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Metacognition and Its Relationship with some Cognitive Variables Among Secondary School Students

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Abstract
Metacognitive thinking has the potential to impact high school student's personality, his cognitive abilities, and psychological state when activating its components through modern educational methods. Through four hypotheses, this study aimed to examine the psychological and educational variables of metacognitive thinking, systemic thinking, and mindfulness that can impact and predict the metacognitive thinking process of secondary school students within the Hawalli Educational Zone of Kuwait. A descriptive and quantitative research design guided this research study with the focus on psychological and cognitive phenomena. The study involved a sample size of 348 participants (169 male and 179 female), aged between 16 and 18 years, randomly drawn from the government secondary schools in the Hawalli Governorate in the State of Kuwait. Data was collected through three distinct scales Metacognitive Thinking Scale, Systems Thinking Scale and Mindfulness Scale. The study found out that there existed a positive and statistically significant relationship between metacognitive thinking and both variables of systemic thinking and mindfulness. Additionally, there were also statistical differences between gender in metacognitive and mindfulness in favor of males. This suggests that systemic thinking and mindfulness can be a predictor of metacognitive thinking. The research implications show that metacognition holds great importance and capability in the educational process. It helps control and guide thinking processes, enhances reading and memorization skills, predicts main ideas, and contributes to the development of critical and creative thinking.

Keywords: Metacognition, Systemic Thinking, Mindfulness, High School Students, Kuwait.

Introduction

Adolescents who possess metacognitive thinking strategies can present unconventional ideas more confidently, engage in discussions with others positively, and demonstrate quality and proficiency in interpersonal communication skills (Alsehibany, 2020). It is evident that metacognitive thinking can make an impact on adolescents' personality, cognitive abilities, and psychological state when activating its components through modern educational methods. This is in accordance with the best educational practices in an educational system that implements modern curricula to activate the components of metacognitive thinking and translate them for various student groups in different environments

Over the past few decades, there has been a significant increase in theoretical and applied research on metacognition (Hussain, 2015). The reason behind this surge can be attributed to the challenges facing humanity in the present time, marked by information, scientific, and knowledge revolutions that surpass any previous revolutions throughout the centuries. Confronting these mentioned revolutions requires the

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availability of a solid scientific foundation, enabling students to keep pace with these rapid changes that we are undergoing. Furthermore, to actively contribute to this swift transformation, individuals must be equipped with a clear understanding of their cognitive capabilities, allowing them to achieve numerous realistic aspirations and ambitions (Alebedy & Shebib, 2019).

Through a rapid shift from traditional direct teaching centered around the teacher as an instructor to a focus on teaching strategies that support the cognitive structure of the student based on the connections between what the student learns and his thoughts, prior experiences, and cognitive skills in managing, organizing, classifying, and illustrating the interactions and relationships among its components. This makes the unconventional cognitive structure of the student play a significant role in building his personality and his ability to face the stimuli of his diverse environments (Alsehibany, 2020).

In such an era of information and knowledge revolution, therefore, it is imperative to review the psychological and educational variables that can impact and predict the metacognitive thinking process. It is necessary to recognize components that can contribute to achieve exceptional and authentic educational outcomes in academic and professional disciplines. Since there is correlation between metacognitive thinking and systemic intelligence in education systems, two components emerge with significant importance to consolidate metacognitive thinking, namely systemic thinking and mindfulness. These two components can build a generation capable of keeping pace with the knowledge revolution and facing various social challenges while having the ability to achieve academic excellence in a distinctive manner.

There is a dire need in educational disciplines to activate the variables of metacognitive thinking, systemic thinking, and mindfulness, particularly in Kuwaiti schools. There is also a dearth of studies and information sources that could have integrated these three variables in a single study. The current study aimed to address these research gaps by correlating metacognitive thinking with systemic thinking and mindfulness among secondary school students in Kuwait.

Literature Review

Metacognition: Scope and Definition

One of the methods to support cognitive development in students to keep up with modern advancements, such as the information revolution, is scientifically known as "metacognition." This concept can be traced back to the world-renowned psychologist at Stanford University, Flavell, who was a supporter of Piaget's theory. Flavell (1979) is considered the first person to use the term "metacognition" in educational research through his writings, focusing on improving children's memory capabilities (Abo-Jado & Noufal, 2007).

Metacognition can be defined as a set of skills that enables an individual to achieve the highest levels of cognitive thinking regarding what they learn, how they learn it, and the assessment of their learning. These skills include planning, organization, and evaluation (Alnajar, Saqer, & Ahmad, 2019). Meanwhile, Ibrahim (2016) defined it as "a type of conscious thinking that involves the ability to think consciously, with self-evaluation of perception through understanding knowledge and self-management of perception through the ability to plan, monitor, control, and evaluate." It is noteworthy that this definition adds the individual's ability to monitor and control, complementing the first definition's emphasis on planning and presentation. However, most previous definitions of metacognition primarily focus on thinking, its abilities, and cognitive dimensions.

The importance of this type of thinking lies in its contribution to the learner's ability to plan, monitor, control, and interact with information at its cognitive source (Monther, Ebrahim, & Alkenany, 2020). It plays a role in problem-solving for unstructured problems (Ader et al., 2023), and it has the potential to address various psychotic symptoms (Han et al., 2023). Furthermore, it enhances the learner's confidence in themselves and their ability to adjust thinking patterns to make them more sophisticated and better utilized (Mahmoud, 2012), along with its ability to process information and improve memory performance through various methods (Alshemery, 2015).

Components of Metacognition

Metacognitive thinking consists of several components, including (i) self-awareness of knowledge, consisting of conceptual knowledge, procedural knowledge, and contextual knowledge; (ii) self-organization of knowledge, which is formed by knowledge management, knowledge evaluation, and knowledge organization (Eshak, Zagloul, & Bahout, 2018). For the successful activation of the components of metacognitive thinking, it requires multiple skills, including task identification, definition, representation, strategy formulation, task execution monitoring, and evaluation (Ahmad, 2002). Therefore, the process of thinking is not an independent process, where it can be studied in its isolated form. Instead, there are numerous dimensions and processes beyond knowledge that influence and control its degrees, levels, and multiple directions. The mind has the ability to generate cognitive outputs in the form of answers to memory questions, judgments about self-attributes, and responses to thinking problems, with the mind's capability to monitor the quality of its outputs (Puente-Díaz, 2023).

In addition, two more components underlie the metacognition which play a significant and influential role in enhancing students' mental abilities, namely systemic thinking and mindfulness. Systemic thinking is considered one of the modern intelligent systems discovered in 2002, which comprises a set of abilities related to an individual's awareness of system components, perception of cause-and-effect relationships among system elements, and awareness of continuous feedback between system components. It also includes the ability to clarify the role of the self within the system (Alfeel, 2015). It is also crucial to emphasize the importance of systemic thinking among students, as it allows for deep thinking, the ability to predict behaviors resulting from surrounding situations, and consequently, the possibility of reaching more appropriate outcomes (Lalani, Gray, & Mitra-Ganguli, 2023).

The second component of mindfulness is a state or condition between full existence and awareness or perception of our surroundings. It involves focusing our feelings and thoughts on the situation itself to comprehend its various aspects (Lopez & Canela, 2023). The mindfulness component helps in enhancing students' ability to perceive and pay positive attention while utilizing emotions in a more positive manner towards surrounding stimuli through the components of mindfulness (Ye et al., 2023). This positive activation will have a beneficial impact on the academic achievement of students, enhancing their adaptability and social integration with peers in both the school and community environments in a more dynamic and effective manner.

By activating these two components of systematic thinking and mindfulness, students can learn to focus on their senses and mental abilities.

Previous Studies

Many previous studies have indicated a positive and statistically significant correlation between metacognitive thinking and systemic intelligence. A few studies have suggested that through systemic intelligence, it is possible to predict metacognitive thinking (Alselmy, 2017; McKim & McKendree, 2020). Additionally, there is a positive and statistically significant correlation between metacognitive thinking and mindfulness (Razavizadeh Tabadkan & Mohammadi Poor, 2016; Tahoon, Sharab, & Hejazi, 2023). The results of these studies have addressed the statistical differences between the variables of metacognitive thinking and mindfulness, indicating an absence of statistically significant differences in metacognitive thinking. Studies like (Abdulhamid, 2020; Alenzy, 2016; Alselmy, 2017; Han et al., 2023; Kresat, 2016; Tahoon et al., 2023) have confirmed the existence of differences between males and females in the variables, in favor of females. Other studies have witnessed variations in the impact of metacognitive thinking (Aljarah & Alebedat, 2011; Alnajar et al., 2019; Break, 2014; Essa, 2018), and have highlighted the shortcomings and deficiencies in the application of study variables in different school environments.

Problem Statement

There is a serious absence of investigative studies on metacognitive thinking and its relationship with systemic thinking and mindfulness, in psychological and educational disciplines. This problem became more profound when it is felt that several Kuwaiti schools lack a clear vision or a pedagogical strategy to activate the components of metacognitive thinking, along with its components of systemic thinking and mindfulness. Hence, a need was felt to activate the variables of metacognitive thinking, systemic thinking, and mindfulness, particularly in Kuwaiti schools, and integrate them in one single study.

Previous studies that have explored these components of metacognitive thinking, systemic thinking, and mindfulness, have rather focused individually and on their other dimensions, with varied results. This study was therefore envisaged to fill up these scientific research gaps, cognitive gaps, temporal gaps, and analytical gaps and contribute to scientific research and its various domains. Based on this, the main research question was drafted: Is there a correlation between metacognitive thinking and both systemic thinking and mindfulness among secondary school students in the Hawalli Educational Zone in the State of Kuwait? To examine this question, two sub-questions were stated: (1) Are there statistically significant acceptable differences between the individuals of the total study sample in the study variables, namely: metacognitive thinking, systemic thinking, and mindfulness attributed to the gender variable? 2) Does each of systemic thinking and mindfulness contribute to influencing and predicting metacognitive thinking in the total study sample of both genders?

Taking a step further, considering various and diverse results observed in previous studies, along with the identification of multiple research gaps, the following hypotheses for the current study were formulated:

H1: *There is a statistically significant positive correlation between metacognitive thinking and systemic thinking among the total sample of male and female participants.*
H2: *There is a statistically significant positive correlation between metacognitive thinking and mindfulness among the total sample of male and female participants.*
H3: *There are statistically significant differences between the average scores of male and female students in the study variables, namely metacognitive thinking, systemic thinking, and mindfulness.*

H4: *Both systemic thinking and mindfulness contribute to the impact and prediction of metacognitive thinking among the total sample of male and female participants.*

Methodology

Research Design

A descriptive and quantitative research design was employed in this study with the focus on psychological and cognitive phenomena. This method involved providing a detailed description, to examine the metacognitive abilities of the respondents. This methodology is characterized by its ease of understanding as the researcher obtains data about the procedures or steps involved in the research, along with various methods used to collect and express that data (Dwidar, 1999). This method involved study procedures a study sample, measurement tools, their psychometric properties in terms of validity and reliability, as well as statistical methods to analyze students' responses for drawing conclusions.

Sampling

The study's sample was drawn from the government secondary schools in the Hawalli Governorate in the State of Kuwait. The participants were randomly selected from the whole population, and the final sample comprised 169 male and 179 female students, from both scientific and literary branches, making a total of 348 participants. The sample also represented 163 citizens and 185 residents in the state of Kuwait.

Instruments

This study focused on three main variables: Metacognitive, Systemic Intelligence, and Mindfulness. Three primary measurement tools were employed, one for each variable, to study the sample and assess their scores. The Metacognitive Thinking Scale, developed by Ebidat (2009), consisted of 24 items, each presenting four choices. The participants were required to select one of the four choices for each item, and responses were collected on a four-point Likert scale. The second scale, Systemic thinking scale, was developed by Dolansky & Moore (2011). It was translated into Arabic for this study. The scale consisted of 16 items, encompassing a single dimension represented by Systemic Intelligence. The responses were collected on a five-point multiple-choice Likert scale. The highest possible total score for the respondent was 80 points, while the lowest was 16 points. A higher score indicated a higher level of the respondent on the mentioned scale, and vice versa. The third scale, the Mindfulness Scale, was developed by Abdulrahman (2016). It consisted of five dimensions: Observation, Description, Dealing with Awareness, Withholding Judgments, and Avoiding Reactions. It included 20 items, and the highest score a respondent could achieve was 100 points, while the lowest was 20 points. A high score reflected a high level of mindfulness in respondents, and conversely, a low score indicated lower mindfulness.

Data Analysis

Right at the outset, the validity and reliability of all the three scales of the study were confirmed study tools, through a pilot study and prior to applying them on the final sample. The quantitative data of all three scales were entered into SPSS program to obtain the descriptive statistics. Finally, all score were analyzed and the obtained results were tabulated for presentation.

Results and Discussion

As a first step in the current study, all study tools were applied to a pilot study to confirm and ensure the psychometric properties of the tools, including their validity, reliability, suitable duration of application, and the integrity of the items in the scales. There were three scales, Metacognitive Thinking Scale, Systematic Thinking Scale and Mindfulness Scale. The pilot study consisted of (n=124) students, from the secondary stage in the Hawalli Educational Zone, aged between (16-18) years, with an average age (Age mean) of 17.4 years. They were selected from four secondary schools, representing both scientific and literary branches in their final year (Grade 12) of their current study.

The first scale, Metacognitive Thinking Scale comprised three dimensions or components: knowledge awareness, knowledge organization, and knowledge processing. The highest achievable score on this scale was 96, indicating a high level of metacognitive element. On the other hand, the lowest score was 15, reflecting a lower level of proficiency. The discrimination validity of this scale was calculated using the discrimination validity statistical method, by calculating the significance of the differences between the means of the low and high quartiles of metacognitive using a t-test. The calculated t-value was (18.1), and the associated statistical significance value was (Sig = .000), which is less than the significance level (P= .01). This indicates the presence of statistically significant differences between the means of the low and high quartiles in metacognitive for the survey study sample, favoring the upper quartile. Therefore, it was confirmed that the mentioned scale has discrimination validity, demonstrating its ability to distinguish between the lower and upper quartiles.

As for the reliability of the scale, it was calculated using Cronbach's Alpha, and the computed value was (α = .87). This is statistically significant and high value, which is scientifically acceptable. From this, we can confidently affirm that the Metacognitive Thinking Scale possessed the required validity and reliability. Hence, it was applied in the current study to achieve the intended research objectives.

The second scale, Systemic Thinking Scale, had the highest possible total score for all respondents (80) points while the lowest was (16) points. A higher score indicated a higher level of the thinking ability of the respondent on the mentioned scale, and vice versa. The validity of this scale was assessed using discrimination validity by comparing the scores of the lowest and highest quartiles through a t-test. The calculated t-value was (17.5), with a corresponding probability value (Sig = .000), which was less than the significance level (P= .01). This indicated statistically significant differences between the average scores of the lower and upper quartiles of Systemic Thinking in the survey sample, favoring the upper quartile. Thus, it was confirmed that the Systemic thinking Scale possessed discrimination validity, demonstrating its ability to distinguish between the scores of the lower and upper quartiles. The reliability of this scale was calculated using Cronbach's Alpha, and the computed value was (α= .77), which was statistically acceptable to ensure the scale's stability. Therefore, we can confirm that the Systemic Thinking Scale possessed the required validity and reliability.

The third scale, the Mindfulness Scale, had the highest score of (100) points, while the lowest was (20) points. A high score reflected a high level of mindfulness in respondents, and conversely, a low score indicated lower mindfulness. The validity of this scale was assessed using discriminant validity and by calculating the significance of the differences between the average scores of respondents in the lower and upper quartiles of mindfulness using a t-test. The calculated t-value was (15.8), and the associated statistical significance value was (Sig = .000), which is lower than the significance level (P= .01). This indicated statistically acceptable differences between the average scores of the lower and upper quartiles in the Mindfulness Scale in favour of the upper quartile. Therefore, it was confirmed that the scale demonstrated discriminant validity, distinguishing between the lower and upper quartile scores according to the t-test results. The reliability of the scale was determined by Cronbach's Alpha, which had the computed value of (a=.70), which was statistically acceptable, confirming the reliability of the scale. Thus, it was confirmed that the Mindfulness Scale also exhibited the required validity and reliability, making it suitable for application in the current study to achieve the study's objectives. After confirming the validity and reliability of the study tools, the three scales were applied to the final study sample, consisting of secondary school students (n= 348), comprising 169 male 179 female students, from both scientific and literary branches. The sample represented citizens (n=163) and residents (n=185) in the state of Kuwait.

Result of the First Hypothesis

This hypothesis aimed to find out whether there was a positively significant correlation between metacognitive thinking and systemic thinking in the total sample of the study, encompassing both genders. To verify and confirm this hypothesis, the Pearson correlation coefficient test was employed as a statistical analysis method to obtain the correlation coefficient value between the two aforementioned variables. Table 1 illustrates the results obtained.

Table 1. *Correlation Coefficients Between Metacognitive and System Thinking.*

Variable	Metacognitive
Systems Thinking	** 56

N=348, **P ≤ .01

Table 1 indicates that the correlation coefficient value between metacognitive thinking and systemic thinking in the total study sample was estimated at (r = 0.56). This value is statistically significant at the required significance level (P = 0.01), suggesting a positive correlation between the mentioned variables. In other words, as one of them increases by a certain amount, the other increases proportionally with the increase in the first variable, and vice versa. This positive correlation is named as such due to the pursuit between them. The opposite applies to a negative correlation.

Such a result reflects multiple statistical and cognitive indicators. It is evident from this result that the components of both variables are intertwined, and there is an interaction between them when individuals face any problems or situations in their surrounding environments. Both variables positively influence each other in a reciprocal relationship. A successful educational administration can leverage this correlational relationship between these variables in various educational environments, activities, and curricula. This positive interaction can have a constructive impact on students' abilities, personalities, and academic achievements.

This result is consistent with Alkazraji (2013), who pointed out that when the systemic approach was applied to the experimental sample, there was an increase in the level and degree of individuals in terms of metacognitive skills and academic achievement in mathematics compared to the control group, which received conventional training methods. This result is also consistent with Cabrera & Cabrera (2021), who argued that

activating the components of systemic thinking made the individual aware of various aspects and the nature of the problem. However, leveraging metacognitive abilities concurrently enhanced the effectiveness of systemic thinking to a greater degree, facilitating the decision-making process and generating appropriate solutions based on the specific context or problem.

The outcome of this study, in accordance with the first hypothesis, also aligns with the findings of Alselmy (2017) and McKim & McKendree (2020). Hence, the first hypothesis of the study was fully accepted and given successful validation.

Result of the Second Hypothesis

This hypothesis aimed to find out whether there was a statistically significant positive correlation between metacognitive thinking and mindfulness in the sample of both genders. To verify the validity of this hypothesis, the Pearson correlation coefficient test was utilized to elucidate the nature of the relationship between them, if any. Table 2 illustrates the results obtained.

Table 2. *Correlation Coefficients Between Metacognitive and Mindfulness.*

Variable	Metacognitive
Mindfulness	** 27

N=348, **P ≤ .01

Table 2 indicates that the correlation coefficient between metacognitive thinking and mindfulness in the college sample of both genders is estimated at (r = 0.27). This value is acceptable and statistically significant at the required significance level (P = 0.01), indicating a positive and statistically significant correlation between the mentioned variables.

The process of thinking is a kind of mentally processing sensory inputs or retrieving information to form thoughts, draw inferences, or make judgments. Therefore, it is a cognitive process that requires experience, accurate and conscious processing, and focus of mental capabilities on various aspects of the situation, problem, or sensory input. The use of metacognitive thinking requires mindfulness in a situation when a problem is faced. This involves focusing sensory capabilities, maintaining attention, and coordinating them together to interact with sensory inputs. This ensures obtaining thoughts and outputs characterized by the ability to evaluate them beforehand and organize them into a distinctive cognitive framework. The higher the level of mindfulness among students, the lower the negative sensitivity towards situations, leading to a more positive mindset and higher levels of mental health (Ye et al., 2023). Undoubtedly, this will automatically reflect an increase in the levels of metacognitive thinking among students and their academic achievement.

This finding is consistent with Almamory (2018), who also indicated that mindfulness supports self-organization and mental flexibility, enhancing an individual's thinking and self-awareness. When an individual possesses mindfulness, it is reflected in higher levels of cognitive reflection, increased attention focusses on the present moment, away from mental distractions. This, in turn, helps and supports the individual in using metacognitive thinking abilities when facing any problem or challenge in their surrounding environment. These results also align with the findings of a few other studies (Razavizadeh Tabadkan & Mohammadi Poor, 2016; Tahoon et al., 2023). Consequently, the validity of the second hypothesis of the study was accepted, given its complete achievement.

Result of the Third Hypothesis

This hypothesis aimed to find out whether there was statistically significant acceptable difference between the average grades of male and female students in the study variables, namely: meta-cognition, systemic thinking, and mindfulness. To verify this hypothesis, a t-test was performed to indicate differences in the mean scores of the study participants based on their gender. Table 3 illustrates the results obtained in this regard.

Table 3. *t-Test Between the Means of Gander Among Study Variables.*

Variables	Male N=169		Female N=179		t	Sig	P-value
	M	SD	M	SD			
Metacognition	73.1	15.2	73.0	12	.11	.01	.05
Systems thinking	54.5	11.5	56.2	9.7	1.5	.14	.05
Mindfulness	61.2	5.1	60.5	9.5	.84	.00	.05

N=348, **P ≤ .05

Table 3 presents the results of the t-test values, showing the significance of differences between genders in the intended study sample in the three study variables: meta-cognition, systemic thinking, and mindfulness. According to these results, there are statistically significant and acceptable differences between genders (males and females) in the current study sample in the measures of meta-cognition and mindfulness in favor of males. The t-test values for the variables were estimated at (t=0.11, 0.84), respectively, with associated probability values equal to (Sig=0.01, 0.00) in sequence. These values are less than the significance

level (0.05), making them statistically significant at the required significance level (0.05). On the other hand, the t-test value for the significance of differences between genders in systemic thinking was estimated at (t=1.5), and it is not statistically significant at the required significance level (0.05).

During the visits to various secondary schools in the Hawalli Educational Zone, direct observations of in-school and extracurricular programs and activities witnessed male students having a larger share of these activities, especially external ones. This included scouting camps, various sports activities, maritime activities, international external participations, and exposure to international experiences and experiments. Such educational and knowledge resources are rarely seen among female students because they adhere to values, social customs, traditions, and societal cultures. The females also do not engage in open sports or travel for international participation in open or mixed activities to the extent that males do. These advantages available to males provided them with motivation and enhanced their ability to acquire various skills and knowledge from local, regional, and international environments surrounding them. This has influenced the elevation of the level and degree of meta-cognition and mindfulness in comparison to females. Although the curricula and textbooks for both genders are identical, these various school activities and programs have played a significant and influential role in shaping the cognitive patterns of male students in the current study sample.

As for the systemic thinking and the absence of statistically significant differences between genders, this can be attributed to the similarity in the nature of social and familial stimuli around individuals in the study sample. Such stimuli serve as a significant source for inspiration and acquiring various systemic thinking skills and abilities. Otherwise, there would have been differences between genders if these stimuli were different. These results differ with a few previous studies (Abdulhamid, 2020; Alqaqa'a, 2022; Alselmy, 2017; Han et al., 2023; Kresat, 2016; Tahoon et al., 2023) regarding the absence of differences between genders in metacognitive thinking. However, other studies have agreed with the finding that females lacked strong cognitive skills (Aljarah & Alebedat, 2011; Alnajar et al., 2019; Break, 2014; Essa, 2018). As for the result of the absence of statistically significant differences attributed to gender in the variable of systemic thinking, the result aligns with studies like Ahmed Diab (2015) and Abdullatif (2011). These studies, too, indicated the absence of acceptable significant differences between genders in some components of systemic thinking.

Finally, concerning the result of gender differences in mindfulness in this study, it differed from the results of studies such as (Alsayed, 2018; Alshabawy, 2020; Tahoon et al., 2023), where their results indicated no statistically significant differences in mindfulness attributed to gender. Based on this result, it was possible to partially accept the third hypothesis of this study, that differences were statistically significant in study variables attributed to gender, except for the systemic thinking variable.

Result of the Fourth Hypothesis

This hypothesis aimed to find out whether it was possible to contribute both systemic thinking and mindfulness in influencing and predicting the metacognitive for the total sample of the college study from both genders. To verify and confirm the validity of this hypothesis, a statistical analysis called regression analysis was used .Regression analysis is used to examine and verify the hypothesis regarding the extent of the contribution of study variables in influencing and predicting the metacognitive for the entire sample of the college study. The regression function is a linear combination/synthesis of independent variables selected for their strength and impact on the dependent variable. The value of multiple linear regression can be calculated using the matrix method or the Least Squares Method. However, the latter is the easier and more commonly used method for estimating the regression equation, which is:

$$Y_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k + e_i$$

Through the use of regression analysis, where the independent variables were entered into the regression model according to their ability to distinguish and impact in order in the dependent variable, and using the (SPSS) software, a suitable model was obtained that aligns with the data used in this study. The value (B) indicated as a regression coefficient or simply a coefficient, represents the estimated change in the dependent variable for a one-unit change in the corresponding independent variable, while holding all other independent variables constant. While the value of (Beta) refers to the standardized coefficients. Table 4 shows the results achieved in this regard.

Table 4. *Regression Analysis for Contribution of Independent Variables in Prediction of Dependent Variable.*

Independent Variables	B	SE	Beta	t	Sig
Metacognitive	.68	.05	.53	12.1	.000
Systems thinking	.31	.07	.18	4.0	.000
Model	F= 94.1		R=.59		

*N=348, Dependent variable: Metacognitive

Table 4 indicates the result of the regression analysis to demonstrate the extent to which independent variables, namely, systematic thinking and mindfulness, contribute to the impact and prediction of the dependent variable, which is metacognitive, among the entire sample of the study. It is evident from the values presented in Table 4 that the mentioned independent variables have the ability to predict the

dependent variable. The t-values are (t = 12.1, 4.0) for systematic thinking and mindfulness, respectively. The associated probability values (Sig = .000) are less than the significance level (05.) and even (01.), making them statistically significant and acceptable for predicting the dependent variable represented by metacognitive. Referring to the regression coefficients (B), it can be concluded that the variable with the most significant impact and prediction on the dependent variable is systematic thinking, accounting for (68%) of the contribution, followed by mindfulness with a contribution of (31%.).

Based on the results of the regression analysis and the values mentioned in the table regarding the contribution of independent variables to predicting metacognitive, such results indicate that both mentioned independent variables can be utilized and activated by male and female students within the current study sample. This could help them refine and shape their cognitive abilities, reflecting this refinement in their ability to influence and predict metacognitive. The independent variables act as fuel that motivates individuals to work and achieve by developing and fully supporting the individual's cognitive abilities through the interaction and interplay between the components of the independent variables. This is done with an awareness of continuous feedback between the components of the system, along with the ability to perceive the role of personality within the system and control its elements in various ways. Ultimately, this process generates thinking characterized by the ability to perceive beyond knowledge with its various components and capabilities. Undoubtedly, this provides the ability to confidently confront the stimuli surrounding individuals.

This finding partly aligns with the findings of Alselmy (2017), who indicated that systemic intelligence had the ability to predict metacognition. Systemic thinking includes several skills such as the ability to analyze shapes, perceive relationships, complete relationships within a shape, and then the ability to draw systemic shapes (Alyakouby, 2010). On the other hand, mindfulness skills include the ability to have an open and receptive attention to knowledge in the present moment, and awareness that arises through intentional attention in an open way to what is happening in the present moment (Lau et al., 2006). Such higher cognitive skills pave the way and support the development of metacognitive, enabling its emergence and activation in various situations and stimuli surrounding individuals. These principles are carefully planned and systematically implemented by the university administration, discouraging students from hatred, aggression, selfishness.

Hence, the independent variables demonstrated the ability to predict the level and degree of metacognitive in the current study sample. Based on this result, the fourth hypothesis of this study was also validated by the ability of independent variables to influence and predict the dependent variable.

Conclusion

In the context of this study, as demonstrated in the statistical analyses. It can be predicted that metacognition holds great importance and capability in the educational process. It helps control and guide thinking processes, enhances reading and memorization skills, predicts main ideas, and contributes to the development of critical and creative thinking. It also became evident in this study that human thinking is manifested in cognitive mental activities, mental representations of information, and past, present, and anticipated experiences.

The ability to think is the foundation of learning and progress at the level of human society. Undoubtedly, it is difficult to achieve significant benefits from this type of thinking without studying various related variables, including systemic thinking and mindfulness. Through these variables, the ability to think beyond knowledge in students can be supported and enhanced. The study also found that the ability to think is the foundation of learning, gaining experiences, solving problems, and making appropriate decisions to achieve psychological and social harmony, as well as academic and professional success. Therefore, thinking methods play a crucial role in various aspects of life, serving as the fundamental pillar upon which all theoretical and scientific disciplines are built. When the capacities related to different thinking methods are strengthened and enhanced, students can contemplate deeply, analyze situations and life problems more profoundly, and confidently arrive at optimal solutions.

Several obstacles and limitations were encountered during this study. For example, there was the scarcity of previous studies that investigated metacognitive and its relationship with systemic thinking and mindfulness in a single study. Secondly, the current study variables were not given attention as important cognitive variables in shaping the cognitive framework and model among students in schools in Kuwait. Consequently, the general framework of the nature of the relationship and interaction between systemic thinking and mindfulness in predicting metacognitive was shrouded in ambiguity and lack of clarity due to the scarcity of previous studies' results in this field and limited scholarly evidence related to the variables of this study. Despite these challenges, the application of this study, with its originality, may contribute to future studies, and it has outlined the future vision of the role and importance of systemic thinking and mindfulness in enhancing and supporting metacognitive.

There are a few recommendations based on the research conducted. First and foremost, school administrations should develop their educational plans and strategies to incorporate various educational methods, activities, and programs that can enhance students' cognitive abilities in general. Specifically, they should focus on reinforcing metacognitive, systemic thinking, and mindfulness to achieve modern, contemporary, and progressive educational goals. These efforts should align with the latest developments, theories, and educational philosophies. Secondly, it is necessary to expand the conduct of comprehensive theoretical and experimental studies and their application in the field of metacognitive and its relationship with the current study variables on one hand, and other variables on the other hand Third, it is necessary to emphasize the inclusion of school curricula, educational activities, and educational programs with skills and strategies to activate applications of metacognitive, systemic thinking, and mindfulness to support cognitive abilities among students of both genders. Fourth, there is a need to create a cognitive awareness counseling program for school administrations and students, providing insights into mechanisms and strategies to activate metacognitive, systemic thinking, and mindfulness, aiming to develop cognitive abilities and skills for all individuals working in the educational environment, not just students. Finally, adequate importance should be given to prepare and standardize new psychological and educational measures and tools to measure the relevant study variables, with the goal of keeping up with their dimensions and components to the latest cognitive, psychological, and educational developments in this field.

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