Inflated Self-assessments and Metacognitive Ability: A Demonstration of the Kruger-Dunning Effect among Knowledge Workers

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ABSTRACT

Meta cognitive Ability impacts many determinants of individual performance including learning, motivation, critical thinking and decision making. Low Meta cognitive ability has been suggested as the cause of inaccurate self-assessment among poor performers. The study uncovers the links between Meta cognitive ability, self-assessment and overall work performance. This study provides evidence of presence of the Kruger – Dunning effect in the workplace performance of knowledge workers. It also lays the foundation for studying meta-cognitive ability as a predictor of performance in modern workplaces. The study further makes a case for range bound interpretation of scores on self-report instruments measuring meta-cognitive ability.

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INTRODUCTION

Modern firms have to operate in a knowledge economy where the firm performance is heavily dependent upon its employees' ability to extract value from knowledge. Such work was termed as "knowledge work" by Drucker in 1960s, and in the intervening decades knowledge work has evolved from being seen as a job characteristic to being seen as a continuum along which work for most employees may vary (Kelloway & Barling, 2000).

As raw information becomes easily accessible, the modern knowledge workers must have the capacity to build upon his existing knowledge, and take mental leaps (Trauth, 2000). Effective performers arenowexpected to adapt to dynamic business environment by learning new tasks, procedures and technologies (Pulakos, Arad, Donovan & Plamondon,2000).

In workplace environments, which are essentially high learner control environments (since professionals themselves have to decide what they wish to learn, when and how) the ability to engage in metacognitive activity has been demonstrated as a critical success factor (Schmidt&Ford , 2003).

Metacognitive ability is the ability of knowing, or being acutely aware of one's cognitive state with the ability to complete a given task (Sigler &Tallent-Runnels, 2006). Metacognitive ability allows people to monitor their progress, identify gaps in understanding and plan their strategy accordingly. Schraw (1998) has stated that metacognitive ability is "multidimensional, domain independent and distinct from general intelligence- which helps to compensate for deficits in general intelligence and even prior knowledge during problem solving".

Dunning, Johnson, Erlinger, and Kruger (2003) postulated that, it is due to a lack of metacognitive ability that creates a "dual burden" on unaccomplished performers who, because they suffer from metacognitive deficits, are both unskilled and unaware of their own lack of skills. In context of the modern workplace, the Kruger – Dunning effect implies that professionals with low metacognitive ability would hold overtly favorable views about their skills, seeks out fewer opportunities to learn, and consequently performs poorly at knowledge work. The effect has been widely demonstrated by various researchers,and,low metacognitive ability has been suggested as the cause of inaccurate self assessment among poor performers. However, the links between metacognitive ability, self assessment and overall work performance have been not yet specifically demonstrated. This study attempts to empirically demonstrate the Kruger – Dunning effect in the workplace performance of knowledge workers, and its relationship with metacognitive ability.

Further, it seems important to study metacognitive ability as a predictor of workplace performance at this juncture, since Metacognition has now been linked to a host of abilities which are critical for success in today's environment such as intellectual skills (Veenman, Kok, &Blote, 2004), problem solving (Lee &Teo, 2011), critical thinking (Choy &Cheah, 2009; Magno, 2010) and motivation (Sungur&Senler, 2009). The study, thus, also lays a foundation for an exploration of how metacognitive ability impacts employee performance.

Metacognition

Metacognition as a concept has foundations in cognitive psychology (Hart, 1965; Peters 2007), in cognitive development psychology (Piaget, 1950; Steinbach, 2008), and in social development psychology (Vygotsky, 1962; Tsai, 2001). Flavell (1979) believed that metacognitionis learners' have knowledge of their own cognition, and called it as 'knowledge and cognition about cognitive phenomena' (p. 906). Brown (1978) defined metacognition as awarenessthat organizationhas of thinking processes used in planned learning and problem solving situations. Swanson (1990) defines metacognition as individuals' awareness of their ability to monitor, regulate and control their own activities concerning learning.Schraw (1998)sees Metacognition as skills that are multidimensional , domain independent and distinct from general intelligence. He asserts that metacognitive skills also helps to compensate for deficits in general intelligence, and even prior knowledge during problem solving.Veenman, Kok and Bolte (2004) found that metacognition is not domain specific.

Researchers accept that metacognition is composed of two separate, yet interrelated elements – Knowledge and Regulation(Schraw & Denison, 1994). Metacognitive Knowledge is knowledge about oneself as a learner and factors affecting cognitionwhich have been defined as self-appraisal (Paris &Winograd, 1990)and epistemological understanding (Kuhn & Dean, 2004). Metacognitive knowledge is further subdivided into declarative (Schraw, Crippen, & Hartley., 2006), procedural (Kuhn& Dean, 2004) and conditional knowledge (Schraw et al., 2006). Regulation of cognition includes controlling of one's cognitive processes. Paris and Winograd (1990) refer to this component as cognitive self-management (p. 18). The five subcomponents of regulation that have been identified by researchers are: Planning, Information Management, Comprehension Monitoring, Debugging, and Evaluation (Paris &Winograd, 1990; Schraw &Moshman, 1995;Whitebread et al., 2009)

Metacognition at workplace

Since Metacognition has been recognized as the master that coordinates smooth operation of all other cognitive processes (Hacker, Dunlosky&Grassr, 2009) has also gained tremendous importance in today's workplaces which rely heavily on the cognitive abilities of its workers. Ford, Kraiger and Merritt (2010) have posited that employees having high metacognitive awareness can match task requirements and skills required in a better way.Greene (2003) asserts that metacognition assists in high speed decision making. Burke and Hutchins (2007) suggest that metacognitive abilities acts as substitutes for a supportive work environment as far as transference of learning is concerned. Dierdoff and Ellington (2012) have shown that people with strong metacognitive abilities are better able to collaborate better and make decisions more efficiently. Metacognitive abilities of managers has been shown to impact their capacity to engage in informal learning (Enos, Kehrhahn& Bell, 2003) and self - managed learning (Gravill, Compeau&Marcolin, 2002) ; take better decisions (Bartha &Carroll, 2007) ; cope with conflict (Dawson, 2008) and approach mindfulness (Wells, 2005) . Not only, Metacognition has been seen to impact important

determinants of an individual's performance at work as listed above, but it is also seen as an important factor affecting group performance. Metacognition has been noted as a key component affecting cooperation (Nonose, Kano &Furuta, 2014), collaboration (Frith, 2012), collective group intelligence (Woolley,Chabris, Pentland, Hashmi& Malone, 2010) team learning (McCarthy, 2008), team effectiveness (Entin & Entin, 2000) and cross cultural collaboration (Chua, Morris &Mor, 2012). Researchers have been able to demonstrate that metacognitive abilities are significantly related to individual performance (Oh, 2016) and overall firm performance (Rhodes, Lok, & Sadeghinejad, 2016).

Kruger – Dunning Effect

It is critically important for self-assessments to be accurate (Brown&Harris 2014; Panadero et al. 2016) when the learner is expected to take charge of his or her learning as in the case in workplace environments. If the self-assessment is inaccurate, this leads to errors in the next steps of the learning process (Brown &Harris 2014). The Kruger – Dunning effect suggests that poor performers are unable to make accurate self assessments regarding their own expertise. The Kruger – Dunning effect, is thus, a cognitive bias that leads people to overestimate their expertise in a particular domain. This effect is more prominently seen among poor performers in that domain who are unable to accurately judge the limits of their knowledge and expertise.

Researchers have demonstrated that the effect is not limited to the intellectual tasks in a controlled environment (Ehrlinger, Johnson, Banner, Dunning, & Kruger, 2008); or it cannot be explained by the mere desire to save face (Ehrlinger et. al, 2008) or as a statistical artefact (Kruger & Dunning, 2003) and cannot be overcome by offering incentives for more accurate self-assessment (Ehrlinger et al., 2008). A summary of the work of Kruger–Dunning concludes that *"…incompetent individuals have more difficulty recognizing their true level of ability than do more competent individuals and that a lack of metacognitive skills may underlie this deficiency"* (Kruger & Dunning, 1999.pg. 31).

The effect has been demonstrated among professionals in various domains including college students (Alicke et al., 1995; Everson & Tobias, 1998; Kruger & Dunning, 1999), medical lab technicians(Haun, Zeringue, Leach,&Foley,2000) and clerks (Edwards, Kellner, Sistrom, & Magyari, 2003). In a study conducted by Hodges, Regehr, and Martin (2001) among medical students conducting a clinical interview, they found that the worst performers rated themselves much more positively than their instructors did. In a study conducted in the workplace computing setting, (Gibbs, Moore, Steel& McKinnon,2017)researchers have confirmed the presence of the Kruger Dunning effect and commented that this misinterpreting skill level can pose challenges for both the employees and the employers.

Knowledge Work

Cooperation and cognitive work are the hallmarks of modern workplaces, where most of the employees are engaged in knowledge work - that is work which involves cognitive effort to extract value from knowledge. While Peter Drucker is believed to have pioneered the concept of knowledge work in 1960s, the exact definition of knowledge work has undergone an evolution from being a job characteristic to a continuum along which work for most employees may vary (Kelloway&Barling, 2000). As raw information becomes easily accessible, a successful knowledge worker must have the capacity to build upon his existing knowledge, and take mental leaps (Trauth, 2000). Choi and Varney (1995) argues that knowledge workers include all people who are well educated, performs non-routine work, and are required to think and make decisions, and such people includes academics, doctors, lawyers, engineers, and scientists. Knowledge work is fundamentally intangible, and only outcomes and behaviours can be observed. The modern worker thus needs to have an accurate assessment of his or her performance on cognitive tasks and this assessment can have far reaching implications for performance at workplace.

Employee Performance measurement

Performance can be seen as criterion measures (Borman & Motowidlo, 1997; Conway 1999; Viswesvaran 1993). Across a number of studies, employees' perceptions of their job performance correlate only weakly with their actual performance whereas, the perceptions of peers and supervisors correlates roughly .62 with their actual performance (Harris & Schaubroeck, 1988). The most prevalent method of evaluation at the workplace is supervisor ratings which is subjective evaluations, usually by the supervisors (on pre- defined criteria. Supervisor ratings have been demonstrated as reliable predictors of performance (Davis, Ford is, Van Harrison, Thorpe& Perrier, L., 2006) especially as compared to self-assessments which is comparatively inaccurate. This inaccuracy of self assessment has been explained through various factors, including deficits in metacognitive abilities (Kruger & Dunning, 1999).

OBJECTIVE

In today's environment, effective performers need to meet ever changing job requirements by learning new tasks, technologies, procedures, and roles (Pulakos, Arad, Donovan &Plamondon,2000). As such, it is important for them to recognize the limits of their own knowledge and skill at any given point in time, and seek learning opportunities accordingly. If knowledge workers too are impeded a lack of awareness regarding their own skills, it is bound to affect their performance adversely. The first objective of this research is to look for evidence of the Kruger – Dunning effect among knowledge workers. Further, the research seeks to find empirical evidence of the role that metacognitive ability plays in creating the Kruger – Dunning effect at the workplace.

This study also lays the groundwork for examining the specific relationship between metacognitive ability and individual performance among knowledge workers which has not been explored especially in the Indian context, even though Metacognition is a recognized factor affecting several key behaviours that impact the workplace performance.

RESEARCH METHODOLOGY

Participants

The study focused on knowledge workers. Reich (1991) clarified that knowledge

workersare involved in tasks such as research, product design, marketing, advertising, financing, searching and contracting (Blackler, 1995, pp.1027). Their tasks may include non-knowledge work; but are largely made up of knowledge assignments. Since knowledge workers work in an environment where Metacognitive ability is used to understand one's own task vis - a- vis others and task performed by others while working in teams and in groups. So, this study only considered the knowledge workers working at various managerial levels in various organizations as explained in the sample below.

AMPLE

Researchers have contacted professionals working in various knowledge based profiles across twenty organizations to explain the purpose of the research. Purposive sampling was used to choose these twenty organizations in order to maintain diversity of knowledge worker's profile. These organizations included Advertising firms, IT Organizations, Business Consulting Firms, Public Sector Undertakings, Logistic Firms and Chartered Accountancy Firms. With the consent of the competent authorities in each organization, list of managerial level employees (Knowledge worker) was taken and every fifth knowledge worker was chosen using systematic sampling technique. A total of 205 questionnaires were circulated individually and the mentor feedback for each knowledge worker was taken from the immediate reporting boss.Out of 205, one hundred and seventy six (176) complete responses in terms of knowledge worker response and mentor feedback was received which was further subjected to analysis. The respondents profile of the completed responses are as 52% respondents were males, 48% were females. 41% respondents had been working for less than 5 years; 23% had been working for 6-10 years; 11% had been working for 11-20 years; and 35% had been working for more than 20 years at the time of participating in the research. 72% of the respondents were employed in Private companies while 28% were employed in PSUs. 62% of the respondents were graduates, 33% were post graduates and 5% had doctoral degrees. Respondents were involved in profiles such as Advertising (11%) ; Sales (21%) ; Design (8%); IT (23%) ; Business consulting (15%); Logistics (12%) ; Chartered Accountancy (7%) and Training (3%).

EASURES USED

Metacognitive Ability

Metacognitive Awareness Inventory for work (Lather, Jain & Bajaj, 2018) was used for measuring metacognitive ability among adult workers. The MAIW (Lather, Jain & Bajaj, 2018) is an adaptation of the MAI (Schraw & Denison, 1994) suited for the Indian knowledge workers. The inventory contains 52 items and follows the two component model of Metacognition as proposed in the original inventory. MAIW has a composite reliability score of .902 and acceptable validity scores(AVE>.05).

Employee Performance

The performance evaluation schedule (PES) (Lather & Jain, 2008) measures employee performance on thirteen criteria. These thirteen performance criteria are Productivity, Fast Delivery, Error Less Delivery, Discipline, Punctuality, Leadership Qualities, Initiative, Innovation, Knowledge Base, Being a team player, Ready to do Attitude, Crisis Handling, and Going beyond the assigned job. The Cronbach Alpha of the scale is .719 and split half reliability coefficient is 0.722.

ESEARCH PROCESS

The questionnaire was divided into three parts. Part 1 contained 52 items of the Metacognitive Awareness Inventory – Work (MAIW) (Lather, Jain & Bajaj, 2018). Part 2 of the questionnaire contained the Performance Evaluation Schedule (Lather & Jain, 2008). Part 1 and 2 were to be filled to by the respondents themselves. Part 3 of the questionnaire also contained the performance evaluation schedule (PES) (Lather & Jain, 2008) but part 3 of the questionnaire had to be filled in by the respondents' respective mentors. This dual assessment of an individual's performance, once by self and once by the respective mentor was built into the research questionnaire because people with low metacognitive abilities tend to hold overly favorable views of their abilities in many social and intellectual domains (Kruger &Dunning, 1999), which would have impacted their responses on the MAIW which is a self-report inventory that has been used to measure Metacognitive ability of the participants in this research.

ESULTS

Metacognitive ability (MC) has been measured through MAIW, which is a self-report inventory. MC scores are calculated as a sum of the scores on each of 52 items of the inventory. Work Performance has been measured through PES. The score for work performance was calculated by adding the scores on each of the 13 parameters of PES. The scores given by the respondent in the self-appraisal(EPA_S) and the scores given by the respective mentor to each respondent (EPA_M) were examined separately.

We have analysed the inter-rater agreement of the performance scores on PES by the self and the mentor. This inter-rater agreement was examined using weighted Kappa statistic (Kw). Kw is used for measuring agreement between two raters in case of ordered categorical variables, when providing for degrees of agreement/ disagreement. Kw is fully chance corrected, and its value ranges from 0 to 1, with 1 implying complete agreement. The value of Kw was seen to be .44 showing only moderate correlation between performance assessments made by respondents themselves and the assessments made by their respective mentors. This indicated that respondents' own evaluation of their performance was different from their mentor's evaluation of their performance.

As the next step, the relationship between self-appraisal scores and Metacognition scores were analyzed using Pearson's correlation. A correlation of .455 was found between performance scores given by self (EPA_S_Total) and Metacognitive Ability Scores (MC). Thereafter, performance scores given by the respective mentors (EPA_M_Total) and metacognitive ability scores (MC) were analyzed. A correlation of.188 was found between EPA_M_Total scores and MC scores using Pearson's correlation. (See Table 1)

Table 1 : Showing Correlations between Performance Evaluation by Self, Performance Evaluation by Mentor and Metacognitive Ability Score

		EP_Self_Total	EP_Mentor_Total	MC_Total
EP_Self_Total	Pearson Correlation	1	.505**	.455**
	Sig. (2-tailed)		.000	.000
	N	176	176	176
EP_Mentor_Total	Pearson Correlation	.505**	1	.188*
	Sig. (2-tailed)	.000		.013
	N	176	176	176
MC_Total	Pearson Correlation	.455**	.188*	1
	Sig. (2-tailed)	.000	.013	
	N	176	176	176
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

Employee performance as reported by the respondent themselves was ,thus, seen to correlate positively and significantly with the Metacognitive Ability. However, there was only a very low positive correlation between performance scores given by the mentor (EPA_M) and the respondent's metacognitive ability score (MC). This discrepancy called for further examination. When we compare correlationbetween mentor reported performance scores and MC scores to the correlation seen between self-report MC scores and self-report performance scores, we see that it decreases sharply. This decrease when viewed together with the result found that there is only moderate agreement among the two raters which indicates the presence of the Kruger – Dunning effect.

TheKruger – Dunning effect suggests that the unskilled tend to overestimate their own performance because they lack metacognitive ability to evaluate themselves accurately. In view of the Kruger – Dunning effect, we went on to examine if the discrepancy in performance evaluation can be explained by their metacognitive ability. We examined the respondents' self-report scores on MAIW. The MAIW asks respondents to self-report the frequency with which they engage in metacognitive behaviours. Respondents who have low metacognitive ability would likely judge themselves to be engaging in such behaviours more frequently than they actually do. Further, the Kruger – Dunning effect predicts that it is the low performers who evaluate their performance on cognitive tasks as being better than it actually is .This tendency to overestimate their skills would also reflect in an exaggerated self-appraisal of their workplace performance. So, it was likely that that respondents who have misjudged their performance, would have also misreported their own metacognitive behaviours.

We wanted to examine if people with inflated reporting of metacognitive behaviours were also likely to rate their performance more favourably as compared to their mentors as predicted by the Kruger – Dunning effect. So, we then compared Self and Mentor Performance scores for each respondent (EPA_S - EPA_M). On the basis of difference between EPA_S and EPA_M scores, respondents fell into one of five categories –

(a) mentor rating higher than self-rating (b) same self and mentor rating (c) self-rating 1 step higher than mentor (d) self-rating 2 step higher than mentor (e) self-rating 3 step higher than mentor . The categories and their mean MC scores are given below

Table 2: Showing Mean Metacognitive Ability Scores according to the Self and Mentor Rating Categories

Category	Mean Metacognitive Ability Score (Self-Assessment)
Mentor rating higher than self	156.65
Same self and mentor rating	163.11
Self rating 1 step higher than mentor	168.13
Self rating 2 step higher than mentor	170.33
Self rating 3 step higher than mentor	191.0

It is evident that the self-report MC scores are increasing in tandem with the tendency to have inflated assessments about one's performance (Figure 1)

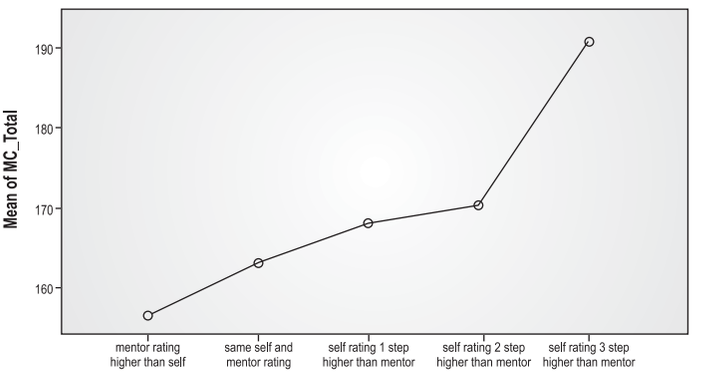

Figure 1: Showing the Mean Scores on Metacognitive Ability as reported by self on Different Categories of Mentor and Self Assessment of Performance

Notably, respondents whose self -rating of their performance was 3 steps higher than their mentor's rating (i.e. they saw themselves as either "High" or "Very High" performers whereas their mentors saw them as either "Very Low" or "Low" performers) had a self-report MC score of 191, which is steeply high in comparison to the scores of employees in the other three categories. The tendency to overestimate the frequency of engagement in metacognitive behaviours is therefore most evident is employees who are poor performers. These are the set of respondents who rate their own performance as "High" or "Very high" while their mentors see them as "Low" or "Very Low" performers. This result provides further empirical proof for the Kruger – Dunning effect demonstrating that the low performers have an inflated assessment of their performance, and are unable to evaluate their cognitive behavior accurately. The results also show that low performers report engaging in metacognitive behaviors with a much higher frequency as compared to the frequency reported by Very High, High or Average performers. This inflation indicates a deficiency in the ability to accurately evaluate their cognitive processes among low performers. And as such, it is the unskilled that are unaware of their lack of skill.

To understand the role metacognitive ability plays in work performance, we divided the respondents into 5 categories based on the performance evaluations given by their respective mentors. These categories were- Very Low, Low, Average, High and Very High performers. There were only two respondents who had been classified as Very Low performers by their respective mentors, so we analyzed only the remaining four categories.

We analyzed if there is any significant difference in the MC scores of the respondents in the sefour categories using ANOVA. The test was significant, indicating that at least one of the four groups varied significantly from the others on their mean MC scores (Table 3).

Table 4: Showing Pair-Wise comparison on the Mean Scores of Metacognitive Ability of Respondents falling in Four Categories According to their Performance Evaluation by Mentors.

EP_Mentor_Cat	N	Subset for alpha=0.05	
		1	2
Average EP	39	156.46	
High EP	61	165.21	165.21
very High EP	72	166.58	166.58
Low EP	4		178.00
Sig.		.264	.157

metacognitive behaviours with a much higher frequency (M = 191 > 185 (164(M) + 21(SD)) such that their MC scores are higher than one standard deviation from the mean scores on the scale. This indicates that the individuals who are assessing themselves correctly are likely to have scores lying within the + 1 standard deviation from the mean scores (164 (Mean) +21 (SD)) on MAIW. Respondents having inflated assessment of their own metacognitive ability have MC scores that lie above one standard deviation of the mean scores on MAIW. These results indicate a need for range bound interpretation of metacognitive ability scores on self report inventories.

ISCUSSION& CONCLUSION

We are in an era where most employees are expected to engage in knowledge work, and their capacity to learn and re- learn is of critical importance to their work performance. Modern day employees who are expected to continually adapt to fast changing business environment need to be aware of

Table 3: Showing Analysis of Variance on Metacognitive Ability Scores of respondents falling in Four Categories According to their Performance Evaluation by Mentors.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	11688.862	2	5844.431	13.920	.000
Within Groups	72634.388	173	419.852		
Total	84323.250	175			

In order to investigate the pair-wise difference, the Duncan test for pair wise comparison which adjusts for multiple comparisons was used.The results showed that there was no significant difference in the mean MC scores of Average, High and Very High performers. However, there was a significant difference in the mean MC scores of Low Performers when compared to the other three groups. Interestingly, respondents who were rated as "Low Performers" by their mentors had the highest scores on the self-report inventory measuring Metacognition (Table 4).

Further assessment of the means and standard deviations of the metacognitive ability scores (M= 164, SD= 21) show that the individuals falling in the category where the difference in self and mentor ratings is 3steps report engaging in

what do they know and how do they learn. As such, accurate self-assessment and metacognitive ability is likely to play an important role in overall workplace performance. Measuring metacognitive ability on a large scale presents a unique challenge. While self-report inventories are an accepted method for measuring metacognitive ability when dealing with large number of respondents, it presents a conundrum. The very nature of self-report inventories is such that they ask the respondents to report the frequency with which a respondent engagesin metacognitive behaviours. In itself, this presents a paradox, because people who have low metacognitive ability are unable to evaluate their own cognitive processes, and are most likely to misreport their cognitive behaviours in a self-report instrument such as MAIW. This phenomenon, that the unskilled suffer from a dual

burden, first of the lack of skill, and second the incapability to evaluate their own performance correctly as was first articulated by Kruger & Dunning in 1999.

Our results showed support for Kruger- Dunning effect in case of knowledge workers, and we saw that people who were categorized as "low performers" by their mentors rated themselves as either "high" or "very high" performers. The results supported the Kruger Dunning hypothesis that the unskilled are likely to evaluate their performance as better than it is. Further, our results also showed that these "low performers" tend to over – report the frequency with which they engage in metacognitive behaviors. Once again, this inaccurate evaluation of one's cognitive processes points to low metacognitive ability among poor performers" as predicted by the Kruger Dunning effect.

ANAGERIAL IMPLICATIONS

The paper provided evidence that the poor performers among knowledge workers tend to have an inflated assessment of their performance at work andof their own metacognitive behaviours. As such, our results support the Kruger - Dunning effect at the workplace.

Also, the paper makes a case for range bound interpretations of self report instruments measuring metacognitive ability.

The results of the study suggest that low performers at the workplace may benefit from metacognitive skills' training which will strengthen their ability to evaluate their own cognitive behavioursaccurately.

IMITATIONS

The study included a small sample (N=176).Organizational and managerial factors affecting the discrepancy in performance assessment were not considered during analysis.

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