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Assessing Metacomprehension and Metacognitive Reading Strategies[1]

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Abstract: *The aim of the study was to establish the similarities and differences among existing instruments for measuring metacognition, in particular the awareness of reading comprehension and further to construct an original instrument for measuring features of metacognition, henceforth referred to as the Metacomprehension and Metacognitive Reading Strategies (M&MRS) Inventory.*
The M&MRS Inventory was distributed to 115 students at University of Palermo. The results revealed a good reliability.
Keywords: *Metacognition, metacognitive awareness, reading comprehension, metacomprehension, M&MRS*

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I. Introduction

Metacognition consists of two components: knowledge and regulation. Metacognitive knowledge includes knowledge about oneself as a learner and the factors that might impact performance, knowledge about strategies, and knowledge about when and why to use strategies. Metacognitive regulation is the monitoring of one's cognition and includes planning activities, awareness of comprehension and task performance, and evaluation of the efficacy of monitoring processes and strategies.

Metacognition has proven to be a particularly useful strategy for such settings that involves awareness and regulation of cognitive processes. Promoting the development of metacognitive skills encourages students to anticipate, monitor and reflect upon their own cognition and can lead to better engagement with learning materials. It can support students in developing their metacognitive skills in further learning or performance situations and in monitoring activity that takes place during critical performance events.

Assessment of metacognition is challenging for a number of reasons: (a) metacognition is a complex construct; (b) it is not directly observable; (c) it may be confounded with both verbal ability and working memory capacity; and (d) existing measures tend to be narrow in focus and decontextualized from learning.

The present paper focuses on the construction of a questionnaire for measuring Metacomprehension and metacognitive knowledge, regulation and responsiveness among university students and the subsequent process of testing to determine its validity.

The Metacomprehension and Metacognitive Reading Strategies Inventory (M&MRS) is a 51-item self-report instrument. It was constructed on the basis of a facet design along two dimensions: components of metacognition and topics related to reading comprehension. The data gathered with the instrument were analysed by means of a generalization study and a decision study.

The purpose of the present study was to generate and test an easily administered metacognitive inventory suitable of specifically detect reading comprehension strategies of university students.

II. Theoretical Background

Researchers have examined metacognition and how it relates to measures of academic achievement. In these studies, metacognitive skills are measured in terms of metacognitive regulation, metacognitive knowledge or both of these components. However, these components are measured differently within the literature. Some researchers use self report inventories to assess metacognitive skills and relate them to achievement measures [1, 2]. Other researchers examine metacognitive judgments in the form of monitoring accuracy as a measure of metacognitive regulation on various tests [3, 4, 5]. Monitoring accuracy is measured in terms of what is considered calibration of performance. Calibration of performance judgments are made at the local and global

[1] Introduction, paragraphs 1, 2 and Conclusion must be attributed to A. La Marca. Paragraphs 3 and 4 must be attributed to V. Di Martino.

levels. Local judgments are made after each item on a test. Local monitoring accuracy is determined to be the average difference between the actual answer of each test question and the students' judgment of how well they answered each question. Global judgments are made after the entire test is completed. Students are to judge how well they think they did on the test as a whole. Global monitoring accuracy is determined to be the difference between the overall test score and the students' judgment of how they did on the test. Local monitoring accuracy is thought to be a measure of ongoing metacognitive regulation during testing and global monitoring accuracy is thought to be a measure of cumulative metacognitive regulation [4]. The following is a brief review of studies utilizing both survey and measures of monitoring accuracy to assess metacognitive knowledge and/or metacognitive regulation.

2.1. Metacognitive knowledge and regulation of cognition

Some studies provide evidence to show that not all students have the ability to regulate and deploy certain key strategies during their learning [6]. However, the presence of a tutor who assisted them in establishing goals and using effective strategies for regulating their learning, created a significant improvement in learning. Students who were given a list of goals to guide their learning were less effective at regulating their own learning.

Planning involves identification and selection of appropriate strategies and allocation of resources, and can include goal setting, activating background knowledge, and budgeting time.

Monitoring or regulating involves attending to and being aware of comprehension and task performance and can include self-testing. Finally, evaluation is defined as "appraising the products and regulatory processes of one's learning," and includes revisiting and revising one's goals [7]. Additionally, in the literature it's reported that despite the different characteristics of students, metacognitive support can improve learning [8].

An understanding of learning styles, such as being aware of one's own learning processes and operating control over learning strategies, can be used to support or increase metacognitive awareness [9]. Students can use different learning styles to select different learning pathway through materials, accessing and processing information that influence the quality of learning process [10]. For instance, some students may understand information better by watching or listening, others by reading, and others by doing and moving or through practical work in a hands-on environment [11].

Finally, several researchers highlight the link between metacognition and motivation [12, 13, 14, 15, 16, 17].

Motivation and students' learning styles are additional important factors that influence learning [18]. Whitebread and his colleagues [12] note that metacognition includes affective and motivational states. Similarly, Martinez [14] argues that metacognition entails the management of affective states, and that metacognitive strategies can improve persistence and motivation in the face of challenging tasks. Paris [15] argues that affect is an inevitable element of metacognition, because as students monitor and appraise their own cognition, they will become more aware of strengths and weaknesses. Gottfried defines "academic" motivation in particular as the "enjoyment of school learning characterized by a mastery orientation; curiosity; persistence; task-endogeny; and the learning of challenging, difficult, and novel tasks" [15, p. 525]. In the context of metacognition, motivation is defined as "beliefs and attitudes that affect the use and development of cognitive and metacognitive skills" [7, p. 112]. According to him, motivation has two primary subcomponents: (1) self-efficacy, which is confidence in one's ability to perform a specific task and (2) epistemological beliefs, which are beliefs about the origin and nature of knowledge.

Eisenberg [13] reviews the research on young children's emotion-related self- regulation, which is the set of "processes used to manage and change if, when, and how one experiences emotions and emotion- related motivation and physiological states and how emotions are expressed behaviorally" (p. 681). This emotion-related self-regulation refers to monitoring and regulating the impact of emotions and motivational states on one's performance and parallels the regulation of cognition involved in the executive functioning dimension of metacognition.

2.1.1. Development of Metacognition Over Time

Kuhn [19] characterizes development of metacognition as the very gradual (and not always unidirectional) movement to acquire better cognitive strategies to replace inefficient ones.

Schraw and Moshman [20] note that young children have difficulty monitoring their thinking during task performance and constructing metacognitive theories frameworks that integrate cognitive knowledge and cognitive regulation. Planning also appears to be a late-developing skill, with dramatic improvements in the ability to select appropriate strategies and allocate resources not appearing until 10-14 years of age.

Several researchers have concluded that metacognitive abilities appear to improve with age [21, 22, 23, 24]. Specifically, Schraw and Moshman [20] suggest that metacognitive development proceeds as follows:

cognitive knowledge appears first, with children as young as age 6 able to reflect on the accuracy of their cognition, and consolidation of these skills typically evident by 8-10 years of age.

Ability to regulate cognition appears next, with dramatic improvements in monitoring and regulation appearing in the form of planning. Monitoring and evaluation of cognition are slower to develop and may remain incomplete in many adults. Finally, the construction of metacognitive theories appears last (if at all). These theories allow for the integration of cognitive knowledge and cognitive regulation.

Students spontaneously construct these theories as they come to reflect on their own thinking and learning. Metacognitive theories tend to originate within a particular domain, and to gradually extend to other domains. These theories begin as implicit and informal, becoming more systematized and formalized over time.

2.1.2. The measurement of metacognition

One of the basic problems of the study on the field of metacognition is to develop and use valid tasks in order to measure metacognitive ability. Zimmerman [25] believes that using the term metacognition to refer to two distinct areas of research makes the research procedure more difficult and creates confusion clouding interpretation of research findings. Although several methods of measuring metacognition have been implemented each method has advantages and disadvantages. For example, one of the most popular approaches for assessing both metacognitive knowledge and control is to ask students directly about what they know or what they do. For assessing metacognitive control participants may be asked to think aloud about what they are doing and thinking as they solve a problem.

Nevertheless, verbal reports are subject to many constraints and limitations. Asking young students about their cognitive processing can produce some special problems. Answers may reflect not what the child respondents know or do not know, but rather what he/she can or cannot tell to the interviewer. On the other hand, metacognition is cognitive in nature rather than behavioral and consequently, self-report inventories are, in some ways, the least problematic technique to measure metacognitive ability [26].

A study to measure students' self-regulation was carried out by Zimmerman who employed learning diaries, which were collected at the end of each week, to structure a series of questions regarding events during a study session. Students were asked to complete a questionnaire that included items about motivation and learning strategies at the outset and at the end of the study. The control group of students were asked to complete a pre-test and a post-test but did not receive self- regulatory training or use the diaries. He reported that students who received self- regulatory training displayed significant improvements in intrinsic motivation, self-efficacy, effort, attention and self-motivation areas whereas those in the control group showed only increases in self- motivation [25].

2.2. Impact of Metacognitive Awareness in students' learning

Students can take more control over their learning and develop leadership of their own 'learning curve'. Self-directed learning includes management of the learning materials, monitoring learning progress and regulating cognitive learning styles. However, this requires students to develop metacognitive strategies so they can identify their own learning styles in the appropriate formal and informal learning situations.

A study by Azevedo and Cromley [6] investigated whether undergraduate students could regulate their own learning about the circulatory system using a hypermedia environment. Results demonstrated that students who regulated their learning by using effective strategies, monitored their understanding, and adapted their time and effort, showed a significant improvement in their learning. By contrast, those who used less effective learning strategies limited their ability to manage their metacognitive monitoring activities and failed to show a significant improvement in their learning [6].

Corliss and Spitulnik [27] state that many students lack the self-regulated learning strategies needed to be successful in these types of learning activities.

Self-regulated learning is a form of metacognitive guided learning whereby students set learning goals for themselves, monitor their progress, regulate and control their cognition [6]. Self-regulation is the ability to develop knowledge, skills and attitudes that can be transferred from one learning environment to another as well as to a leisure and work environment [28]. Students who are aware of their learning strengths and weaknesses are self-regulated students [29].

Self-regulated students can organise, manage and adapt their thoughts into skills that are required for learning. They continuously monitor their progress towards a goal or outcome and redirect efforts when necessary [30].

Students need to be aware of their own thought processes and monitor the effectiveness of their learning strategies to develop an ability to self-regulate [25]. Furthermore, it is essential that students attain strategies such as identifying the main points in a given task, asking questions or dealing with a task from start to finish [31], and be motivated to use developed or newly acquired self-regulatory strategies effectively.

2.2.1. Reading Comprehension

Reading is the interaction of four things including the reader, the text, the fluent reading or ―the ability or read at an appropriate rate with adequate comprehension and strategic reading, or ―the ability of the reader to use a variety of reading strategies to accomplish a purpose for reading‖ (p. 8). Discovering the best methods and techniques or processes the learners choose to access, is the goal of research in reading strategies [32].

In addition, reading is the kind of process in which one needs to not only understand its direct meaning, but also comprehend its implied ideas. Learning to read is not [only] learning to recognize words; it is [also] learning to make sense of texts. It involves a great deal of cognitive capacity available for comprehension. For example, good readers know that comprehension is most likely to occur from reading activity. They know how to relate what is being read to prior knowledge, how to predict what might be coming up in the text, and summarize what is being read. These comprehension strategies are metacognitive concepts in reading. If students are capable of comprehending what they are reading through a variety of strategies, they will create an interested and self-regulative attitude toward the path of academic achievement [32].

Research on the relationship between metacognition and reading comprehension has progressed through several different stages. During the early stages, research focused on the investigation of the relationship between metacognition and reading comprehension from the developmental perspective. Brown [33] and Baker and Brown [34] were among the first influential researchers in this field. They concluded that young students are ignorant of metacognitive strategies in knowing when they are comprehending, knowing what they need to know and what they have comprehended, knowing where they fail to comprehend, and knowing what they need to do in order to repair comprehension failure.

A strategy is an individual's comprehension approach to a task. It includes how a person thinks and acts when planning and evaluating his or her study behavior. In effect, successful people are good strategy users; they know how to use a variety of goal-specific tactics, execute a planned sequence, and monitor their use.There are many reading strategies employed by successful language learners such as being able to organize information, use linguistic knowledge of their first language when they are learning their second language, use contextual cues, and learn how to chunk language, to name a few.

Successful language learners know how to use such reading strategies efficiently. The purposes of reading strategies are to have general knowledge, get a specific detail, find the main idea or theme, learn, remember, delight, summarize, and do research. Regarding the importance of reading strategies, Pressley and Afflerbach [35] identified several key strategies that were evident in the verbal protocols they reviewed, including: (a) overview before reading; (b) look for important information and pay greater attention to it; (c) relate important points to one another; (d) activate and use prior knowledge; (e) change strategies when understanding is not good; and (f) monitor understanding and take action to correct inaccuracies in comprehension.

The current understanding of reading strategies has been shaped significantly by research on what expert readers do [35]. These studies demonstrate that successful comprehension does not occur automatically. Rather, successful comprehension depends on directed cognitive effort, referred to as metacognitive processing, which consists of knowledge about and regulation of processing. During reading, metacognitive processing is expressed through strategies, which are ―procedural, purposeful, effortful, willful, essential, and facilitative in nature‖ and ―the reader must purposefully or intentionally or willfully invoke strategies and does so to regulate and enhance learning from text. Through metacognitive strategies, a reader allocates significant attention to controlling, monitoring, and evaluating the reading process. Additionally, Sheorey and Mokhtari [36] stated that it is the combination of conscious awareness of the strategic reading processes and the actual use of reading strategies that distinguishes the skilled from unskilled readers. Studies show that unsuccessful students lack this strategic awareness and monitoring of the comprehension process [37].

Despite the serious interest in metacognition and reading, an intricately connected web of issues and questions remains to be addressed prior to achieving a full understanding of the nature of the metacognitive processing skills and strategies as they relate to reading and text understanding. This understanding should help in the design and development of adequate assessment measures of metacognitive reading strategies, as well as effective instructional and curriculum frameworks for advancing students' awareness and use of reading strategies when they read. Several contributors to the special issue of Metacognition and Learning published in 2011 [38] commented on the challenges and complexities related to metacognition and reading, in particular challenges related to the assessment of metacognitive processing strategies. In the following excerpt, MacNamara [39] provides an excellent description of some of the potential challenges involved in "developing a pure (separable) measure of strategy use that is also reliable, valid, and contextualized" (p. 159):

"There is a heightened understanding that metacognition and strategy use are crucial to deep, long-lasting comprehension and learning, but their assessment is challenging. First, students' judgments of what their

abilities and habits are, and measurements of their performance often do not match. Second, students tend to learn and comprehend differently depending on the subject matter, contexts, goals, and tasks [40].

As a consequence, a student may appear to use deep, reflective strategies in one situation, and fail to do so in other circumstances. Third, it is generally assumed that strategy use (metacognition, metacomprehension) are separable constructs from the underlying skills germane to the target task [39].

MacNamara's appraisal of the status of the field reminds us that, as a research community, we have a great deal more to do to develop adequate measures for assessing the cognitive and metacognitive processes involved in reading and text understanding [40].

III. Methods

3.1 Participants and procedure

The participants were 115 undergraduate students from the University of Palermo during a regular class period, with the help of the classroom instructors who were well acquainted with the general objective of the research project. Students voluntarily participated in the study. The researcher gave an overview of the purpose of the study, and a description of the instrument with an explanation of the steps involved in completing.

3.2 Measures

The Metacomprehension and Metacognitive Reading Strategies (M&MRS) Inventory was applied. It is a self-report questionnaire specifically elaborated that includes several subscales assessing metacognitive awareness of reading strategies (MARSI-R), metacognitive knowledge and regulation in reading comprehension (MAI-R) and the knowledge of specific metacognitive aspects that influence the ability to understand (ALM Inventory). They are described in detail in the following subsections. The M&MRS Inventory was transformed into a web format so it could be completed by students online.

3.2.1 Assessment of Metacognitive Awareness of Reading Strategies (MARSI-R)

The students' metacognitive awareness of reading strategies was assessed through the use of the metacognitive awareness of reading strategies inventory (MARSI) [42], which was designed for measuring adolescent and adult students' awareness and use of reading strategies while reading academic or school-related materials.

Mokhtari et al. [40] recently made a few changes to the MARSI taking into account results and suggestions of others research. These changes mainly concern the improvement of readability and comprehensibility of the strategy statements, the number of items (from 30 to 15) and new 5-point scale format taps students' degree of knowledge and awareness of reading strategies ranging from 1 point "I have never heard of this strategy before", 2 points "I have heard of this strategy, but I don't know what it means", 3 points "I have heard of this strategy, and I think I know what it means", 4 points "I know this strategy, and I can explain how and when to use it" to 5 points "I know this strategy quite well, and I often use it when I read".

The MARSI-R instrument measures three broad categories of strategies including:

- Global Reading Strategies (GRS), which can be thought of as generalized or global reading strategies aimed at setting the stage for the reading act (e.g., setting purpose for reading, previewing text content, predicting what the text is about, etc.);
- Problem-Solving Strategies (PSS), which are localized, focused problem-solving or repair strategies used when problems develop in understanding textual information (e.g., checking one's understanding upon encountering conflicting information, re-reading for better understanding, etc.); and
- Support Reading Strategies (SRS), which involve using the support mechanisms or tools aimed at sustaining responsiveness to reading (e.g., use of reference materials like dictionaries and other support systems).

These three classes of strategies interact with and support each other when used in the process of constructing meaning from text [42].

The scale score is obtained by summing the items in the three reading strategy scales or categories: global reading strategies (items 1,3,5,12, and 13), problem-solving strategies (items 7,9,11,14, and 15), and support reading strategies (items 2,4,6,8, and 10). The total score is obtained by summing the scores of all strategy items in the inventory. A complete description of MARSI-R, including its psychometric properties as well as its theoretical and research foundations, can be found in Mokhtari et al. [40]. The instrument consists of 15 items:

01. Having a purpose in mind when I read.
02. Taking notes while reading.
03. Previewing the text to see what it is about before reading it.
04. Reading aloud to help me understand what I'm reading.
05. Checking to see if the content of the text fits my purpose for reading.

06. Discussing what I read with others to check my understanding.
07. Getting back on track when getting sidetracked or distracted.
08. Underlining or circling important information in the text.
09. Adjusting my reading pace or speed based on what I'm reading.
10. Using reference materials such as dictionaries to support my reading.
11. Stopping from time to time to think about what I'm reading.
12. Using typographical aids like bold face and italics to pick out key information.
13. Critically analyzing and evaluating the information read.
14. Re-reading to make sure I understand what I'm reading.
15. Guessing the meaning of unknown words or phrases.

3.2.2 Revised Metacognitive Awareness Inventory (MAI-R)

Students' metacognitive awareness was measured using a specifically adapted version of the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison [1] in which items are classified into two categories of metacognition (i.e., knowledge of cognition and regulation of cognition) [43].

Schraw and Dennison [1] also tested the convergent validity of the MAI by comparing MAI scores with other measures thought to be related to metacognition such as pretest monitoring ability, actual test performance and the ability to accurately monitor test performance.

In a departure from utilizing metacognitive judgments as a method to determine metacognitive skills Schraw and Dennison [1] developed the MAI as a quick and easy means to assess metacognitive awareness. As reported above they found the MAI correlated with reading comprehension test performance, a measure of academic achievement, only on the knowledge of cognition factor. Sperling et al. [2] did not find a correlation with more comprehensive measures of academic achievement such as SAT scores or high school GPA. Obviously the results of the studies in which the MAI was used to assess metacognition are mixed. The MAI, needs to be examined further and in a broader context. Instruments used to assess metacognition must be sensitive to comprehensive measures of academic achievement that require a variety of cognitive skills in addition to general verbal ability. Assessments must be easy to administer and score so professors can use the information to help students over the course of a semester. Metacognitive assessments must also be comprehensive assessments of the theorized components of metacognition, namely metacognitive knowledge and metacognitive regulation.

The MAI was chosen because it is an easy to administer survey for adults, which can be delivered in both face to face and online classes. Additionally, the MAI taps into the two component model of metacognition cited in the research [1]: metacognitive knowledge and metacognitive regulation. Within the MAI these are referred to as the knowledge of cognition factor and the regulation of cognition factor.

- Knowledge of Cognition Factor (KCF) relates to what students know about themselves, strategies, and conditions under which strategies are most useful. It includes declarative and procedural knowledge;
- Regulation of Cognition Factor (RCF) corresponds to knowledge about the way students plan, implement strategies, monitor, correct comprehension errors, and evaluate their learning.

In this study, the original version of MAI was specifically adapted to metacognitive knowledge and regulation in reading comprehension.

The revised version of MAI (MAI-R) consists of 31 statements which students rate as being false or true. The two components of metacognition discussed above are represented within the scale, metacognitive knowledge and metacognitive regulation.

Within the inventory there are 11 questions related to the knowledge of cognition factor (item from 1 to 11) and 20 questions related to the regulation of cognition factor (item from 21 to 31). The factor scores are calculated by adding the scores on questions related to each of the factors. Higher scores correspond to greater metacognitive knowledge and greater metacognitive regulation. In addition to the knowledge of cognition score and the regulation of cognition score a MAI-R total score is derived by summing responses to all 31 questions. The instrument was designed for use on adult populations. The revised items of MAI-R are the following:

Knowledge of Cognition Factor (KCF)

1 I know my strengths and weaknesses in identifying the most important information.
2 I recognize what kind of information is more important to "underline".
3 I am good at organizing information to understand the difficult words.
4 I am good at remembering information.
5 I am a good judge of how well my partner has understood something.
6 I ask myself if I summarize better when I'm interested in the topic.
7 To understand what will be discussed, I try to use strategies that have already worked in the past.
8 I ask myself what tools I need before starting a summary.

9 I think of several ways to summarize a text and choose the best one.
10 I summarize what I have read after I finish.
11 I am aware of what strategies I use when I summarize.

Regulation of Cognition Factor (RCF)
12 I am more motivated to identify the most important information if the topic is interesting.
13 I use different ways to understand unclear words.
14 I ask myself if there was an easier/faster way to do things after I finish summarizing a text.
15 I ask others for help when I do not understand something.
16 When needed, I am motivated to imagine what might happen in the text.
17 I use my partner's strengths to compensate for my weaknesses in summarizing.
18 I find myself using helpful learning strategies automatically to identify the most important information.
19 I find myself stopping regularly to check if I am understanding all the words read.
20 I ask myself if I have considered all the possible choices before changing a sentence or even a word to improve a summary.
21 I try to explain new information to my partner into my own words.
22 When I realize that my partner has not understood, I look for new strategies.
23 Comparing the answers found by my partner with mine helps me to understand better.
24 I read instructions carefully before I begin a task (that is what is asked to me).
25 When I am not sure about the contents I have read, I recheck them together with my partner to get "the core" of it.
26 I try to break the text down into smaller phases/parts.
27 I focus on overall meaning rather than specifics.
28 I ask myself questions about how well I am understanding while I am reading something new.
29 I ask myself if I know the technic that I have used once I finish summarizing.
30 I stop and go back over new information that is not clear.
31 I stop and reread when I do not know how to choose the groups of the most important words.

3.2.3 The Metacomprehension scale of ALM Inventory (Awareness Learning Metacognitive)

The ALM Inventory (Awareness Learning Metacognitive) verifies the degree of knowledge of specific metacognitive aspects that influence the ability to understand [45]. For the purpose of this study only the Metacomprehension scale has been taken into consideration. It refers to the conscious abilities that the student must apply to come to understand the meaning of what she/he reads or listens to. Such as: the ability to select useful information for understanding and to relate it to what you study or listen to, with what is already known or with your own experience; the ability to infer non explicit conclusions in the text and to use analogies to understand or solve problems; knowledge of reading purposes; understanding control; knowledge of strategies; sensitivity to the text; imagination; fantastic processing.

The Metacomprehension scale of ALM is accompanied by a 4-point response scale including almost never, sometimes, often, almost always. The score is calculated assigning 1 point to the answer "Almost never", 2 points to the answer "Sometimes", 3 points to the answer "Often", 4 point to the answer "Almost always". To obtain the scale score all the points of the items that compose it will be added up.

This scale consists of 9 items:

1- I easily understand if a concept or an argument is unclear to me.
2- I can choose the meaning that corresponds to each word among those offered by dictionaries.
3- By reading, I reconstruct the situations, the characters or the events narrated with my imagination.
4- When I make mistakes, I wonder what the cause is.
5- While I read, I try to be careful and try to understand what is exposed in the text.
6- I easily summarize the content of an oral exposure.
7- Before tackling a difficult task or a new activity, I collect all the necessary information.
8- When I read a story, I try to identify the main characters.
9- I ask questions to professors to understand the concepts which I do not understand well.

3.2.4 Internal consistency reliability

The internal consistency reliability coefficients for its three documented subscales (MARSI-R, MAI and ALM) ranged from 0,62 to 0,88 and reliability for the total instrument was 0,87 indicating a reasonably dependable measure of metacognitive awareness of reading strategies (Table 1).

Instrument/Subscale	Alpha di Cronbach	N. of items
M&MRS	0,871	55
MARSI-R	*0,882*	*15*
MAI	*0,621*	*31*
ALM	*0,654*	*9*

Table 1. Internal consistency reliability coefficients of Metacomprehension & Metacognitive Reading Strategies

IV. Results and discussion

Descriptive analyses of all the scales and subscales are presented in Table 2. The results for each of them will be taken into closer consideration in the following subparagraphs.

	N	Min	Max	Mean	SD
MARSI-R	115	15,00	74,00	59,46	9,35
MARSI-R_GRS	*115*	*5*	*25*	*19,10*	*3,34*
MARSI-R_PSS	*115*	*5*	*25*	*19,83*	*3,76*
MARSI-R_SRS	*115*	*5*	*25*	*20,53*	*3,20*
MAI-R	112	14,00	31,00	23,85	3,40
MAI-R_KFC	*113*	*4,00*	*11,00*	*8,95*	*1,61*
MAI-R_RCF	*114*	*8,00*	*20,00*	*14,89*	*2,29*
ALM	115	12	27	22,38	2,85

Table 2. Descriptive analyses

4.1 MARSI-R

As Table 3 shows, the means of individual strategy use ranged from a high of 4,48 (underlining or circling important information in the text) to a low of 3,18 (previewing the text to see what it is about before reading it), with an overall reported strategy usage mean of 3,96 (SD=0,62).

A closer examination of Table 3 shows that 13 of the 15 strategies reported (86,7%) fell in the high usage category (mean of 3.5 or higher) while the remaining 2 strategies (13,3%) had means between 2.5 and 3.49 indicating medium usage of these strategies [42].

By comparing the different types of strategies, it appears that on average students use more Support Reading Strategies (mean of 20,53; SD=3,20) than Problem Solving Strategies (mean of 19,83; SD=3,76) and Global Reading Strategies (mean of 19,10; SD=3,34).

			N	Min	Max	Mean	SD
1	GRS	Having a purpose in mind when I read.	115	1	5	3,85	0,966
3	GRS	Previewing the text to see what it is about before reading it.	115	1	5	3,18	1,056
5	GRS	Checking to see if the content of the text fits my purpose for reading.	115	1	5	4,21	1,030
12	GRS	Using typographical aids like bold face and italics to pick out key information.	115	1	5	3,90	1,108
13	GRS	Critically analyzing and evaluating the information read.	115	1	5	3,95	1,007
	GRS	**Global Reading Strategies**	**115**	**5**	**25**	**19,10**	**3,34**
7	PSS	Getting back on track when getting sidetracked or distracted.	115	1	5	4,33	0,925
9	PSS	Adjusting my reading pace or speed based on what I'm reading.	115	1	5	3,89	1,168
11	PSS	Stopping from time to time to think about what I'm reading.	115	1	5	4,13	0,960
14	PSS	Re-reading to make sure I understand what I'm reading.	115	1	5	4,27	0,949
15	PSS	Guessing the meaning of unknown words or phrases.	115	1	5	3,22	1,323
	PSS	**Problem Solving Strategies**	**115**	**5**	**25**	**19,83**	**3,76**
2	SRS	Taking notes while reading.	115	1	5	3,97	0,903
4	SRS	Reading aloud to help me understand what I'm reading.	115	1	5	3,88	0,938
6	SRS	Discussing what I read with others to check my understanding.	115	1	5	4,22	0,998
8	SRS	Underlining or circling important information in the text.	115	1	5	4,48	0,862
10	SRS	Using reference materials such as dictionaries to support my reading.	115	1	5	3,98	0,927
	SRS	**Support Reading Strategies**	**115**	**5**	**25**	**20,53**	**3,20**

Table 3. Descriptive analyses of items and subscales of MARSI-R

4.2 MAI-R

Results from the revised version of MAI, shows higher scores in the scale related to Knowledge of Cognition Factor as compared to Regulation of Cognition Factor (Fig. 1).

More specifically, in relation to the first factor, a higher score is obtained in declarative knowledge compared to procedural knowledge. In the Regulation of Cognition scale, the average scores in all the subscales (Comprehension Monitoring, Debugging strategies, Evaluation, Planning) are lower when compared to the first factor, except for the "Information Management Strategies" subscale.

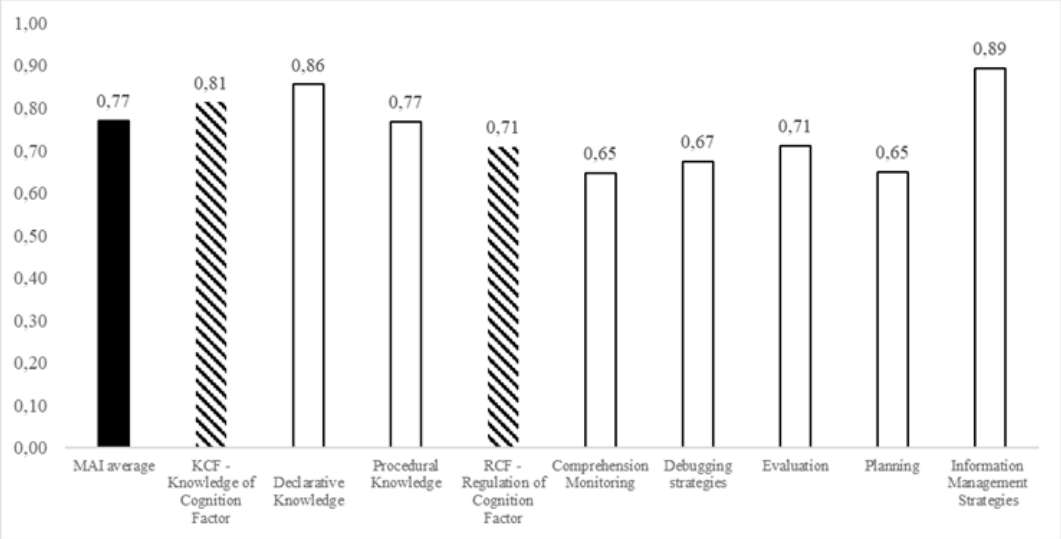

Fig. 1. Scales and subscales scores of MAI-R

4.3 Correlation analyses

As was expected and found in previous research [1, 2] there was a significant correlation between the different components of M&MRS: all the scales correlate with other scales (Table 4). Significant correlations were found between the revised versions of Metacognitive Awareness Inventory (MAI-R), Metacognitive Awareness of Reading Strategies (MARSI-R) and the Metacomprehension scale of Awareness Learning Metacognitive Inventory (ALM).

This data confirms the multifaceted nature of reading comprehension of which both students and teachers need to be aware in order to deeply comprehend a written text and/or implement targeted teaching interventions to acquire specific metacognitive and meta-understanding strategies.

Table 4. Correlation matrix of dependant variables (Pearson's r).

	MAI-R	MARSI-R	Metacomprehension of ALM
MAI-R	1	,	
MARSI-R	,401**	1	
Metacomprehension of ALM	,412**	,338**	1

** $p < 0{,}01$

V. Conclusion

The purpose of the present research was to validate the M&MRS Inventory and investigate the university students metacognitive reading comprehension strategies. We focused on two related issues: (a) whether there was empirical support to the three component of M&MRS, (b) whether the three components were related to each other.

The M&MRS Inventory is a reliable and valid instrument for measuring metacognitive knowledge, regulation and responsiveness during reading comprehension process. This finding is consistent with many previous theoretical accounts of metacognition [1, 2].

The instrument is suitable for use in the evaluation of the effects of interventions aiming at increasing metacognitive knowledge, regulation and responsiveness in students. It also may help identify lower performing students who frequently display comprehension monitoring deficiencies that can be remediated using a variety of instructional strategies.

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