory (Schraw & Dennison, 1994) by investigating its usefulness in the context of course learning and (b) to investigate the relationship between metacognitive awareness and motivational factors in more ecologically valid context of an academic course.

Nineteen volunteers from an introductory educational psychology course at a large eastern university were selected as a sample. Metacognitive Awareness was measured by Metacognitive Awareness Inventory (MAI, Schraw & Dennison, 1994) Motivation and strategy used were measured by the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia & Mckeachie, 1991) Both the MAI & MSLQ have likert type scales.

Academic performance measures included a 20-item multiple choice tests from questions from the course test bank on material covered in class. Online confidence ratings followed each item on the 20-item test. These online confidence ratings were on a 0-100 mm bipolar scale. Subjects drew a line on the scale, from 0% confidence on the left to 100% confidence on the right that indicated their confidence that the previous item was correct.

The second performance measure was of pretest judgments, made before the subjects took the test. These subjects believed they could monitor the accuracy of their performance on these kinds of multiple choice tests. Subjects drew a mark on a bipolar 100 mm scale labeled 0-100, with poor monitoring ability (0) at the left end and excellent monitoring ability (100) at the right.

An iterative principle axis factor analysis forcing two factors with orthogonal (varimax) loadings was performed on the item responses for the metacognitive Awareness Inventory.

This factor analysis yielded loadings corresponding theoretically with knowledge of cognition and regulation of cognition. Factor loadings
also supported Schraw & Dennison's (1994) item loadings.

The first objective of the study was to expand upon the previous research of the MAI by investigating it in the context of learning behaviors and test performance in the context of a college course. The MAI measure of knowledge of cognition was positively correlated with pretest judgment and on-line confidence ratings of the test, pretest judgment was positively correlated with both the test and on-line confidence. Students seemed to be aware of how they would do on tests in this course. In addition, they seemed to be able to monitor their answers to test items.

The second objective was investigating the relationship between metacognition and motivation factors in course performance. Metacognition processes and motivational ones appear to be correlated on subcomponent levels related to performance measures.

Knowledge of cognition was correlated positively with self-efficacy for learning performance and negatively with test anxiety. Self-efficacy was correlated with test, pretest judgments and online confidence. Test anxiety was negatively correlated with pretest judgment and online confidence.

Regulation of cognition was correlated with the individual learning strategies scales of the MSLQ.

Metacognitive self regulation (learning strategies MSLQ) was correlated with both knowledge of cognition and regulation of cognition of the MAI.

This study provides evidence that students' metacognitive awareness is related to their task motivation and their subsequent use of strategies in preparing for classroom assessment. It seems that students need to be metacognitively aware of the need to use strategies, knowledgeable about strategies and motivated to use those strategies. Without such awareness, strategy instruction seems futile.
3.4.10 Study-10

Title: Reliability and Validity of a State Metacognitive Inventory: Potential for Alternative Assessment

Researcher: O'Neil H.F. & Abedi J. 14

Year: 1996

Place: University of California, Los Angeles


URL: http://www.jstor.org/stable/27542038

http://www.cse.ucla.edu/products/Reports/TECH 469.pdf

The main objective of the study was to establish reliability and validity of a state Metacognitive inventory. In this study metacognition was consisting of Planning, Monitoring, Cognitive strategies and Awareness. The measure had been validated in a series of experimental studies.

Early Development Stage:

Initially the self-monitoring questionnaire of 26 items about students' planning monitoring, cognitive strategy used and awareness was prepared. Then it was administered on community college students and university undergraduates (N=120). Then afterwards more items were created for the development of subscales for the state Metacognitive inventory. There were total 39 items in a scale.

Community College Sample:

The state Metacognitive inventory consisted of four subscales of metacognition was administered to a group of 219 community college students along with 20 item math test. Item means, item remainder correlations, factor loadings, commonalities and reliability coefficients were calculated and then 15 items from different subscales were removed.
Initial High school Sample:

At this stage 8 new items were added to the scale because the sample was of high school students. At this stage 32 item inventory was administered on a group of 230 high school students. Means and standard deviations as well as alpha coefficients for each of the subscales were computed, and principal components factor analysis with varimax rotation was applied on the subscale items to see how items grouped together under each subscale.

National Assessment of Educational Progress (NAEP) Studies:

This set of studies investigated two objectives: a) the impact of various experimental treatments on test performance and b) the reliability and validity of the state Metacognitive inventory.

In this set of studies, at three different stages the state metacognitive Inventory along with math achievement test was administered. These three samples were as follows:

12th Grade pilot sample (N=213) who received 50¢ per correct test items, 8th Grade sample (N=744) who received 1$ per correct item and 12th Grade main sample (N=715) who received 1$ per correct item.

Findings:

For the 12th graders, the results of both alpha reliability estimates and factor analysis indicated that subscales are reasonably reliable (alpha above .70) and unidimensional. Further, since the subscales have only 5 items each, they meet the standard of brevity.

The construct validity was measured with respect to construct validity; the following prediction was preliminarily supported: Higher level of state Metacognition would lead to better academic performance. Since the reliability of the inventory is marginal for the 8th graders, the current state metacognitive inventory is not recommended for 8th graders or younger students. This inventory is useful for the 12th graders and older students only.
3.4.11 Study-11

Title: Assessing Metacognitive Awareness

Researcher: Gregory Schraw & Rayne Sperling Dennison

Year: 1994

Place: Department of Educational Psychology, University of Nebraska at Lincoln

Source: Contemporary Educational Psychology, Vol. 19, pp 460-475


Objectives:

The purpose of the present research was to generate and test an easily administered metacognitive inventory suitable for adolescents and adults. The researchers focused on three related issues: a) whether there was empirical support for the two components view of metacognition, b) whether the two components were related to each other, and c) whether either of the components was related to empirical measures of cognitive and metacognitive performance.

Procedure: Experiment 1 (Reliability)

An initial pool of 120 items was written, including at least eight items in each of the eight categories. Items were piloted on a group of college undergraduates (N=70), revised, and eliminated where appropriate. Items with extreme mean scores were dropped. Some highly intercorrelated items were dropped such that only one of these items remained on the scale.

The final version of the instrument consisted of 52 items distributed across the eight scales with at least four items per scale. Ratings on each item were made on 100 mm bi-polar scale adapted from the multidimensional scaling literature.
Finally a 52-item self-report instrument was prepared and then administered on 112 females and 85 males, total one hundred and ninety seven (N=197) undergraduates. There was no time limit for the scale.

Coefficient $\alpha$ for items loading on each factor reached .91 indicating a high degree of internal consistency. Coefficient $\alpha$ for the entire instrument reached .95.

**Experiment 2 (Validity):**

The purpose of the experiment 2 was to validate the MAI using empirically derived measures of metacognitive knowledge, test performance and metacognitive regulation.

Individuals first were asked to complete the MAI. General instructions were given next regarding the reading comprehension phase of the study. Individuals next rated their monitoring ability, completed the practice reading passage, and then completed the four reading comprehension tests. The format for each test was identical; Individuals read the story, turned to the next page in their booklet to complete the test, and then rated how much confidence they had in each response. Participants were not allowed to look back at text passage once they began the test. There were no time limits on any phase of the experiment. This experiment was carried out on one hundred and ten (69 females, 41 males) undergraduates.

Data were analyzed using Factor Analysis, MNOVA, and ANOVA statistical techniques.

**Major Findings:**

- Both experiments strongly supported the two component model of metacognition. The forced two factor solutions observed in these experiments corresponded closely to knowledge and regulation of cognition.

- In contrast, neither experiment supported the multiple subcomponents view of metacognition
• Both experiments reported a statistically significant relationship between knowledge and regulation of cognition (i.e., $r = .54$ and $.45$ respectively)

• Experiment 2 reported a number of statistically significant relationships among the MAI and measures of metacognitive awareness and performance.

3.4.12 Study-12

Title : Value of a Scale Used to Measure Metacognitive Reading Awareness

Researcher : K.Victoria Mayer McLain, Betty E.Gridley, David McIntosh

Year : 1991

Place : University of Houston


URL : http://www.jstor.org/stable/27540458

In 1987, Jacobs and Paris had developed and used a multiple choice instrument called the Index of Reading Awareness. That scale was used to measure Metacognitive Reading Awareness (IRA). However it was not clear from their results whether the IRA was a reliable or valid way of measuring metacognition in reading.

The purpose of this study was to determine preliminary reliability and validity data on the scale. The sample consisted of 145 students in the third, fourth and fifth grades from a laboratory school affiliated with a mid sized public university in the Mid West. The average age was 10 years, with standard deviation of 10 months. There were 76 males and 69 females.

The Index of Reading Awareness (IRA) and Woodcock Reading Mastery Test-Revised (WRMT-R) were administered on the sample students.
Cronbach's alphas for the IRA subscales were as follows: Evaluation: .31, Planning: .32, Regulation: .15, and Conditional Knowledge: .20. Internal consistency reliabilities for the total test score were calculated using both item (.61) and subscales scores (.56). Reliabilities of the subscales from .15 to .32 were too low to support use of the subscales as separate scores for any analysis.

The validity of the scale was examined with two different aspects. If performance on the IRA conforms to the proposed developmental nature of metacognition in reading then scores should increase with age. However, there was significant differences between third and fourth graders and third and fifth graders but not between fourth and fifth graders.

The second aspect of the validity was the relationship between metacognition in reading as measured on the IRA and reading comprehension on a standardized reading test WRMT-R. Moderate correlations were found between scores on the IRA and measures of reading comprehension.

The analysis leads to conclude that the IRA should be used cautiously as a measure of metacognition in reading for both research and classroom use.

3.5 COMPARATIVE SUMMARY OF THE PAST STUDIES

Comparative summary of the past studies are shown in table-3.1
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Researcher</th>
<th>Uni./ Inst.</th>
<th>Components</th>
<th>Age/ Grade</th>
<th>Sample</th>
<th>Tool</th>
<th>Findings</th>
</tr>
</thead>
</table>
| 1      | Assessing Metacognitive Awareness              | Gregory Schraw & Rayne Sperling Dennison | 1994, University of Nebraska at Lincoln | A) Knowledge about cognition  
- Declarative knowledge  
- Procedural knowledge  
- Conditional knowledge  
B) Regulation of cognition  
- Planning  
- Information management strategies  
- Monitoring  
- Debugging  
- Evaluation | Undergraduate students | Experiment 1  
N= 70  
Experiment 2  
N= 110 | 1) Metacognitive Awareness Inventory  
2) Reading comprehension test | Both experiments strongly supported the two component model of metacognition. In contrast, neither experiment supported the multiple subcomponents view of metacognition.  
- Both experiment reported a statistically significant relationship between knowledge and regulation of cognition  
- Experiment 2 reported a number of statistically significant relationship among the MAI and measures of metacognitive awareness and performance. |
| 2      | Assessing Students’ Metacognitive Awareness of Reading strategies | Kouider Mokhtari and Carla A. Richard | 2002, Oklahoma State University | 1) Global Reading Strategies,  
2) Problem Solving strategies,  
3) Support Reading strategies | Grade 6-12 | Stage 1  
N=825  
State 2  
N= 44 3 | Metacognitive Awareness of Reading strategies Inventory | Reliability for the total sample was .89. The relationship between self reported reading ability and strategy usage provided preliminary evidence of construct validity. |
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| 3      | The Construct Validity Of An Inventory For The Measurement Of Young Pupils’ Metacognitive Abilities In Mathematics | Areti Panaoura & George Philippou                                            | 2003, University of Cyprus                                       | 1) Knowledge of cognition  
2) Regulation of cognition                                                      | Grade 4-6  | N = 246      | Inventory for the measurement of young pupil’s Metacognitive ability in mathematics | - The value of Cronbach’s alpha was .8298.  
- The construct validity was calculated. As a result of factor analysis a first order factor contained items for the knowledge of cognition and a different first order factor contained items for the regulation of cognition |
| 4      | Reliability and Validity of a State Metacognitive Inventory : Potential for Alternative Assessment | O’Neil H.F. & Abedi J.                                                     | 1996, University of California, Los Angeles                    | 1) Planning,  
2) Monitoring,  
3) Cognitive strategies  
4) Awareness                                                        | Grade 12th & College students  
N = 715 | 1) State Metacognitive Inventory  
2) Math Achievement Test                                        | - Reliability was calculated and the value of Cronbach’s alpha was above .70  
- Construct validity was measured.  
The scale is not valid and reliable for the 8th graders & young pupils |
| 5      | Development of an Instrument Designed to Investigate Elements of Science students’ Metacognition, Self-efficacy and Learning Processes: The SEMLI-S | Gregory Thomas, David Anderson and, Samson Nashon                           | 2008, University of Alberta, Canada & University of British Columbia, Canada | 1) Constructivist Connectivity (CC)  
2) Monitoring,  
3) Evaluation and Planning (MEP)  
4) Science learning Self-efficacy (SE)  
5) Learning Risk Awareness (AW); and  
6) Control of concentration (CO) | Age 13 to 18 years  
N = 465 | Self Efficacy and Metacognition Learning Inventory - Science-SEMLI-S | - Reliability and Validity were calculated  
- The value of Cronbach’s alphas for different subscales were .77 to .85  
- Discriminant validity was calculated for each sub scales. |
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<tr>
<td>6</td>
<td>Conceptualization, Development and validation of an Instrument for Investigating the Metacognitive Orientation of Science Class Environment Learning Environments: The Metacognitive Orientation Learning Environment Scale- Science (MOLES-S)</td>
<td>Thomas Gregory P.</td>
<td>2003, Department of Science, The Hong Kong Institute of Education, China</td>
<td>1. Metacognitive demands, 2. Student-Student discourse, 3. Student-Teacher discourse, 4. Student voice, 5. Distributed control, 6. Teacher encouragement and support, 7. Emotional Support.</td>
<td>Age: 14-17 Years</td>
<td>N=1026</td>
<td>The Metacognitive Orientation Learning Environment Scale- Science (MOLES-S)</td>
<td>-The reliability and validity were calculated. Results suggest that the instrument is reliable and valid for the measurement of the Metacognitive orientation learning environment in a science class room.</td>
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<td>7</td>
<td>Value of a Scale Used to Measure Metacognitive Reading Awareness.</td>
<td>K.Victoria Mayer McLain, Betty E.Gridley, David McIntash</td>
<td>1991, University of Houston</td>
<td>1. Evaluation 2. Planning 3. Regulation 4. Conditional Knowledge</td>
<td>Grade: 3-5, Age: 10 years</td>
<td>N=145</td>
<td>1. Index of Reading Awareness (IRA) and 2. Woodcock Reading Mastery Test –Revised (WRMT-R)</td>
<td>Reliabilities of the subscales of from .15 to .32 were too low to support use of the subscales as separate scores for any analysis. Validity was of the scale was calculated with two aspects and the results indicated that the scale should be used cautiously as a measure of metacognition in reading for both research and classroom use.</td>
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<td>8</td>
<td>Adaptation, validity and Reliability of the Metacognition Questionnaire-30 for the Turkish Population, and its Relationship to Anxiety and obsessive compulsive symptoms</td>
<td>Ahmet TOSUN, Metehen IRAK</td>
<td>2008, University Students (Age 21.22 years)</td>
<td>1) Cognitive Confidence 2) Positive Beliefs 3) Cognitive Self-consciousness 4) Uncontrollability and Danger 5) Need to Control Thoughts</td>
<td>N=850</td>
<td>1. Metacognitive Questionnaire 30, 2. Trait Anxiety Inventory and 3. Maudsley Obsessive Compulsive Inventory</td>
<td>The Turkish MCQ-30 showed acceptable to good test-retest reliability, internal consistency and convergent validity. Significant positive relationship between the subscales of MCQ-30 and measures of anxiety and obsessive compulsive symptoms provided further support for the convergent validity of the Turkish version. Significant negative correlations were observed between age and MCQ-30 subscales, and the effect of gender was significant on some of the subscales.</td>
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<td>Researcher</td>
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- Results of factor analysis showed that the inventory had adequate construct validity.  
- The result showed that the awareness and cognitive strategies subscales of the inventory were significantly and positively correlated with reading comprehension. Self-checking and evaluation subscales of the inventory were significantly and positively correlated with science course grades of the gifted students.  
- No significant correlations were found between the metacognition scores and the achievement in the Turkish, Science and Mathematics courses. |
| 10     | The relation between intellectual and Metacognitive skills in early adolescence. | Marcel V.J. Veenman, Roslie Kok & Anke W.Blote | 2005, Leiden University, the Netherlands | Age: 12-13 Years | N=41 | 1. Groningen Intelligence test  
2. Math word problems  
3. Metacognitive skillfulness was assessed through systematical observation | A major finding of the study was that Metacognitive cueing triggers a higher level of metacognitive activities.  
- Metacognitive cueing yielded better learning outcomes.  
- Metacognitive skills have their own virtue in learning, partly independent of intellectual ability, even for young adolescents who are in an early stage of metacognitive skill development. |
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<tr>
<td>12</td>
<td>Metacognitive Awareness Assessment in Self-Regulated Learning and performance measures in an introductory Educational Psychology Course.</td>
<td>Hammann Lynne A.; Stevens, Robert J.</td>
<td>1998, The Pennsylvania State University</td>
<td>1. Metacognitive Awareness Inventory (MAI, Schraw &amp; Dennison, 1994) 2. Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia &amp; McKeachie, 1991) 3. Achievement test 4. Online confidence ratings</td>
<td></td>
<td></td>
<td>The MAI measure of knowledge of cognition was positively correlated with pretest judgment and on-line confidence ratings of the test, pretest judgment was positively correlated with both the test and on-line confidence. - Knowledge of cognition was correlated positively with self-efficacy for learning performance and negatively with test anxiety. --- Self-efficacy was correlated with test, pretest judgments and online confidence. Test anxiety was negatively correlated with pretest judgment and online confidence. - Regulation of cognition was correlated with the individual learning strategies scales of the MSLQ.</td>
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3.6 REVIEWS OF THE PREVIOUS STUDIES

In the present report researcher has presented twelve reviews of the researches done in this field. Among these twelve researchers nine researches are related to the development and validation of an instrument for the measure of metacognition and others are related to its relation with other variables such as intelligence, test anxiety, surface approach to studying and performance.

Schraw & Dennison (1994), O'Neil & Abedi (1996) had developed an inventory for the assessment of metacognition for the undergraduate students. According to Schraw & Dennison metacognition was consisted of two components, Metacognitive Knowledge and Regulation of Cognition. According to O'Neil and Abedi metacognition was consisted of Planning, Monitoring, Cognitive strategies and Awareness.

Cetinkaya & Erktin (2002) had also developed metacognition inventory for the sixth graders. Subscales of the inventory were Evaluation, Self-checking, Awareness & Cognitive Strategies.

Ahmet TOSUN & Metehen IRAK (2008) had translated a Metacognition Questionnaire-30 from English to Turkish. The original questionnaire was prepared by Cartwright-Hatton and Wells in 1997, which consisted of five factors named 1) Cognitive Confidence, 2) Positive Beliefs, 3) Cognitive Self-consciousness, 4) Uncontrollability and Danger and 5) Need to control thoughts. This questionnaire was standardized on university students.

Panaoura & Philippou (2003) had constructed and validated an inventory for the measurement of young pupils metacognitive abilities in mathematics, for the pupils of grade 4 to 6. According to them components of metacognition were, 1) Knowledge of Cognition and 2) Regulation of Cognition.

Mokhatari & Reichard (2002) had developed an inventory to assess student's metacognitive awareness of reading strategies for the students of
grade 6 to 12. Subscales of the inventory were Global Reading Strategies, Problem Solving Strategies, and Support Reading Strategies.

McLain, Gridley, & McIntosh (1991) had evaluated metacognitive reading awareness inventory named Index of Reading Awareness prepared by Jacobs & Paris in 1987, for the students belong to grade 3 to 5. Subscales of the scale were Evaluation, Planning, Regulation and Conditional Knowledge. The results indicated that the scale should be used cautiously as a measure of metacognition in reading.

Thomas (2003) had developed the metacognition orientation learning environment scale-Science, for the students of age group of 14 years to 17 years. Subscales of the MOLES-S were 1) Metacognitive demands, 2) Student-Student discourse, 3) Student-Teacher discourse, 4) Student voice, 5) Distributed control, 6) Teacher encouragement and Support, 7) Emotional Support.

Thomas, Anderson & Nashon (2008) had developed an inventory named Self-Efficacy and Metacognition Learning Inventory-Science (SEMLI-S). This instrument was designed to investigate elements of science students' metacognition, self-efficacy, and learning process, for the students of 13 to 18 years. Subscales of the SEMLI-S were 1) Constructivist Connectivity (CC), 2) Monitoring, Evaluation and Planning (MEP), 3) Science learning and Self-Efficacy (SE), 4) Learning Risk Awareness (AW), 5) Control of Concentration (CO).

In all the researchers reliability and validity of the instrument were calculated but they did not establish norms for any instrument. Most of the researchers had done factor analysis and calculated Cronbach's alpha for the reliability and validity of the scale. However, Thomas, Anderson & Nashon (2008) had employed exploratory factor analysis and Rasch analysis. Furthermore, Ahmet TOSUN & Metehen IRAK (2008) had calculated reliability with test-retest method also.

Regarding the relation between metacognition and other variables,
according to TOSUN & IRAK (2008) there was significant positive relationship between the subscales of MCQ-30 and measure of anxiety and obsessive compulsive symptoms. Moreover, significant negative correlations were observed between age and MCQ-30 subscales, and the effect of the gender was significant on some of the subscales.

According to Cetinkaya & Erktin (2002), research results showed that awareness and cognitive strategies subscales of the inventory were significantly and positively correlated with reading comprehension. Self-checking and evaluation subscales of the inventory were significantly and positively correlated with science course grades of the gifted students. No significant correlations were found between the metacognition scores and the achievement in the Turkish, Science and Mathematics courses.

According to Veenman, Kok & Blote (2005) metacognition cueing triggers a higher level of metacognition activities. Moreover, metacognitive cueing yielded better learning outcomes. Results suggest that metacognitive skills have their own virtue in learning, partly independent of intellectual ability.

Research finding of Spada, Nikcevic, Moneta & Ireson (2006) suggests that metacognition appears to play a central role in determining whether or not test anxiety leads to a surface approach to studying.

Results of Hammann & Stevens (1998) suggest that, the MAI measure of knowledge of cognition was positively correlated with pretest judgment and on-line confidence ratings of the test, pretest judgment was positively correlated with both the test and on-line confidence. Knowledge of cognition was correlated positively with self-efficacy for learning performance and negatively with test anxiety.

3.7 SIGNIFICANCE OF THE PRESENT STUDY

In India, metacognition is in its infant stage. In Gujarat State, only few researchers have started doing research in this field. Furthermore, until today there is not any standardized tool available in Gujarati language for
the assessment of metacognition. So that in this context this study to prepare a
standardized tool is very significant.

Furthermore, following are some points, which make this study more
significant in comparison with past researches done in the field.

- Present study covered the secondary schools of Gujarat State.
- Sample was selected through stratified random sampling technique.
- The reliability of the scale was checked by different methods.
- The validity of the test was calculated by using the systematic
  procedure.
- In the present study, norms were established.
REFERENCES


