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Cognitive distortions and their impact on metacognitive awareness: A study with sports science students

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Abstract

This study investigated the relationship between university students' levels of metacognitive awareness and the presence of cognitive distortions in their cognitive processes. The sample consisted of 384 students from the Faculty of Physical Education and Sports Sciences. Data were collected using the Physical Formation Form, the Metacognitive Awareness Scale, and the Cognitive Distortion Scale. Pearson correlation and regression analyses were conducted to examine the relationships between variables. A significant negative relationship was found between metacognitive awareness and cognitive distortions. In the regression analysis, where metacognitive awareness was the dependent variable, cognitive distortions were found to have a negative predictive effect. Overall, the findings revealed that higher levels of cognitive distortions were associated with lower levels of metacognitive awareness among university students. It can be concluded that enhancing university students' metacognitive awareness may contribute to reducing their cognitive distortions.

Introduction

Today, the significance of cognitive processes and decision-making in shaping individuals' lives is increasingly recognized as a crucial area of study. Since decisions play a central role in guiding our lives, impulsive and unconscious decisions often stemming from cognitive distortions can lead to negative consequences. This is particularly relevant for university students, who are at a pivotal stage in their development. In contrast, self-awareness and reflective thinking key components of metacognitive awareness form the foundation for making more deliberate and informed choices in all areas of life. Therefore, this study aims to contribute to the literature by addressing the cognitive processes and metacognitive development of university students. By fostering metacognitive awareness, it may be possible to reduce the occurrence of cognitive distortions and promote more conscious, reflective decision-making. Cognitive distortions arise from flawed or incomplete cognitive processing and are often rooted in beliefs or schemas formed during childhood or developed later in life (Beck, 2001). These distortions influence not only specific situations but also individuals' broader evaluations, thereby affecting various aspects of their lives (Kuyucu, 2007). Following the evaluative process, cognitive distortions can result in erroneous assumptions, misunderstandings, and dysfunctional attitudes, depending on the individual's interpretation (Ağır, 2007; Türkçapar, 2015). Often referred to as thinking errors, cognitive distortions are categorized into eleven types: arbitrary inference, selective abstraction (mental filtering), overgeneralization, magnification and minimization, dichotomous (all-or-nothing) thinking, personalization, catastrophizing, "should" statements, emotional reasoning, and labeling. These patterns represent distorted and dysfunctional ways of thinking that negatively influence how individuals perceive themselves, their current situations, and their futures. Such cognitive patterns often result in evaluations that are inconsistent with reality and

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may cause emotional distress. Furthermore, individuals frequently accept these thoughts without questioning their validity (Türkçapar, 2018). Epözdemir (2022) found that sub-dimensions of students' cognitive distortion levels had a significant impact on their academic achievement. Since academic performance can shape students' futures and trigger both positive and negative emotional responses, understanding the role of cognitive distortions is essential.

The concept of metacognitive awareness is rooted in conscious self-regulation, evaluation, planning, behavior control, and monitoring of the learning process. It involves understanding how one learns and developing lifelong metacognitive skills (Selçioğlu Demirsöz, 2010). Metacognitive awareness encompasses not only what individuals know but also their reflections on how they feel, think, and regulate those thoughts.

According to Norman et al. (2019), although conceptualizations may differ across disciplines, all metacognitive activities fundamentally stem from an individual's awareness of their own cognitive processes. Through this awareness, individuals are able to monitor and control their cognitive activities.

Although metacognitive knowledge includes various constructs, three widely accepted dimensions can be identified: 1) *Strategic Knowledge:* The use of learning and thinking strategies. 2) *Self-Awareness:* A critical component of conceptual knowledge and metacognition, referring to an individual's understanding of their own strengths and weaknesses. For example, if a student realizes they struggle with a particular subject, they may adopt alternative strategies. Similarly, recognizing difficulties with certain test formats may lead them to use methods better suited to their learning style (Pintrich, 2002). 3) *Cognitive Monitoring and Evaluation:* The ability to assess one's own understanding and progress.

Significant correlations have been found between metacognitive components such as awareness, cognitive strategies, self-regulation, and evaluation, and students' reading comprehension and academic success (Çetinkaya, 2000).

According to the *Dual Process Theory* developed by Amos Tversky and Daniel Kahneman, individuals utilize two systems for processing information: *System 1:* Fast, intuitive, and effortless. *System 2:* Slow, analytical, conscious, and effortful.

Since System 1 operates automatically and rapidly, it is more susceptible to cognitive biases and errors. In contrast, the deliberate and reflective nature of System 2 supports more accurate decision-making, guided by cognitive awareness (Kahneman, 2011; Tversky & Kahneman, 1990). Based on this theory, as individuals' cognitive awareness increases, they become more resilient against the cognitive distortions that stem from rapid, biased, and intuitive thinking. In other words, individuals who actively engage in monitoring, regulating, and reflecting on their thoughts are better equipped to manage and resist cognitive distortions.

Drawing from the literature, this study proposes that enhancing cognitive awareness can help prevent the distortions that lead to bias, error, and misjudgment in both academic and everyday contexts. Developing such awareness may enable students to make more conscious, rational, and analytically driven decisions, ultimately empowering them to take positive steps toward shaping their educational and personal futures.

The central question guiding this study is what impact university students' levels of cognitive awareness have on the prevalence of cognitive distortions. Given the importance of enhancing self-awareness and reducing cognitive distortions to foster more accurate cognitive insight, it is assumed that there is a significant relationship between students' cognitive awareness and their cognitive distortions. Specifically, it is hypothesised that there is a negative correlation between cognitive awareness and cognitive distortions, such that an increase in cognitive awareness is associated with a decrease in cognitive distortions.

Method

Research Model

The research model employed in this study, which investigates the relationship between metacognitive awareness and cognitive distortions, is the relational screening model as defined by Karasar (2007).

Sample Size

The required sample size was calculated using G*Power analysis. A linear bivariate regression analysis was used to determine the appropriate sample size for identifying a statistically significant slope in a one-tailed hypothesis test. The hypothesized slope under the alternative hypothesis

(H1) was set at 0.17, while the null hypothesis (H0) slope was set at 0. The standard deviations of both the independent (σx) and dependent (σy) variables were assumed to be 1. The significance level (α) was set at 0.05, and the desired statistical power was 0.95.

According to this analysis, to detect a slope of 0.17 with 95% power at a 5% significance level in a one-tailed test, a sample size of 366 is required. The noncentrality parameter represents the expected effect size under the alternative hypothesis, and the critical t-value marks the threshold for statistical significance given the specified alpha level and degrees of freedom.

This approach is consistent with the statistical power analysis framework for linear regression as outlined by Cohen (1988). Performing a power analysis ensures that the study is sufficiently powered to detect meaningful effects, thereby reducing the risk of Type II errors—failing to identify a true relationship.

Participants

The study population consisted of university students enrolled in the Faculty of Sports Sciences at (Anonymized) University. The sample was selected using the simple random sampling method. In this method, each unit in the population has an equal chance of being selected. If the population size is denoted as N and the sample size as n, then the probability of any unit being selected is n/N (Ural & Kılıç, 2005).

All class levels from the Departments of Physical Education and Sports Teaching, Coaching, Sports Management, and Recreation were included. Students whose sequence numbers were even on the class lists were selected. From a total of 16 classes, an average of 24 students was selected per class (this number may vary slightly depending on class size). As a result, a total of 384 students out of approximately 850 were included in the study.

The study was conducted at (Anonymized) University Faculty of Sports Sciences. The inclusion criteria for participants were: 1) Being a student at (Anonymized) University, 2) Being over the age of 18, 3)Being enrolled in the Faculty of Sports Sciences.

Institutional Review Board Statement

This study was approved by the (Anonymized) University Institute of Health Sciences, Social and Human Sciences Ethics Committee (Approval No: 240; Approval Date: 28.05.2024). Written informed consent was obtained from all participants prior to data collection.

Data Collection Tools

Demographic information form

This form consists of a total of 8 items designed to gather basic demographic information from university students, including age, gender, department, general grade point average (GPA), class level, employment status, intention for graduate education, and monthly income.

Metacognitive awareness inventory

The "Metacognitive Awareness Inventory (MAI)" developed by Schraw and Dennison (1994) was used to collect data on students' metacognitive awareness. The Turkish adaptation of the scale was conducted by Abacı et al. (2007). The MAI is a 5-point Likert-type scale composed of 52 items and two main dimensions: Knowledge of Cognition and Regulation of Cognition.

Knowledge of Cognition includes the sub-dimensions of declarative knowledge, procedural knowledge, and conditional knowledge.

Regulation of Cognition includes the sub-dimensions of planning, information management, monitoring, debugging, and evaluation.

The overall internal consistency reliability coefficient of the MAI is 0.95 (Akın et al., 2007). The total score ranges from 52 to 260. Since the inventory does not include any negatively worded items, higher scores indicate higher levels of metacognitive awareness. To interpret an individual's awareness level, the total score is divided by the number of items (52). A score below 2.5 suggests low metacognitive awareness, while a score above 2.5 indicates high metacognitive awareness.

Cognitive distortions scale

The original 15-item Cognitive Distortions Scale was developed by de Oliveira (2015) to measure the intensity and frequency of cognitive distortions experienced by individuals over the past week. The Turkish validation of the scale was conducted by Batmaz et al. (2015).

This self-report questionnaire assesses 15 types of cognitive distortions. Participants are asked to rate both the frequency and intensity of each distortion. Frequency options include:

(a) Never,

(b) Occasionally (1–2 days),

(c) Most of the time (3–5 days),

(d) Almost always (6–7 days).

For intensity, participants are asked how strongly they believe in these distortions, with the following options:

(a) Not at all,

(b) A little (up to 30%),

(c) A lot (30–70%),

(d) A great deal (more than 70%).

The responses are scored using a 4x4 matrix, with each cell assigned a value ranging from 0 to 5. The scale yields three scores: (i) frequency score, (ii) intensity score, and (iii) total (composite) score, which is the sum of the frequency and intensity scores across all items (Batmaz et al., 2015).

Data Analysis

The data were analyzed using SPSS version 25. Normality of the distribution was assessed using skewness-kurtosis coefficients and Q-Q and P-P plots. Frequency analysis was employed to evaluate demographic variables. Pearson correlation analysis and regression analysis were used to examine relationships between variables.

Results

Table 1 presents the distribution of the students' demographic characteristics. Table 2 displays the minimum, maximum, mean, standard deviation, Kurtosis, and Skewness values for the typical distributions of the scale scores.

Fisher's Z transformation was applied to the correlation presented in Table 3 between Metacognitive Awareness and Cognitive Distortions ($r = -0.58$; $p < .001$), yielding a Z score of 0.66. The results revealed a strong negative correlation between students' metacognitive awareness and cognitive distortions. This finding suggests that as metacognitive awareness increases, cognitive distortions tend to decrease. The use of Fisher's Z transformation allowed for a more precise interpretation of the strength and direction of this relationship, facilitating comparison with other correlations by converting the r value into a normally distributed Z score.

Table 1
Demographic characteristics.

Variables	Groups	n	%
		384	100
Gender	Female	159	41.4
	Male	225	58.6
Age	18-20 Years Old	106	27.6
	21-23 Years Old	136	35.4
	24-26 Years Old	109	28.4
	27 Years and Above	33	8.6
Grade	1	102	26.6
	2	107	27.9
	3	110	28.6
	4	65	16.9
Department	Teaching	97	25.3
	Coaching	102	26.6
	Sports Management	91	23.7
	Recreation	94	24.5
General Grade Average (GPA)	2.00-2.50	94	24.5
	2.51-3.00	202	52.6
	3.01 and above	88	22.9
Working Status	Yes	170	44.3
	No	214	55.7
Income	0-5.000 TL	195	50.8
	5001-10.000 TL	73	19.0
	10.001-15.000 TL	59	15.4
	15.001 TL and Above	57	14.8
Postgraduate Education Expectations	Yes	178	46.4
	No	206	53.6

Table 2
Normality distributions of scale scores.

Scales	n	Min.	Max.	Mean	SD	Skewness	Kurtosis
Metacognitive Awareness	384	1	5	3.59	.63	-.22	.61
Cognitive Distortions	384	0	61	26.27	13.20	.29	-.65

Table 3
The relationship between scale scores.

	Mean	SD	Metacognitive Awareness	Cognitive Distortions
Metacognitive Awareness	3.59	.63	1	-.58**
Cognitive Distortions	26.28	13.21	-.58**	1

*p < .05; ** p < .01; n = 384.*

Table 4
Regression analysis of participants' metacognitive awareness and cognitive distortions

		ß (Standardized)	ß (Unstandardized)	SE	t	p
Metacognitive Awareness	Cognitive Distortions	-.58	-.03	.00	-13.90	.000
		R= .58; R^2=.34; Adj.R^2= .33; F= 193.22; p= .00				
		Mean=1.88; Std. Dev.=0.999; n=384				

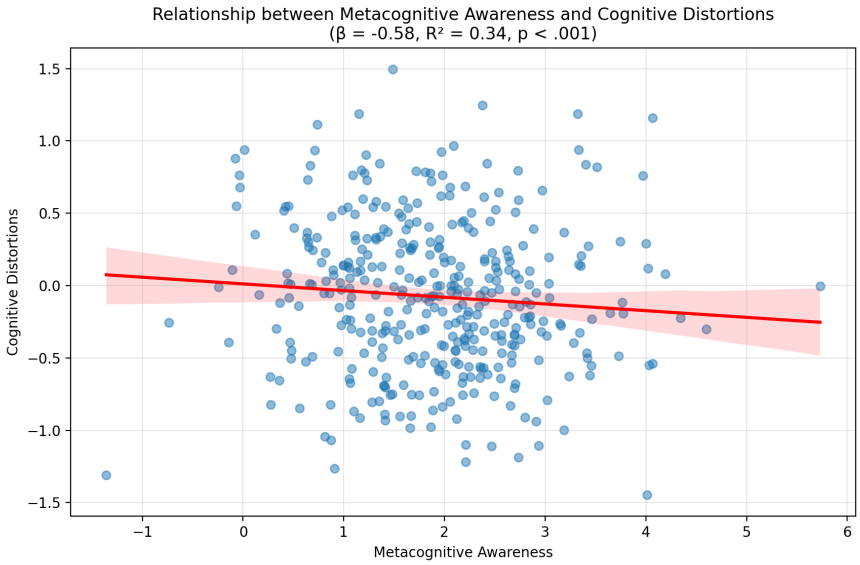

Figure 1. Scatterplot demonstrating the relationship between metacognitive awareness and cognitive distortions.

Table 4 presents a statistically significant relationship between Metacognitive Awareness and Cognitive Distortions (R = .58; R^2 = .34, p < .05). The R^2 value indicates that 34% of the variance in metacognitive awareness can be explained by cognitive distortions. The t-test results (t = -13.90; p < .001) show that cognitive distortions are a significant negative predictor of metacognitive awareness. Additionally, the F-test result (F = 193.22; p < .05) confirms the overall significance of the regression model. These findings suggest that as cognitive distortions increase, levels of metacognitive awareness decrease, supporting the presence of a strong negative predictive relationship.

The figure 1 illustrates the negative relationship between metacognitive awareness and cognitive distortions, as supported by the regression output (β=−0.58; R^2 =0.34; p<.001). The red line represents the regression line, while the scatter points depict the distribution of the data. As metacognitive awareness increases, cognitive distortions tend to decrease.

Discussion

Examining the research findings reveals the following demographic characteristics of the participants, as determined through frequency analysis: 41.4% of the students were female, and 58.6% were male. The age distribution of the participants was as follows: 27.6% were aged 18-20, 35.4% were aged 21-23, 28.4% were aged 24-26, and 8.6% were aged 27 and over. Regarding their

academic year, 26.6% were in their first year, 27.9% in their second year, 28.6% in their third year, and 16.9% in their fourth year. The distribution of participants across departments was: 25.3% were students of the department of teaching, 26.6% of the department of coaching, 23.7% of the department of sports management, and 24.5% of the department of recreation.

In a related study, Yavuzer (2015) investigated the relationship between self-handicapping behaviors, cognitive distortions, and self-esteem among education faculty students. The study found that women exhibited higher self-handicapping scores compared to men.

An examination of the participants' Grade Point Average (GPA) distribution revealed that 24.5% had a GPA between 2.00 and 2.51, 52.6% had a GPA between 2.51 and 3.00, and 22.9% had a GPA of 3.01 and above. Regarding the participants' employment status, 44.3% were employed in some capacity, while 55.7% were not. When their income levels were analyzed, it was found that 50.8% had an income between 0 and 5,000 TL, 19.0% between 5,001 and 10,000 TL, 15.4% between 10,001 and 15,000 TL, and 14.8% had an income of 15,001 TL and above. In terms of their expectations for graduate education, 46.4% intended to pursue graduate studies, while 53.6% did not.

Correlation analysis was employed to explore the relationships between Metacognitive Awareness and Cognitive Distortion. The findings indicated a significant negative relationship between these two variables. Fisher's Z score, which further clarifies the strength and direction of this relationship, also pointed to a negative association between Metacognitive Awareness and Cognitive Distortion. This suggests that enhancing Metacognitive Awareness within the sample could significantly contribute to reducing individuals' levels of Cognitive Distortion.

Karakelle (2012) identified significant relationships between metacognitive awareness, perception of problem-solving, and the need for thinking. Existing literature underscores the importance of metacognitive awareness for students, highlighting that university students' metacognitive awareness is linked to their problem-solving abilities and cognitive engagement. Students with low metacognitive awareness may also exhibit weaker problem-solving skills and reduced cognitive participation. Özsoy et al. (2010) concluded that teacher candidates in their third and fourth years demonstrated higher levels of metacognitive awareness compared to those in their first and second years. Literature generally suggests that as individuals mature, gain experience, and progress academically, their metacognitive awareness tends to increase. This development may be supported by individuals' growing self-awareness. Cengiz (2017) found in a study with adolescents that cognitive distortion scores were significantly related to emotional reactivity, depression, and anxiety scores. The literature indicates that cognitive distortions can be negatively influenced by emotional reactivity and depression, often triggered by impulsive decisions. The findings of a study by Jelinek et al. (2013) revealed that metacognitive training administered to patients with depression significantly reduced cognitive distortions and biases. These findings in the literature align with the results of our current study.

Finally, this study analyzed a regression model with Metacognitive Awareness as the dependent variable and Cognitive Distortions as the independent variable. The findings indicated that Cognitive Distortions significantly predicted Metacognitive Awareness, suggesting that the participants' levels of Cognitive Distortion explained their degree of Metacognitive Awareness.

Duman et al. (2019) noted that cognitive distortions can lead to hopelessness by negatively impacting individuals' future expectations, problem-solving approaches, and environmental adaptation. Consistent with our findings and existing literature, cognitive distortions in university students appear to negatively influence their thinking and decision-making processes. However, fostering metacognitive awareness can potentially mitigate these cognitive distortions, enabling a more calm and conscious approach to both life plans and academic pursuits. Özgüç (2020) found that metacognitive training significantly reduced the frequency of patients' use of all types of cognitive distortions, with 'personalization' showing the most notable decrease. In contrast, the control group showed no significant changes post-test, except for 'all-or-nothing thinking'. These literature findings support our study's results and the inference that metacognitive training can be effective in reducing cognitive distortions.

Implications for Practice

The observed negative relationship between university students' metacognitive awareness and cognitive distortions underscores the need for programs designed to enhance students' ability to evaluate their knowledge, encourage the expression of thoughts, and develop self-awareness as learners (Lin, 2001). Preventing cognitive distortions is also crucial. Empowering students to manage their cognitive processes through greater self-knowledge is vital in mitigating negative outcomes associated with these distortions. One effective strategy for promoting metacognitive awareness involves encouraging students to reflect on their activities and prompting them with questions like, "How do you know?" or "What can you say about this?" (Kuhn & David, 2004).

Limitations of the Study

This research was limited to students within the Faculty of Sports Sciences at (Anonymized) University. The study utilized only a demographic information form, the Metacognitive Awareness Inventory, and the Cognitive Distortions Scale. The participant pool consisted of 384 university students.

Suggestions

Given the negative correlation found between metacognitive awareness and cognitive distortion, providing university students with education and guidance aimed at improving their cognitive processes, fostering diverse thinking skills, and encouraging consideration of multiple perspectives may help reduce cognitive distortions and their negative consequences. Furthermore, enhancing metacognitive awareness is believed to contribute to more effective planning and management of both academic and post-academic life. Blakey and Spence (1990) argued that teaching metacognitive awareness skills improves students' learning and plays a critical role in addressing daily life challenges and developing problem-solving abilities, a point supported by existing literature.

Conclusion

In conclusion, this study revealed a moderate, negative, and statistically significant relationship between university students' metacognitive awareness and cognitive distortions. Furthermore, the participants' levels of cognitive distortion were found to predict their levels of metacognitive awareness. This negative relationship suggests that improving metacognitive awareness among university students during their academic years, a crucial period for life decisions, can effectively reduce their cognitive distortions and foster more conscious decision-making in both career and personal life.

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Authors' Contribution

Study Design: OP, MBT; Data Collection: MBT, ÇÇ; Statistical Analysis: VŞG, MBT; Manuscript Preparation: VŞG, OP; Funds Collection: ÇÇ, MBT.

Ethical Approval

The study was approved by the Erciyes University of Social Sciences and Humanities Ethical Committee (2024/240) and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

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Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this research.

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