© Journal of the Indian Academy of Applied Psychology
Jul 2018, Vol. 44, No. 2, 277-287

Metacognition Awareness Inventory: Adaptation for Indian Working Professionals

Anu Singh Lather
Delhi Technical University, Delhi

Shilpa Jain & Bhavna Bajaj
GGSIPU, Delhi

Metacognition, a term that is scarcely used at workplaces, drives emotional intelligence, social intelligence, problem-solving skills and learning capabilities of individuals. In this context, the present research puts forward an adaptation of Metacognition Awareness Inventory (originally developed by Schraw and Dennison, 1994) for working professionals. The inventory was adapted by administering MAI, reworded for work context, on 297 working professionals. The composite reliability score has been found to be .90. Convergent validity has also been established. The inventory can now be used for working professionals to assess their metacognitive ability, which in turn facilitates an insight into their problem-solving abilities, capacity for collaboration and mindfulness.

Keywords: Metacognition; Workplace Performance; Measuring Metacognition; Workplace learning.

In today's knowledge economy, learning to learn is a critical skill for success at the workplace (Bridgestock, 2014). Employees are thus expected to continually learn, unlearn and relearn. Jacobes and Harskamp (2012) have demonstrated that metacognition is a key predictor of an individual's learning performance. Studies have established metacognition to be a relevant predictor of an individual's ability to accomplish complex learning tasks (Dignath & Buttner, 2008; van der Stel & Veenman, 2010). Metacognition (or metacognitive ability) can thus be expected to emerge as a key determinant of employee performance.

Metacognition was first described as "thinking about thinking" by Flavell in 1979. Since then, metacognition (or metacognitive ability) has come to be "conceptualized as a bundle of competencies which impact learning, critical thinking, reflective judgment, problem solving, and decision-making" (Dawson, 2008). Researchers have found metacognition to be related to intellectual skills (Veenman, Kok, & Blote, 2005), problem solving (Gardner, 1995; Karmiloff-smith, 1992; Lee & Teo, 2011), critical thinking (Choy & Cheah, 2009; Magno, 2010), emotional regulation (Efklides, 2006), effective team work (Briñol & DeMarre, 2012); collaboration (Frith, 2012) and motivation (Martinez, 2006, Sungur & Senler, 2009).

Metacognitive skills are becoming an increasingly vital asset for the manager to be able to function in the workplace (Braun, 2004). Ford, Kraiger and Merritt (2010) have noted that employees having high metacognitive ability can match task requirements and skills required better. In an analysis of nursing students' performance during simulations, Oh (2016) showed that high metacognition group had higher scores compared to groups with lower metacognition. Greene (2003) highlights that metacognition is especially important in today's dynamic environment which necessitates high speed decision making. Well-developed metacognitive skills have a positive impact on adults' ability to handle complexity and cope with conflict (Dawson, 2008). Burke and Hutchins (2007) suggest that metacognitive ability could act as a substitute for a supportive work environment especially regarding transference of learning. Dierdoff and Ellington (2012) have shown that people with strong metacognitive abilities are better able to collaborate and make decisions more efficiently. In 2014, Nonose, Kano and Furuta showed that metacognition is the key process affecting cooperation.

Even though, metacognition has been linked to several key factors affecting workplace performance as cited above, it has not been explicitly studied in the context of workplace performance of employees. Meanwhile, several constructs like Mindfulness, Self-awareness, and Self-regulated learning which are inherently driven by metacognition have been gaining importance in the OB literature in the recent times. It is thus important to study metacognition in the workplace to understand how it impacts individual employee performance as well as team performance. Such investigation will also help us separate metacognitive ability from other constructs.

However, to examine the impact of metacognition in the workplace - tools that can measure metacognitive abilities of adults in the context of work are required.

Metacognition has been studied predominantly among children in educational settings using interviews (Zimmerman & Martinez-Pons, 1992), analysis of think-aloud protocols (Afflerbach, 2000; Veenman, Elshout & Groen, 1993), observations (Veenman & Spaans, 2005), eye-movement registration (Kinnunen & Vauras, 1995), on-line computer-logfile registration (Veenman, Wilhelm, & Beishuizen, 2004) and stimulated recall (van Hout-Wolters, 2000). Several subject specific measures have also been developed such as Metacognitive Awareness of Reading Strategies Inventory (Mokhtari & Reichard, 2002) and metacognitive knowledge in Mathematics Questionnaire (MKMQ) (Efklides & Vlachopoulous, 2012) etc. Other assessment methods used in educational contexts include open ended interviews (Myers & Paris, 1978) and scenario-based tests such as Index of Reading Awareness (Jacobs & Paris, 1987).

Metacognition is usually measured as a construct comprising of two major components - Metacognitive Knowledge and Metacognitive Regulation (Shamir, Mevarech, & Gida, 2008). While metacognitive knowledge is evaluated using metacognitive awareness inventories, metacognitive regulation, is assessed through metacognitive judgments; by observing actual strategy use or by asking participants to report strategy use (Händel, Artelt & Weinert, 2013). However, both these components of metacognition can be measured effectively through self-report inventories (Schraw & Dennison, 1994; Pereira-Laird & Deane, 1997). Commonly used inventories include Metacognitive Awareness Inventory (MAI; Schraw and Dennison 1994), Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich and De Groot 1990), and the Learning and Study Strategies Inventory (LASSI; Weinstein et al. 1988). Sperling, Howard, Miller and Murphy (2002) report that among all methods of measurement, self-report inventories are the least problematic technique for measuring metacognition, especially when involving many participants. From among the above-mentioned inventories, the MAI (Metacognitive Awareness Inventory), proposed by Schraw and Dennison in 1994, was specifically developed for measuring metacognition among adults. It is a 52-item self-report inventory measuring Knowledge and Regulation of Cognition in line with the accepted two component model of metacognition (alpha =.90). According to a meta-review of measurement methods performed by Gascoine, Higgins and Wall in 2016, the MAI possesses internal consistency, construct validity and replicability. Researchers (Abdellah, 2015; Coutinho, 2007; Pintrich, Wolters & Baxter, 2000; Young & Fry, 2008) have verified that the MAI has external validity. MAI is seen as a "more specific measure of metacognition" when compared to other self-report inventories such as MSLQ and "more appropriate" for baseline assessment (Mytkowicz, Goss, & Steinberg 2014).

Researchers have adapted MAI for use in diverse contexts including its use amongst Indonesian (Hermita & Thamrin 2015), Iranian (Ghonsooly, Khajavy, & Mahjoobi, 2014) and Portuguese (Rui, Mário, & Leandro, 2016) respondents. As a robust and easy to use instrument, MAI is widely used in studies that examine relationships of metacognition with other constructs such as achievement goals (Sungur & Senler, 2009), self-regulated learning (Turan, Demirel, & Sayek, 2009) and problem solving (Lee, Teo, & Bergin, 2009).

The MAI was developed to assess metacognition among adults (Schraw & Dennison, 1994); its psychometric properties have been assessed unlike other measurement methods (Sperling et al., 2002); and it can be easily administered for large scale assessments. Thus, researchers chose to adapt MAI for use in the context of work to measure metacognition among adults in this study.

Rationale of the study

Metacognitive ability is a person's specific characteristic that is independent of IQ and tends to play a larger role in task performance (Veenman et al., 2005). Researchers in cognitive psychology have linked metacognition to a number of constructs, including meta-memory, critical thinking, self-efficacy and motivation. Undoubtedly, metacognition supports high quality thinking. Recently, the metacognitive knowledge of the top management team was shown to impact the firm's performance (Rhodes, Lok, & Sadeghinejad, 2016). Since metacognition impacts all significant determinants of workplace behavior, and also affects overall organizational performance, it is important to study metacognition among working adults. However, instruments available for measuring metacognition have been developed only for use with students in context of formal education. A reliable tool for assessment of metacognition at work can lay the foundation for metacognitive training at work and can help build high performance teams.

Measuring metacognition among adults can also help enhance our understanding of the multiple overlapping constructs of emotional intelligence, social intelligence, self-regulated learning, executive function and mindfulness. In this research, we aim to adapt the MAI (Schraw & Dennison, 1994), for work so that it can be used for large-scale assessment of metacognitive abilities of adults in the workplace.

Objective of the Study

To adapt and validate Metacognitive Awareness Inventory (originally developed by Schraw and Dennison, 1994) for working professionals in India.

Method

Procedure

Item Generation: Items in the original inventory with an obvious reference to educational tasks (read, write etc.) were altered to better indicate activities performed in the context of work. A 5-point Likert scale with responses varying from Never (0) to Always (4) was used to replace the binary (Y/N) responses of original inventory. Similar addition of a Likert Scale has been made by other researchers (Balcikanli, 2011; Stewart, Cooper, & Moulding, 2007) while using MAI in their work.

The modified inventory consisted of 52 items measuring the two components of Metacognitive Ability: Awareness and Regulation, with three subdomains namely - Procedural knowledge (PK), Conditional Knowledge (CK), Declarative Knowledge (DK) under the component "Awareness/ Knowledge"; and five subdomains namely Debugging Strategies (DS), Information Management Strategies (IMS), Monitoring (M), Planning (P), Evaluation (E) under the component "Regulation". Definitions of these subdomains were revised to suit work context. Original and revised definitions of these sub domains are given in Table 1. An inventory with the modified items was then circulated among six experts in Psychology and Organizational Behaviour to seek comments and establish face validity.

Data Collection:

Researchers contacted professionals employed in various organizations and explained the purpose of the research. Once they consented, questionnaires were sent to them through email. A total of 400 questionnaires were circulated among knowledge workers engaged in varied work profiles.

Sample

A total of 361 responses were received. 297 questionnaires were complete in all respects. Only the fully completed questionnaires were analysed for the study (n=297). 47% of the respondents were male and 53% were female. 84% of the respondents were less than 45 years of age. 53% of the respondents were graduates, 41% were postgraduates and 4% had doctoral degrees. Of the sample, 69% of the respondents were employed in private organizations, while 15% were employed in public sector units and 16% were self-employed. Respondents

Table 1. Original and revised definitions of the sub domains of metacognition

COMPONENT	DOMAIN	ORIGINAL DEFINITION	REVISED DEFINITION
Knowledge of Cognition	Declarative knowledge (DK)	Knowledge about oneself as a learner and factors affecting cognition (Cross & Paris, 1988; Schraw et al., 2006)	Knowledge about oneself as a worker and factors affecting task performance
	Procedural Knowledge (PK)	Awareness and management of cognition, including knowledge about strategies (Cross & Paris, 1988 Schraw et al., 2006)	Awareness and management of task requirements, including knowledge about strategies that can be employed for successful completion of various work-related tasks
	Conditional knowledge (CK)	Knowledge about why and when to use a given strategy (Schraw et al., 2006)	Knowledge about why and when to use a given strategy at work
Regulation of Cognition	Planning (P)	Identification and selection of appropriate strategies and allocation of resources (Schraw et al., 2006 Whitebread et al., 2009)	Identification and selection of appropriate strategies and allocation of resources, prior to undertaking an activity at work
	Monitoring (M)	Assessment of one's learning or strategy use (Schraw et al., 2006)	Assessment of outcome of the strategy one uses at work
	Evaluating (E)	Assessing the processes and products of one's learning, and revisiting and revising learning goals (Schraw et al., 2006 Whitebread et al., 2009)	Assessing the processes and products of one's work and revisiting and revising goals in the context of the given task
	Information Management Strategies (IMS)	Skills and strategy sequences used to process information more efficiently (e.g., organizing, elaborating, summarizing, selective focusing) (Schraw et al., 2006)	Skills and strategy sequences used to process information more efficiently
	Debugging Strategies (DS)	Strategies used to correct comprehension and performance errors (Schraw et al., 2006)	Strategies used to correct comprehension and performance errors at work

were reportedly engaged in varied profiles such as marketing (18%), web design and software development (21%), institutional sales (11%), customer relations (23%), management consultancy (9%) and IT operations (18%).

Analysis

To establish the psychometric properties of the adapted inventory, a measurement model was proposed as given in the original inventory. A confirmatory factor analysis (CFA) of measurement model was done using AMOS 21.0. Factor analysis was used to measure construct validity (Muijs, 2004, p.70).

Results

Our analysis revealed that the data collected for the MAIW fit the two-component model of Metacognition and all the fit indices were well within range. Loadings on each individual item can be seen in Table 2. The overall measurement model reflected the acceptable model fit. Chi-square to degree of freedom ratio (CMIN/df) was 1.3, which is less than the suggested value of 5 (Hair, Babin & Tatham, 2006). The Comparative Fit Index (CFI: Bentler, 1990), which is one of the measures least affected by sample size (Fan, Thompson & Wang, 1999), was reported to be .997. A CFI ≥ 0.95 is recognized as indicative of good fit (Hu & Bentler, 1999). Further, RMSEA below 0.08 is required for a good fit (MacCallum, Browne, & Sugawara, 1996). The reported RMSEA for the MAIW was .035. Other fit indices namely GFI, AGFI, NFI are reported in Table 3.

Table 2: Item Loadings

Item	Sub domain	S. Estimate
I ask myself periodically if I am meeting my goals.	M	.44
I consider several alternatives to a problem before I proceed	M	.48
I try to use strategies that have worked in the past.	PK	.40
I pace myself while working in order to have enough time.	P	.50
I understand my intellectual strengths and weaknesses.	DK	.51
I think about what I really need to do before I begin a task	P	.49
I know how well I did once I finish a task	E	.32
I set specific goals before I begin a task.	P	.60
I slow down when I encounter important information.	IMS	.25
I know what kind of information is most important to gather for successful completion of a task	DK	.61
I ask myself if I have considered all options when solving a problem.	M	.48
I am good at organizing information.	DK	.60
I consciously focus my attention on important information.	IMS	.52
I have a specific purpose for each strategy I use to complete my task	PK	.55
I can alter my work style to suit the requirements at a particular time	CK	.49
I know what the boss expects me to accomplish	DK	.43
I am good at remembering information.	DK	.49
I use different work strategies depending on the situation.	CK	.50
I ask myself if there was an easier way to do things after I finish a task.	E	.52
I have control over how well I work	DK	.52
I periodically review the information I have, to help me understand important relationships.	M	.62
I ask myself questions about the task at hand before I begin.	P	.56
I think of several ways to solve a problem and choose the best one.	P	.72
I summarize what I've done after I finish.	E	.63
I ask others for help when I don't understand something.	DS	.51
I can motivate myself to work when I need to	CK	.64
I am aware of what strategies I use when I approach a typical work task	PK	.66
I find myself analyzing the usefulness of strategies while I work.	M	.69
I use my intellectual strengths to compensate for my weaknesses.	CK	.46
I focus on the meaning and significance of new information.	IMS	.71
I create my own examples to make information more meaningful.	IMS	.55
I am a good judge of how well I understand something.	DK	.54
I find myself using helpful work strategies automatically.	PK	.61
I find myself pausing regularly to check my comprehension.	M	.48

I know when each strategy I use will be most effective.	CK	.50
I ask myself how well I accomplish my goals once I'm finished.	E	.52
I draw pictures or diagrams to help me understand while working.	IMS	.66
I ask myself if I have considered all options after I solve a problem.	E	.73
I try to translate new information into my own words.	IMS	.66
I change strategies when I fail to work well.	DS	.51
I use the information provided to me to help me complete my tasks.	IMS	.65
I read instructions carefully before I begin a task.	P	.48
I ask myself if the information I have received is related to what I already know.	IMS	.61
I reevaluate my assumptions when I get confused.	DS	.66
I organize my time to best accomplish my goals.	P	.49
I work better more when I am interested in a particular task.	DK	.50
I try to break work into down into smaller steps.	IMS	.48
I focus on overall meaning rather than specifics.	IMS	.61
I ask myself questions about how well I am doing while I am doing something new.	M	.61
I ask myself if I learned as much as I could have once I finish a task.	E	.64
I stop and go back over new information that is not clear.	DS	.69
I stop and reread the given information when I get confused.	DS	.66

For any inventory, reliability and validity scores are as important as fit indices. Composite reliability which is a measure of the overall reliability of a collection of heterogeneous, but similar items was used to measure the reliability of the MAIW. Composite reliability above the 0.70 threshold and an extracted variance above the 0.50 threshold have been recommended. The MAIW showed composite reliability values of .90 and an extracted variance of .64 for metacognitive regulation and composite reliability values of .87 and an extracted variance of .70 for metacognitive knowledge. All the factor loadings in MAIW were above .5; AVE had a value of .649 and CR had a value of .902 suggesting acceptable convergent validity as per criteria prescribed by Hair et. al (2006) (see Table 4 for details).

In the two-component model of metacognition, it is seen that knowledge and regulation of cognition are mutually correlated (Jacobs & Paris, 1987) especially where metacognitive knowledge is correct (Veenman, van Hout-Wolters, & Afflerbach, 2006). In the original MAI (Schraw & Dennison, 1994), knowledge of cognition and regulation of cognition were strongly inter-correlated. This close correlation was also confirmed by the results of Sperling et al. (2002). Our data too shows high degree of correlation between respondents' metacognitive regulation and knowledge (r=.966).

Conclusion

Metacognition is known to be important in decision-making particularly when the solution is not obvious (e.g. Zysset, Huber, Ferstl, & Von Cramon, 2002), or when decisions are made jointly between two people (Bahrami et al., 2010; Frith, 2012) because metacognition allows people to change their behavior strategically in accordance with task demands. "Accelerated learning, enhanced performance, and expertise, may be the result… of metacognitive abilities which are domain-general in that they can be applied to a variety of novel tasks and domains" (Eccles & Feltovich, 2008, p. 43).

Metacognitive strategies' trainings are known to impact Emotional Intelligence (Alavinia & Mollahossein, 2012); problem solving ability (Sharei, Kazemi & Jafari, 2012) and team performance (Newell, Dahm, Harvey, & Newell, 2004). It can thus be expected that metacognitive abilities will play a significant role in workplace performance. Researchers have linked Metacognition to superior job performance in certain contexts such as teaching (Balcikanli, 2011, Stewart et. al, 2007), sports (MacIntyre, Igou, Campbell, Moran & Matthews, 2014), and military teams (Thompson & Cohen, 2012).

Given that workplaces are distinct from educational settings and from each other, instruments used for measuring metacognition among students need to be adapted for specific work contexts to assess the impact that metacognition may have on individual's

Table 3: MAIW Fit Indices

	CMIN/ DF	GFI (Goodness of Fit Index)	AGFI (Adjusted Goodness of Fit Index)	CFI (Comparative Fit Index)	NFI (Normed Fit Index)	SRMR (Standardized Root Mean Residual)	RMSEA (Root Mean Square Error of Approximation)
Acceptable Levels	1-5	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≤ 0.08	≤ 0.10
Metacognition	1.368	.981	.959	.997	.989	.05	.035
Regulation							
Planning	2.069	.971	.943	.962	.931	.038	.060
Monitoring	2.443	.969	.938	.944	.910	.041	.070
Evaluation	1.618	.983	.961	.982	.956	.032	.046
Debugging Strategies	1.852	.987	.961	.985	.969	.023	.054
Information Management Strategies	2.906	.937	.900	.905	.901	.045	.080
Knowledge							
Conditional Knowledge	3.798	.975	.924	.918	.907	.041	.097
Declarative Knowledge	1.718	.977	.955	.968	.928	.032	.049
Procedural Knowledge	3.729	.988	.942	.962	.950	.027	.096

Table 4: MAIW Reliability and Validity

Knowledge			Standardized Estimate(R^2)
Procedural Knowledge	<---	Knowledge	.818
Declarative Knowledge	<---	Knowledge	.879
Conditional Knowledge	<---	Knowledge	.816
Average Variance Explained			.703
Composite Reliability			.876
Regulation			
Debugging Strategies	<---	Regulation	.713
Monitoring	<---	Regulation	.854
Planning	<---	Regulation	.839
Information Management Strategies	<---	Regulation	.850
Evaluation	<---	Regulation	.762
Average Variance Explained			.649
Composite Reliability			.902

workplace performance. The MAIW has been developed for knowledge workers, and hence is suited to a large percentage of working adults in the world today. It is advisable to be specific about the context in which metacognition is measured (McNamara, 2011). Through confirmatory factor analysis, we have been able to demonstrate that MAI adapted for Work (MAIW) follows the two-component model of Metacognition widely accepted in literature (Sperling et al., 2002, Shamir et al., 2008).

Our analysis has shown optimal values for major fit indices and high composite reliability scores. It is thus proposed that MAIW be used for measuring metacognitive ability among working adults, especially in the Indian context. Use of MAIW to identify employees' metacognitive ability can help enhance T&D outcomes since metacognition is an accepted predictor of learning. Further, given that metacognitive ability of team members is known to have a distinct impact on team learning capabilities (McCarthy, 2008); the MAIW can be used to identify and group together individuals who are likely to perform better in teams. MAIW also adds to the practitioners' arsenal of psychometric assessments that provide a quantitative insight into the individual's mental process, strengths and weaknesses which will be exceptionally useful as we move into the age of HR analytics.

Limitations

This research was conducted on a small sample of working personnel in the metro cities of India – and needs to be conducted on a larger, more diverse population to elicit generalizable results. Also, the respondents were employed in a few selected organizations that may not adequately represent the working population in the country. Organizational factors affecting workplace behavior was not considered in the study. The results of this study are also limited by the shortcomings of self-report inventories.

Future directions

Further research needs to be conducted on how the specific components of metacognitive ability impact workplace performance. Research can be done on the impact of individual's metacognitive ability on his performance in a team, and on the overall team effectiveness. Research can also be conducted to establish relationships between metacognitive ability and related concepts currently popular in OB literature such as self-awareness and mindfulness.

References

Abdellah, R. (2015). Metacognitive awareness and its relation to academic achievement and teaching performance of pre-service female teachers in Ajman University in UAE. *Procedia-Social and Behavioral Sciences, 174*, 560-567.

Afflerbach, P. (2000). Verbal Reports and Protocol Analysis. *Handbook of reading research, 3,* 163-179.

McCarthy, A., & Garavan, T. N. (2008). Team learning and metacognition: A neglected area of HRD research and practice. *Advances in Developing Human Resources, 10*(4), 509-524.

Alavinia, P., & Mollahossein, H. (2012). On the correlation between Iranian EFL learners' use of metacognitive listening strategies and their emotional intelligence. *International Education Studies, 5*(6), 189.

Bahrami, B., Olsen, K., Latham, P. E., Roepstorff, A., Rees, G., & Frith, C. D. (2010). *Optimally interacting minds. Science, 329*(5995), 1081-1085.

Balcikanli, C. (2011). Metacognitive awareness inventory for teachers (MAIT). *Electronic Journal of Research in Educational Psychology, 9*(25), 1309-1332.

Bártolo-Ribeiro, Rui & Simões, Mário & Almeida, Leandro. (2016). Metacognitive awareness inventory (MAI): Adaptation and validation of Portuguese version. *Revista Iberoamericana de Diagnosticoy Evaluacion Psicologica. 2*, 143-159.

Bentler, P. M. (1990), Comparative Fit Indexes in Structural Models, *Psychological Bulletin, 107*(2), 238-246.

Braun, N. M. (2004). Critical thinking in the business curriculum, *Journal of Education for Business, 79*(4), 232–236.

Bridgestock, L. (2014), *"The importance of learning to learn",* (blog post) retrieved from www.topuniversities.com/blog/importance-learning-learn.

Briñol, P., & DeMarree, K. G. (Eds.). (2012). *Social Metacognition.* London, UK: Psychology Press.

Burke, L. and Hutchins, H. (2007). Training Transfer: An Integrative Literature Review. *Human Resource Development Review, 6*(3), 263-296.

Choy, S. C., & Cheah, P. K. (2009). Teacher perceptions of critical thinking among students and its influence on higher education International *Journal of Teaching and Learning in Higher Education, 20*(2), 198–206.

Coutinho, S. (2007). The relationship between goals, metacognition, and academic success. *Educate Journal, 7,* 39–47.

Cross, D. R. & Paris, S. G. (1988). Developmental and instructional analyses of children's metacognition and reading comprehension. *Journal of Educational Psychology, 80*(2), 131-142.

Dawson, T. L. (2008). *Metacognition and learning in adulthood (Prepared in response to tasking from ODNI/CHCO/IC Leadership Development Office,* Developmental Testing Service, LLC). Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.483.6043&rep=rep1&type=pdf

Dierdoff, E. C., & Ellington, J. K. (2012). Members Matter in Team Training: Multilevel and Longitudinal Relationships between Goal Orientation, Self-Regulation, and Team Outcomes. *Personnel Psychology, 65*(3), 661-703.

Dignath, C., & Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning, 3*(3), 231-264.

Eccles, D. W., & Feltovich, P. J. (2008). Implications of domain-general "psychological support skills" for transfer of skill and acquisition of expertise. *Performance Improvement Quarterly, 21*(1), 43-60.

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review,1*(1), 3-14.

Efklides, A., & Vlachopoulos, S. P. (2012). Measurement of metacognitive knowledge of self, task, and strategies in mathematics. *European Journal of Psychological Assessment., 28*, 227-239.

Fan, X., Thompson, B., and Wang, L. (1999). Effects of sample size, estimation methods, and model specification on structural equation modeling fit indexes, *Structural Equation Modeling, 6*(1), 56-83.

Ford, K., Kraiger, K., & Merritt, S.M. (2010). An updated review of the multidimensionality of training outcomes: New directions for training evaluation research. In S.W. Kozlowski & E. Salas (Eds.), *Learning, training, and development in organizations* (pp.135-165). Routledge: Taylor & Francis Group.

Frith, C. D. (2012). The role of metacognition in human social interactions. *Philosophical Transactions of the Royal Society B: Biological Sciences, 367*(1599), 2213–2223.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist, 34*(10), 906-911.

Gardner, H. (1995). Reflections on multiple intelligences: Myths and messages. *Phi Delta Kappan, 77*(3), 200-209.

Gascoine, L., Higgins, S. & Wall, K. (2016). The assessment of metacognition in children aged 4-16 years: a systematic review. *Review of Education, 5*(1), 3-57.

Ghonsooly, B., Khajavy, G. & Mahjoobi, F. (2014). Self-efficacy and Metacognition as Predictors of Iranian Teacher Trainees' Academic Performance: A Path Analysis Approach. *Procedia - Social and Behavioral Sciences, 98*, 590-598.

Greene, J. O. (2003). Models of adult communication skill acquisition: Practice and the course of performance improvement. In J. O. Greene & B. R. Burleson (Eds.), *Handbook of Communication and Social Interaction Skills* (pp. 51-91). Mahwah, NJ: Lawrence Erlbaum.

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). *Multivariate data analysis* (6th Ed.). Uppersaddle River, N.J.: Pearson Prentice Hall.

Händel, M., Artelt, C., & Weinert, S. (2013). Assessing metacognitive knowledge: Development and evaluation of a test instrument/Erfassung metakognitiven Wissens: Entwicklung und Evaluation eines Testinstruments. *Journal For Educational Research Online, 5*(2), 162-168.

Hermita, M. & Thamrin, W. (2015). Metacognition toward Academic Self-efficacy among Indonesian Private University Scholarship Students. *Procedia - Social and Behavioral Sciences, 171*, 1075-1080.

Hu, L. T. & Bentler, P. M. (1999), Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria VersusNew Alternatives, *Structural Equation Modeling, 6*(1), 1-55.

Jacobs, J. E., & Paris, S. G. (1987). Children's metacognition about reading: Issues in definition, measurement, and instruction. *Educational Psychologist, 22*(3-4), 255-278.

Jacobse A. E, Harskamp E. G. (2012) Towards efficient measurement of metacognition in mathematical problem solving. *Metacognition and Learning, 7,* 133–149.

Karmiloff-Smith, A. (1992). Beyond Modularity: *A Developmental Perspective on Cognitive Science,* Cambridge, MA: MIT Press.

Kinnunen, R., & Vauras, M. (1995). Comprehension monitoring and the level of comprehension in high-and low-achieving primary school children's reading. *Learning and Instruction, 5*(2), 143-165.

Lee, C. B., Teo, T. & Bergin, D. (2009) Children's use of metacognition in solving everyday problems: An initial study from an Asian context, Australian *Educational Researcher. 36,*(3), 89-102.

Lee, C. B., & Teo, T. (2011). Shifting pre-service teachers' metacognition through problem solving. *Asia-Pacific Education Researcher, 20*(3), 570–578.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*(2), 130-149.

MacIntyre, T., Igou, E. Campbell, M. Moran, A. & Matthews, J. (2014). Metacognition and action: A new pathway to understanding social and cognitive aspects of expertise in sport. *Frontiers in Psychology, 5*, 1155. doi: 10.3389/fpsyg.2014.01155.

McNamara, D. S. (2011). Measuring deep, reflective comprehension and learning strategies: challenges and successes. Metacognition and Learning, 6, 195–203.

Magno, C. (2010). The role of metacognitive skills in developing critical thinking. *Metacognition and Learning, 5*(2), 137-156.

Martinez, M. E. (2006). What is metacognition? *Phi delta kappan, 87*(9), 696-699.

Mokhtari, K., & Reichard, C. (2002). Metacognitive awareness of reading strategies inventory. *Teaching Exceptional Children, 34*(2), 29-34.

Muijs, D. (2004). *Doing quantitative research in education with SPSS* (pp.70). California, US. Sage Publications.

Myers, M., & Paris, S. G. (1978). Children's metacognitive knowledge about reading. *Journal of Educational Psychology, 70,* 680–690.

Mytkowicz, P., Goss, D., & Steinberg, B. (2014). Assessing Metacognition as a Learning Outcome in a Postsecondary Strategic Learning Course. *Journal of Postsecondary Education and Disability, 27*(1), 51-62.

Newell, J., Dahm, K., Harvey, R. O. B. E. R. T. A., & Newell, H. (2004). Developing metacognitive engineering teams. *Chemical Engineering Education, 38*(4), 316-320.

Nonose, K., Kanno, T., & Furuta, K. (2014). Effects of metacognition in cooperation on team behaviors. *Cognition, technology & work, 16*(3), 349-358.

Oh, H. K. (2016). Impact of Metacognitive Ability on Learning Achievement and Skill Performance in Nursing Simulation Learning. *Advanced Science and Technology Letters, 128*, 83-88.

Pereira-Laird, J. A., & Deane, F. P. (1997). Development and validation of a self-report measure of reading strategy use. *Reading Psychology, 18*, 185–235.

Pintrich, P., Wolters, C., & Baxter, G. (2000). Assessing metacognition and self-regulated learning. In G. Schraw & J. Impara (Eds.), *Issues in the measurement of metacognition* (pp. 43–97). Lincoln, NE: The University of Nebraska Press.

Pintrich, P. & DeGroot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82,* 33-40.

Rhodes, J., Lok, P., & Sadeghinejad, Z. (2016). The Impact of Metacognitive Knowledge and Experience on Top Management Team Diversity and Small to Medium Enterprises Performance. *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 10*(8), 2842-2846.

Schraw, G. & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19,* 460–475.

Schraw, G., Crippen., K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. *Research in Science Education 36* (1-2), 111-139.

Shamir, A., Mevarech, Z. & Gida, C. (2008). The assessment of meta-cognition in different contexts: individualized vs. peer assisted learning. *Metacognition and Learning, 4*(1), 47-61.

Sharei, M., Kazemi, F., & Jafari, M. (2012). Investigation the effect of emotional intelligence skills and metacognitive capabilities on student's mathematical problem solving. *Educational Research, 3*(11), 844-850.

Sperling, R. A., Howard, B. C., Miller, L. A., & Murphy, C. (2002). Measures of children's knowledge and regulation of cognition. *Contemporary Educational Psychology, 27,* 51–79.

Stewart, P. W., Cooper, S. S., & Moulding, L. R. (2007). Metacognitive development in professional educators. *The Researcher, 21*(1), 32-40.

Sungur, S. & Senler, B. (2009). An analysis of Turkish high school students' metacognition and motivation. *Educational Research and Evaluation, 15*(1), 45-62.

Thompson, L. E. I. G. H., & Cohen, T. R. (2012). Metacognition in teams and organizations. *Social Metacognition,* 283-302.

Turan, S., Demirel, Ö., & Sayek, İ. (2009). Metacognitive awareness and self-regulated learning skills of medical students in different medical curricula. *Medical Teacher, 31*(10), e477-e483.

van Hout-Wolters, B. (2000). *Assessing active self-directed learning.* In New learning (pp. 83-99). Springer, Dordrecht.

van der Stel, M., & Veenman, M. V. (2010). Development of metacognitive skillfulness: A longitudinal study. *Learning and Individual Differences, 20*(3), 220-224.

Veenman, M. V., Elshout, J. J., & Groen, M. G. (1993). *Thinking aloud: does it affect regulatory processes in learning?.* Tijdschrift voor Onderwijsresearch.

Veenman, M. V., & Spaans, M. A. (2005). Relation between intellectual and metacognitive skills: Age and task differences. *Learning and individual differences, 15*(2), 159-176.

Veenman, M. V. J., Kok, R., & Blote, A. W. (2005). The Relation between Intellectual and Metacognitive Skills in Early Adolescence. *Instructional Science, 33*, 193-211.

Veenman, M. V., Van Hout-Wolters, B. H., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and Learning, 1*(1), 3-14.

Veenman, M. V., Wilhelm, P., & Beishuizen, J. J. (2004). The relation between intellectual and metacognitive skills from a developmental perspective. *Learning and instruction, 14*(1), 89-109.

Weinstein, C. E., Zimmermann, S. A., Palmer, D. R. (1988). Assessing learning strategies: the design and development of the LASSI. In Weinstein, C. E., Goetz, E. T., & Alexander, P. A. (Eds.), *Learning and study strategies: issues in assessment, instruction, and evaluation* (pp. 25-40). San Diego, CA: Academic Press.

Whitebread, D., Coltman, P., Pasternak, D. P., Sangster, C., Grau, V., Bingham, S., Almeqdad, Q., & Demetriou, D. (2009). The development of two observational tools for assessing metacognition and self-regulated learning in young children. *Metacognition and Learning, 4*(1), 63-85.

Young, A. & Fry J. D. (2008). Metacognitive awareness and academic achievement in college students. *Journal of the Scholarship of Teaching and Learning, 8*(2), 1-10.

Zysset, S., Huber, O., Ferstl, E., & von Cramon, D. Y. (2002). The anterior frontomedian cortex and evaluative judgment: an fMRI study. *Neuroimage, 15*(4), 983-991.

Zimmerman, B. J., & Martinez-Pons, M. (1992). Perceptions of efficacy and strategy use in the self-regulation of learning. In D. H. Schunk and J. L. Meece (Eds.), *Student perceptions in the classroom* (pp. 185-207). Hillsdale, NJ: LEA.

Manuscript submitted on October 24, 2017
Final revision received on February 19, 2017
Accepted on April, 28, 2018

Anu Singh Lather, Pro-Vice Chancellor, Delhi Technological University, Delhi. Email: anusinghlather@gmail.com

Shilpa Jain, Assistant Professor, University School of Management Studies, Guru Gobind Singh, Indraprastha University, Delhi. Email: shilpajain.usms@gmail.com

Bhavna Bajaj (Corresponding Author), Research Scholar, University School of Management Studies, Guru Gobind Singh Indraprastha University, Delhi. Email: bhavnabajaj16@gmail.com