

Metacognitive Thinking among University Startup founders: Insights from a Saudi Business Incubator

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التفكير ما وراء المعرفي لدى مؤسسي الشركات الناشئة الجامعية: رؤى مستمدة من حاضنة أعمال سعودية

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أستاذ مشارك، قسم علم النفس، كلية العلوم الاجتماعية، جامعة الإمام محمد بن سعود الإسلامية، الرياض، المملكة العربية السعودية

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الملخص:

يعد التفكير ما وراء المعرفي بوصفه القدرة على مراقبة العمليات المعرفية وتقييمها وتنظيمها، من الكفاءات المهمة في اتخاذ القرارات وحل المشكلات. ومع ذلك، لا يزال التفكير ما وراء المعرفي لدى مؤسسي الشركات الناشئة الجامعية، خاصة في سياق حاضنات الأعمال السعودية، بحاجة إلى مزيد من البحث. هدفت الدراسة إلى تحديد مستوى التفكير ما وراء المعرفي لدى مؤسسي الشركات الناشئة المستفيدين من حاضنة الأعمال الجامعية، وفحص الفروق فيه وفقاً للجنس ونوع برنامج ريادة الأعمال. اتبعت الدراسة المنهج الوصفي التحليلي، وشملت عينة عشوائية من 27 مؤسساً (14 ذكراً و13 أنثى). جمعت البيانات باستخدام استمارة للبيانات الديموغرافية وبيانات الشركات الناشئة، ومقياس معتمد للتفكير ما وراء المعرفي يتضمن ثلاثة أبعاد: معرفة المعرفة، وتنظيم المعرفة، والمعالجة المعرفية. أظهر المقياس اتساقاً داخلياً مرتفعاً (كرونباخ ألفا = 0.89؛ سبيرمان-براون = 0.86). واستخدم برنامج SPSS لإجراء الإحصاءات الوصفية واختبارات التوزيع الطبيعي واختبار (t) للعينات المستقلة. أظهرت النتائج ارتفاع مستوى التفكير ما وراء المعرفي لدى المشاركين (م = 4.33، انحراف معياري = 0.50)، مع عدم وجود فروق ذات دلالة إحصائية تعزى إلى الجنس أو نوع برنامج ريادة الأعمال ($p > 0.05$). وتبرز النتائج أهمية دمج التدريب الصريح على مهارات التفكير ما وراء المعرفي في برامج تعليم ريادة الأعمال وحاضنات الأعمال الجامعية.

الكلمات المفتاحية: التفكير ما وراء المعرفي، التنظيم المعرفي، الشركات الناشئة الجامعية، برامج حاضنات الأعمال، ريادة الأعمال

Abstract:

Metacognitive thinking, defined as the ability to monitor, evaluate, and regulate cognitive processes, is an important competency for effective decision-making and problem-solving. However, it remains underexplored among university startup founders, particularly within Saudi business incubator contexts. This study examined the level of metacognitive thinking among startup founders benefiting from the university-based business incubator and investigated differences by gender and entrepreneurship program type. A descriptive-analytical design was used with a random sample of 27 university startup founders (14 males and 13 females). Data were collected using a demographic and startup information form and a validated Metacognitive Thinking Scale covering three dimensions: knowledge of cognition, regulation of cognition, and cognitive processing. The scale demonstrated high internal consistency (Cronbach's $\alpha = .89$; Spearman-Brown = .86). Data were analyzed using SPSS, including descriptive statistics, normality testing, and independent-samples t-tests. Findings indicated a high overall level of metacognitive thinking ($M = 4.33$, $SD = 0.50$), with no statistically significant differences by gender or entrepreneurship program type ($p > .05$). These findings suggest comparable metacognitive thinking levels across participant groups and highlight the importance of integrating explicit metacognitive training into university entrepreneurship education and business incubation programs

Keywords: metacognitive thinking, cognitive regulation, university startups, business incubators, entrepreneurship education

Introduction

Metacognition is widely recognized as one of the most influential constructs in contemporary cognitive regulation of those processes to impart learning and performance (Ormrod, 1995). Livingston (1997) characterized metacognitive thinking as a higher-order form of cognition—*thinking about thinking*—that entails the active supervision of one's cognitive processes, including planning for a task, monitoring comprehension, and evaluating progress. Similarly, Al-Jarrah and Obeidat (2011) conceptualized metacognitive thinking as comprising three interrelated dimensions: knowledge about cognition, organization of knowledge, and processing of knowledge. Through these dimensions, individuals are able to regulate their cognitive activities, direct attention, and adapt their strategies to meet complex intellectual challenges.

As a theoretical construct, metacognitive thinking intersects with several domains in psychology and education, including intelligence, learning, problem-solving, and decision-making. In this regard, Abdulaziz (2007, as cited in Al-Mahdawi, 2016) described metacognition as a higher-order control mechanism that enables individuals to plan, monitor, and evaluate their performance while solving problems. Through this executive control, individuals can manage cognitive resources efficiently, foster independence in thinking, and engage in self-directed reflection, as key attributes of lifelong learning and adaptive expertise. Within this framework, decision-making and problem-solving are also two essential manifestations of higher-order thinking and metacognitive regulation. Swartz and Perkins (1990) posited that these strategies represent fundamental modes of human thought, as individuals continually face challenges and make decisions in everyday life.

Decision-making and problem-solving are closely related structured cognitive processes that can be learned, refined, and intentionally applied (Jarwan, 2007). Jad (2007) defined decision-making as a cognitive and mental process involving the clear identification of a problem, the collection of relevant information, the generation and evaluation of possible alternatives, and the selection of the most effective solution. The core objective of decision-making is to choose the optimal course of action to achieve a desired goal (Jarwan, 2007). Similarly, Harrison (1974) described it as a process of evaluating alternatives in light of available constraints and obstacles, while Heller (1988) emphasized its multistage nature: spanning information gathering, idea generation, assessment of risks and benefits, and final decision execution. Decision-making, therefore, constitutes an essential life skill. Individuals engage in it repeatedly across personal, academic, and professional domains influencing the trajectory of their actions and shaping their behaviors (Hussein & Fakhro, 2002). Concurring with this, Al-Zaghloul and Al-Zaghloul (2003) asserted that most human behaviors are direct outcomes of decision-making processes, as individuals evaluate

psychology (Efklides, 2008; Flavell, 1979). It involves both the knowledge individuals possess about their own cognitive processes and their deliberate re

situations to choose the most suitable responses that maximize benefits and minimize risks. In this sense, decision-making represents a strategic expression of individual thinking style (Sternberg, 1988).

Problem-solving, as Al-Zaghloul and Al-Zaghloul (2003) define it, refers to the process of overcoming difficulties by applying one's accumulated knowledge, reasoning skills, and experiences to clarify ambiguities, resolve contradictions, or remove obstacles. Effective problem-solving requires a blend of courage, creativity, and logical reasoning. It enables individuals to identify viable and efficient alternatives that meet objectives with minimal effort and cost. Swartz (2008, as cited in Al-Humaidien & Yaqub, 2019) contends that problem-solving is a deliberate and reflective process involving conscious selection among competing alternatives, guided by critical judgment and goal-oriented reasoning. This being said, decision-making and problem-solving exemplify the application of metacognitive awareness and regulation in real-world contexts.

Startups as Catalysts for Economic and Educational Transformation

Over the last decades, startups have received a substantial focus from policymakers, international organizations, and academic researchers, for their potential in innovation, job creation, socioeconomic development, technological advancement, and in offering disruptive solutions to emerging market needs, among others (Audretsch & Belitski, 2021). Along with their direct economic contributions, startups play a transformative role in reshaping educational paradigms by fostering entrepreneurial mindsets, problem-solving capacities, and experiential learning among students and graduates (Bărbulescu et al., 2021). Recognizing their importance, the Government of the Kingdom of Saudi Arabia has encouraged the development of the startup ecosystem as part of its broader national transformation agenda (Al-Mukhlafi, 2014). Indeed, Saudi Vision 2030 explicitly calls for the promotion of innovation and entrepreneurship, the expansion of small and medium-sized enterprises (SMEs), and the alignment of educational outcomes with labor market needs. The vision seeks to increase SMEs' contribution to the gross domestic product (GDP) from 20% to 35% by 2030 through the creation of an empowering environment that promotes entrepreneurship, youth employability, and knowledge-based ventures (*Access Initiative for Entrepreneurship*, 2020).

Universities play an influential role in promoting entrepreneurial ecosystems by functioning as incubators of human capital, innovation, and project creation (Audretsch & Theodoraki, 2024). Put differently, thanks to education, mentorship, and incubation programs, higher education institutions act as mediators between

knowledge generation and entrepreneurial practice (Etzkowitz, 2017; Guerrero et al., 2016). In support of this view, the European Commission (2018) underscored that university students and graduates should develop strong entrepreneurial competencies, such as opportunity recognition, resilience, and the ability to initiate and sustain business ventures, to remain competitive in a rapidly growing global economy. Likewise, Arnaout (2017) argued that universities should evolve into entrepreneurial institutions, integrating entrepreneurship education into curricula, promoting self-employment as a learning goal, and cultivating the competencies required to launch successful ventures. This trend is reflected globally in the establishment of university startups, which may emerge either from faculty-led research initiatives or from student innovation projects (*student startups*) (Abdulaziz, 2020).

International indicators, however, suggest that the outcomes of startup initiatives remain insignificant as to job creation, startup survival rates, and value added (*Access Initiative for Entrepreneurship*, 2020). For instance, Riyadh Center for Information and Consulting Studies (2015) conducted a study on 400 startups, and identified several causes underlying startup failure: operational inefficiencies (13%), poor sales performance (11%), lack of commitment (11%), insufficient funding (10%), misuse of financial resources (10%), employee indiscipline (9%), unexpected operational costs (9%), labor shortages (7%), rising raw material prices (6%), rent increases (6%), external competition (6%), and regulatory changes (2%). These findings implied that metacognitive thinking functions as a cognitive foundation for entrepreneurial competence, enabling individuals to plan strategically, navigate business challenges and learn adaptively from experience (Argaam, 2019).

Given the increasing emphasis on entrepreneurship as a catalyst for economic diversification and innovation, understanding the cognitive and metacognitive thinking that underpin entrepreneurial success has become imperative. Empirical evidence underscores the importance of metacognitive skills for entrepreneurial performance. Indeed, while Arasti et al. (2014) and Foda and Radwan (2020) highlighted the significant impact of decision-making competence on business success and greater performance, Kim et al. (2018) reported that problem-solving ability positively influences opportunity recognition and innovative behavior among students. Of particular importance is that Tahiri et al. (2020) emphasized that effective problem-solving and decision-making are crucial for addressing emerging organizational challenges. Notwithstanding, research probing the internal cognitive mechanisms, namely metacognitive thinking that impact on entrepreneurs' decision-making and problem-solving competencies, especially in Arab context like Saudi Arabia, is still limited. Against this background, the current study seeks to investigate the level of metacognitive thinking among university startup founders and examine

potential differences based on demographic and program type variables. Put simply, the study compares those enrolled in business incubator programs with those involved in accelerator programs. It also explores potential gender-based differences in metacognitive thinking to determine whether male and female founders vary in their cognitive self-regulation and reflective practices. On the whole, the study intends to offer insights into how contextual and demographic factors influence metacognitive engagement among emerging entrepreneurs in university-based startup ecosystems.

Research Questions

This study is designed to answer the following research questions:

What is the level of metacognitive thinking among university startup founders?

Are there statistically significant differences in metacognitive thinking among university startup founders by business program type (incubation program vs. business accelerator program)?

Are there statistically significant differences by gender in metacognitive thinking among university startup founders?

Research Hypotheses

Based on the research questions outlined above, the current study posits the following research hypotheses:

H1: University startup founders display a high level of metacognitive thinking across the dimensions of knowledge of cognition, regulation of cognition, and cognitive processing.

H2: There exist differences by program type in metacognitive thinking among university startup founders.

H3: There are statistically significant differences by gender in metacognitive thinking among university startup founders.

Significance of the Study

This study features both theoretical and practical significance about the understanding of metacognitive thinking within entrepreneurial psychology, particularly in the context of university startup founders, a population rarely explored in prior research. From a theoretical perspective, this study will hopefully offer insights into new perspectives on how cognitive self-regulation shapes entrepreneurial decision-making and problem-solving. By analyzing variations in metacognitive thinking according to program type (incubation versus accelerator) and gender, the current study will further enrich the theoretical understanding of the contextual and individual determinants influencing cognitive development in entrepreneurial settings.

Seen from a practical perspective, the study aligns with the broader goals of Saudi Vision 2030, providing data-

driven insights that can guide educational institutions, policymakers, and business incubators in enhancing entrepreneurial ecosystems. The findings will highlight the importance of fostering metacognitive skills as a core component of entrepreneurial training, thereby supporting the development of reflective, adaptive, and self-regulated founders capable of sustaining successful ventures. Moreover, the study will offer practical implications for universities seeking to strengthen their incubation and acceleration programs by embedding cognitive and metacognitive training into curricula and mentorship practices. By equipping emergent entrepreneurs with self-awareness, problem-solving, and decision-making capacities, this study would contribute to preparing a generation of competent, innovative, and resilient entrepreneurs capable of navigating business challenges and driving sustainable economic and educational development.

Literature Review

This section outlines previous studies on metacognitive thinking and its relationship to entrepreneurial skills. Then, it deals with studies tackling university-based startup development, with particular attention to the Saudi context where empirical evidence remains limited.

Studies on Metacognitive Thinking

Metacognitive thinking processes have been the research focus of Bastian and Zucchella (2022), who endeavored to highlight the critical role of the entrepreneur's mind in the internationalization process among nascent entrepreneurs, especially within startup competitions and project development contexts. Their findings revealed that social capital underlies metacognitive awareness and regulation in entrepreneurial context in that it stimulates reflective decision-making and adaptive thinking under uncertainty or when facing challenges. Importantly, entrepreneurs were found to engage in feedback-oriented cognition, evaluate alternatives, and refine their strategies, processes essential to metacognitive control. In a similar vein, Al-Shuraida (2019) conducted a study on the predictive role of metacognitive thinking on entrepreneurial skills among graduate students at Umm Al-Qura University, Kingdom of Saudi Arabia. To this end, he deployed validated Arabic adaptations of Schraw and Dennison's (1994) *Metacognitive Awareness Inventory* and Florin and Rossiter's (2007) *Entrepreneurial Skills Scale*. Results highlight high metacognitive levels across all dimensions and above-average entrepreneurial skills. More importantly, metacognitive thinking was a significant predictor of entrepreneurial competence, confirming its developmental role in cognitive control and opportunity recognition.

Similarly, Al-Humaidien and Yacoub (2019), drawing on a multivariate design, found that metacognitive strategies and deep processing positively predicted

problem-solving skills among Jordanian secondary school students. More specifically, they showed that metacognitive strategies accounted for 44% of the variance in problem-solving ability, suggesting their strong explanatory power. These findings support the growing body of evidence linking metacognitive regulation to cognitive adaptability and executive control (Flavell, 1979; Veenman, 2011). Building on this perspective, Kim et al. (2018) explored the relationship between problem-solving ability, innovative behavior, and opportunity recognition among entrepreneurship students in Korean universities. The study revealed that problem-solving ability significantly enhanced both innovation behavior and opportunity recognition, highlighting metacognition as a psychological mechanism that mediates between learning experiences and entrepreneurial creativity.

Other regional studies have expanded their focus on metacognition to comprise academic settings. For instance, Kharisat (2016) found generally high metacognitive awareness among Jordanian undergraduates, with academic achievement emerging as a distinguishing variable. Al-Mahdawi (2016), on the other hand, reported a significant relationship between metacognition and problem-solving styles among Saudi students, though gender and major or specialty differences were nonsignificant. Al-Jbeili (2013), using a large sample of Saudi students, found only moderate levels of problem-solving ability. This finding could reflect the impact of contextual and pedagogical factors on metacognitive skill development. Overall, these findings seem to confirm that metacognitive thinking remains a vital cognitive construct that supports learning transfer, innovation, and adaptive decision-making in educational and entrepreneurial environments.

Studies on University-Based Startups

Within entrepreneurship education, recent attention has shifted to the role of university incubators and accelerators as important drivers of entrepreneurial innovation ecosystems, for they provide behavioral training grounds (Chan et al., 2022). Qamara (2023) found that Saudi business incubators significantly enhance the creative capacities of small enterprises by providing financial planning support, mentoring, and structured feedback, all of which stimulate metacognitive regulation in decision-making. Al-Momeen (2021) further observed moderate yet positive correlations between decision-making and problem-solving skills among founders of university-based startups, underscoring the need to integrate metacognitive training within incubator curricula.

Foda and Radwan (2020) demonstrated that digital entrepreneurship modules could effectively enhance decision-making performance, while Al-Mukhlafi (2017) highlighted structural deficiencies in Saudi universities' entrepreneurship education, particularly the absence of experiential learning components critical to metacognitive development. Similarly, Al-Zubair (2018) in his study on the contribution of a university employment and entrepreneurship services center in enhancing entrepreneurial competencies (psychological, entrepreneurial, economic) among 100 female students at Imam Mohammad ibn Saud Islamic University, stressed the critical role of centers in honing female students' entrepreneurial skills and the success of small ventures. She also underscored the importance of promoting entrepreneurial awareness to reduce graduate unemployment rates. Overall, these studies have a common denominator; that is, metacognitive thinking is of paramount importance to entrepreneurial cognition and performance. Yet, despite its theoretical salience, few empirical studies have explored how metacognition manifests among founders of university-based startups. The scarcity of research in the Saudi and broader Arab contexts represents a significant gap, particularly in understanding how different incubation programs (e.g., incubation vs. acceleration) contribute to developing metacognitive thinking and related decision-making skills

Methodology

Research Design

This study adopted a descriptive-analytical research design to investigate the level of metacognitive thinking among university startup founders. The descriptive component allowed for a detailed characterization of participants' metacognitive processes as they naturally occur, while the analytical aspect facilitated examination of potential differences across demographic and programmatic factors. This combined approach enabled the researcher to get both quantitative trends and nuanced patterns in metacognitive thinking, ensuring a comprehensive understanding of the phenomenon.

Participants

The final analytical sample consisted of 27 university startup founders selected from an initial pool of 36 respondents. Only participants who currently owned a startup and had participated in the Imam University Business Incubator (Sahabat Al-Imam) were included in the statistical analyses. Among these founders, 22 had completed an incubation program, 10 had completed an accelerator program, and some participants had completed both programs, resulting in overlapping group membership. Therefore,

comparisons by program participation should be interpreted descriptively rather than as strictly independent group comparisons.

Table 1: Summary of Participants' Profile

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	14	51.9
	Female	13	48.1
Startup founder	Yes	27	75%
	No	9	25%
Entrepreneurship Program Participation	Incubation	22	81.5
	Accelerator	10	37.0
University Affiliation	Student / Alumni	24	88.9
	Non-affiliate	3	11.1
Role / Status	Student	10	41.7
	Alumni	10	41.7
	Administrative / Faculty	4	16.6
Academic Discipline	Business & Admin	10	41.7
	Other (Media, Medicine, Science, Languages, Sharia, Social Sciences)	14	58.3

As shown in Table 1 above, there exists a nearly equal distribution of males (51.9%) and females (48.1%). Most participants were affiliated with Imam Mohammad ibn Saud University (88.9%), either as current students or alumni. The participants' academic disciplines were diverse, predominantly from Business Administration (37.5%), along with other fields such as Media, Medicine, Social Sciences, and Sharia. With respect to role or status, the sample comprised mostly students and alumni (each 41.7%), with a smaller number of administrative staff and faculty (16.6%). This diverse yet focused sample provided a rich context to examine metacognitive thinking among university startup founders across multiple dimensions of cognition and entrepreneurial experience.

Instruments

Two instruments were deployed in this study: demographic and startup data form and meta-cognitive thinking scale.

Demographic and Startup Data Form

The researcher designed and sent an online structured form to collect participants' demographic and

entrepreneurial information as shown in Table 1. It included items on whether the participant owns a university startup, participation in the Imam University Business Incubator (Sahabat Al-Imam), completion of an incubation or accelerator program, gender, university affiliation (faculty, college, or administrative unit), and role (student, faculty member, administrative staff, or graduate). For participants not affiliated with Imam University, additional items elicited the name of their institution and role.

The Metacognitive Thinking Scale

This scale was adapted from Al-Jarrah and Obeidat's (2011) metacognitive thinking framework and modified to fit the entrepreneurial context of

university startup founders. Metacognitive Thinking Scale was used to measure participants' metacognitive awareness across three dimensions: *knowledge of cognition*, *regulation of cognition*, and *cognitive processing*. Items were rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). In the piloting study where 15 participants were selected to participate, the internal consistency and reliability of the scale's dimensions were verified on some items using Pearson correlation coefficients, Cronbach's alpha, and split-half (Spearman-Brown), confirming its appropriateness for assessing metacognitive thinking among university startup founders, as evinced in Table 2 below.

Table 2 : Summary of reliability and internal consistency of the Metacognitive Thinking Scale across the tests used for checking

Dimension	Items No.	Cronbach's α	Split-Half (Spearman-Brown)	Pearson r (Item-Total)	p-value
Knowledge of Cognition	12	.883	.844	.391 – .775	< .01
Regulation of Cognition	19	.912	.907	.390 – .865	< .01
Cognitive Processing	11	.845	.829	.397 – .763	< .01
Overall score of the Scale in focus	42	.956	.949	—	< .01

Metacognitive Thinking Scale has strong reliability and internal consistency across the three tests (all statistically significant at $p < .01$). Indeed, Cronbach's alpha values ranged from .845 to .912 across the three dimensions, with an overall coefficient of .956, indicating excellent internal consistency. The Split-Half (Spearman-Brown) values (.829–.949) further confirm scale stability. Significant item-total correlations ($r = .390$ –.865) demonstrate that all items contribute meaningfully to the construct. Overall, the scale reveals robust psychometric properties, making it a reliable tool for assessing metacognitive thinking among university startup founders.

Data Collection Procedures

Data were collected through an online survey distributed to university startup founders affiliated with Imam Mohammad ibn Saud Islamic University. Participants were contacted through institutional entrepreneurial networks and invited voluntarily to complete the questionnaire. Responses were collected anonymously over a four-week period.

Statistical Methods

To analyze the collected data, the present study made use of the Statistical Package for the Social Sciences (SPSS). Following data coding and entry, several statistical procedures were applied to answer research questions and test hypotheses, respectively. Pearson item-total correlations were used to assess internal consistency of the scale items, while Cronbach's alpha and the Split-Half (Spearman-Brown) method were used to estimate reliability. Descriptive statistics summarized participants' demographic data and the overall level of metacognitive thinking. As for Kolmogorov-Smirnov test, it was

conducted to verify score normality. To explore group differences, the independent samples t-test compared scores by gender tested variations according to the type of business incubation program (incubator vs. accelerator). These statistical techniques ensured rigorous data analysis along with hypothesis testing. They also support the interpretation of results within the study's theoretical framework

As indicated earlier, Kolmogorov-Smirnov test was used to check for the assumption of score normality. To this end, the distribution of scores in the Metacognitive Thinking Scale was calculated. The following table illustrates the results obtained.

Table 3: Kolmogorov-Smirnov Test Results for Normality of Metacognitive Thinking Scores

Instrument	Sample Group	K-S Statistic	Significance (p)	Interpretation
Metacognitive Thinking Scale	Male	0.136	0.200	Non-significant
	Female	0.157	0.200	Non-significant

Results shown in Table 3 above shows that the Kolmogorov-Smirnov test indicated non-significant results ($p > .200$) for both male and female participants, suggesting no significant deviation from normality. This result suggests that the distribution of scores on the Metacognitive Thinking Scale is approximately normal. Therefore, the Independent Samples t-test and is deemed appropriate for examining differences in metacognitive thinking levels and their respective subdimensions.

Ethical Considerations

This study observed the ethical standards outlined in the *American Psychological Association's (APA, 2017) Ethical Principles of Psychologists and Code of Conduct* and followed the research ethics policies of Imam Mohammad ibn Saud Islamic University. Before collecting data, the research protocol was reviewed and approved by the university's Institutional Review Board (IRB). Participation in the study was entirely voluntary, and all participants were informed about the purpose, procedures, and expected duration of the research. They were assured that their responses would remain confidential and be used only for academic and research purposes. Informed consent was obtained from all participants before the administration of the research instruments. Participants were informed that they have the right to withdraw from the study at any time without any academic or professional consequences. To ensure anonymity, identifying information was neither collected nor stored, and all data were securely maintained in password-protected digital files accessible only to the principal investigator. Besides, ethical considerations were extended to the interpretation and reporting of results. Data were analyzed objectively, and findings were presented clearly to avoid misrepresentation or researcher bias. The study also ensured that participants' intellectual and entrepreneurial contributions, particularly their startup initiatives, were treated with respect and confidentiality, reflecting the university's commitment to responsible research practices.

Results and Discussion

RQ1 Results

The first research question was as follows: "What is the level of metacognitive thinking among university startup founders?" To address this question, descriptive statistics, including mean and standard deviations of the responses of the university startup founders on the Metacognitive Thinking Scale as a whole were calculated. The interpretation of the scale scores was based on the following classification (1.00-2.33: Low level of metacognitive thinking; 2.34-3.67: Moderate level of metacognitive thinking; 3.68 -5.00: High level of metacognitive thinking). Table 4 illustrated the results obtained as follows:

Table 4: Descriptive Statistics of university start up founders' responses on the Metacognitive Thinking Scale

Dimension	Items	Mean	SD	Level
Knowledge of Cognition	12	4.29	0.541	High
Regulation of Cognition	19	4.32	0.538	High
Processing of Cognition	11	4.38	0.501	High
Overall Scale Score	42	4.33	0.500	High

As shown in Table 4, the results indicate consistently high levels across all dimensions of metacognitive thinking among university startup owners. Knowledge of Cognition dimension recorded a high mean and SD

scores (4.29; 0.541 respectively), reflecting a strong awareness of cognitive knowledge and understanding of mental processes among the participants. Similarly, regulation of cognition achieved high mean and SD scores of 4.32 and 0.538, suggesting that the participants possess a high capacity to organize, monitor, and control their cognitive activities effectively. Besides, processing of cognition dimension obtained the highest mean score of 4.38 and SD (0.501), implying that the university startup founders possess advanced skills in processing, analyzing, and applying cognitive strategies in problem-solving and decision-making contexts. Overall, these results underscore a well-developed metacognitive profile among the participants, capable of engaging in reflective and strategic thinking within entrepreneurial settings.

This result stands in line with the findings of Al-Shuraida (2019), who reported that students scored high on metacognitive thinking overall and across its subdimensions. Given metacognitive thinking is closely related with problem-solving strategies and decision-making (Abdulaziz, 2007, as cited in Al-Mahdawi, 2016), the present finding aligns with Arasti et al. (2014), who highlighted the impact of decision-making skills on the success of business ventures. In a similar vein, Foda and Radwan (2020) found that developing decision-making skills in business management contexts led to achievement levels exceeding 90%. However, this result diverges from the findings of Al-Jbeili (2013), who reported that university students exhibited only a moderate level of problem-solving skills, with no significant gender-based differences, though some variation existed among students from different colleges. The current researcher attributes this discrepancy to the unique experiential context of university startup owners, whose continuous engagement in entrepreneurial activities enhances their problem-solving and decision-making capacities. Unlike regular university students, startup founders encounter real-world challenges that demand the use of higher-order thinking strategies, promoting thereby the development of metacognitive awareness and control.

The high level of metacognitive thinking observed among university startup founders can be explained by their heightened awareness of their cognitive processes, cultivated through continuous exposure to diverse and complex real-life experiences during the management and development of their ventures. Indeed, entrepreneurial engagement requires ongoing planning and analysis, which nurtures metacognitive growth. In this sense, business practice offers students authentic opportunities to exercise higher-order thinking skills in action.

RQ2 Results

The second research question is worded as follows: "Are there statistically significant differences in

metacognitive thinking among university startup founders by program type (incubation program vs. business accelerator program)?” To address this

question, independent sample t-tests were deployed to examine any potential differences. Table 5 below outlines the statistical results obtained as follows.

Table 5: Results for Differences Among University Startup Founders over Metacognitive Thinking dimensions by Program Type

<i>Dimension</i>	<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>Interpretation</i>
Knowledge of Cognition	<i>Between Groups</i>	1.224	3	0.408	1.469	0.24	Not significant
	<i>Within Groups</i>	6.392	23	0.278			
Regulation of Cognition	<i>Total</i>	7.616	26	0.624	2.532	0.08	Not significant
	<i>Between Groups</i>	1.873	3				
	<i>Within Groups</i>	5.669	23	0.246			
	<i>Total</i>	7.542	26				
Processing of Cognition	<i>Between Groups</i>	1.322	3	0.441	1.949	0.15	Not significant
	<i>Within Groups</i>	5.200	23	0.226			
	<i>Total</i>	6.522	26				
Overall Metacognitive Thinking Score	<i>Between Groups</i>	1.471	3	0.490	2.236	0.11	Not significant
	<i>Within Groups</i>	5.043	23	0.219			
	<i>Total</i>	6.514	26				

As Table 5 above shows, the differences between the mean scores across the three dimensions of the Metacognitive Thinking Scale were not statistically significant (*Knowledge of Cognition* = 0.24; *Regulation of cognition* = 0.08; *Processing of cognition* = 0.15) among university startup founders by program type. All these levels exceed the significance threshold (0.05). The same holds true for the overall score of the Metacognitive Thinking Scale ($F = 2.236$; $p = .11$). These results suggest that both programs demonstrated comparable levels of metacognitive awareness across all dimensions featured. This fact could be accounted for by the similarity in the content and structure of both programs. Both programs offer a comparable set of workshops, mentoring sessions, and advisory activities, suggesting minimal differentiation in how they develop participants' metacognitive skills.

Further, the shorter duration of the Accelerator Program (typically three months) compared to the Incubation Program (about six months) may have limited participants' opportunities for extended reflection, interaction with mentors, and peer learning. Such experiences are critical for the development of higher-order cognitive skills, including metacognitive

reflection, problem-solving, and decision-making. As a result, the shorter timeframe may have reduced the potential for observable improvements in metacognitive thinking among accelerator participants. It could be explained by the focus on om the procedural and managerial aspects of startup operations, such as scaling, marketing, and investor readiness, rather than explicitly honing metacognitive skills through reflective decision-making and strategic problem-solving. Accordingly, participants in both programs may have reached similar levels of metacognitive thinking, as neither program appeared to focus directly on enhancing these higher-order cognitive processes.

Results

The third research question is as follows: “Are there statistically significant differences in the level of metacognitive thinking among university startup founders by gender?” To answer this question, an Independent Samples *t*-test was employed to examine potential gender differences in overall metacognitive thinking and its subdimensions. The results obtained are illustrated in in Table 6 below.

Table 6: Independent-Samples *t*-Test Results for Metacognitive Thinking Dimensions Scores by Gender

Dimension	Gender	n	M	SD	t	p	Interpretation
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Knowledge of Cognition	Male	14	4.21	0.655	-0.780	0.44	Not significant
	Female	13	4.37	0.393			
Regulation of Cognition	Male	14	4.19	0.574	-1.238	0.22	Not significant
	Female	13	4.45	0.485			
Processing of Cognition	Male	14	4.36	0.520	-0.249	0.80	Not significant
	Female	13	4.41	0.498			
Total Metacognitive Thinking	Male	14	4.24	0.547	-0.903	0.37	Not significant

Results shown in Table 6 indicate that the Differences in mean scores according to gender were not statistically significant across the dimensions of the Metacognitive Thinking Scale. More specifically, the significance levels were (0.44) for the *knowledge of cognition* dimension, (0.22) for the *regulation of cognition* dimension, and (0.80) for the *processing of cognition* dimension, all of which were greater than the significance threshold of (0.05). Similarly, the overall score on the Metacognitive Thinking Scale did not show a statistically significant difference according to gender, as the calculated *t*-value was (-0.903) with a significance level of (0.37), which also exceeds the significance threshold (0.05). This finding is in line with the results of Khrisat (2016) and Al-Mahdawi (2016), both of which reported no significant gender differences in metacognitive thinking levels among university students. It also aligns with Al-Momeen (2021), who found no statistically significant differences between gender in decision-making and problem-solving skills, nor between innovative idea owners and startup entrepreneurs in these competencies. Likewise, it is consistent with Al-Jbeili (2013), who reported no significant gender-based differences in university students' problem-solving skills.

The consistency of these findings may be imputed by the nature of metacognitive thinking itself, which involves an individual's awareness of their cognitive processes and structure, as well as their ability to use planning, monitoring, and evaluation strategies to regulate such processes effectively (Al-Jarrah & Obeidat, 2011). Metacognitive thinking is also closely related to problem-solving and decision-making strategies, reflecting the effective use of one's cognitive abilities to meet the demands of thinking tasks (Abdulaziz, 2007; cited in Al-Mahdawi, 2016). These are general cognitive skills that are not inherently linked to biological or gender-related factors; therefore, both males and females are expected to exhibit comparable levels of metacognitive thinking.

Besides, universities often provide a supportive environment for both male and female to learn and practice higher-order thinking skills. Entrepreneurship programs and business incubators typically offer equivalent support, mentorship, and resources to male and female participants alike, thereby reducing the likelihood of gender-based differences. Contemporary

educational trends also emphasize empowering all students, regardless of gender, to develop higher-order thinking and entrepreneurial competencies. Given the global emphasis on youth empowerment in entrepreneurship, it is reasonable to conclude that variations in metacognitive thinking are more likely to stem from individual differences rather than gender distinctions.

Discussion

The present study aimed to assess the level of metacognitive thinking among university startup founders benefiting from Imam Mohammad ibn Saud Islamic University business incubator, as well as to examine possible differences based on the type of incubation program and gender. The findings revealed that the overall level of metacognitive thinking among the participants was high, indicating that these university entrepreneurs possess well-developed skills in planning, monitoring, and evaluating their cognitive processes during business decision-making. This result aligns with the growing body of literature emphasizing the importance of metacognitive regulation in entrepreneurial success (Urban, 2020). Entrepreneurs with advanced metacognitive capacities are better equipped to adapt to potential challenges, reflect on their strategies, and alter their business approaches when necessary (Cope, 2011).

The first hypothesis claimed that university startup founders demonstrate a high level of metacognitive thinking. This hypothesis was confirmed, as the mean scores indicated elevated levels across all sub-dimensions of the metacognitive scale. Similar findings were reported by Haynie and Shepherd (2009), who found that metacognitive awareness enables entrepreneurs to learn from failure and improve their opportunity recognition capabilities. In the same line of thought, Urban (2020) demonstrated that metacognitive ability enhances entrepreneurial vigilance and opportunity evaluation, particularly in dynamic business environments. The present results, hence, extend these

conclusions to the context of Saudi higher education, where structured incubation programs need to cultivate reflective and self-regulatory thinking.

The second hypothesis posited that differences in metacognitive thinking levels would exist according to the type of entrepreneurship program (incubation vs. accelerator). However, this hypothesis was not supported, as statistical analyses revealed no significant differences between participants across all metacognitive dimensions. This suggests that both incubation and accelerator programs may provide comparable opportunities for developing metacognitive skills, despite differences in program duration and emphasis. These findings suggest that the mentorship and reflective learning embedded in incubation environments provide a fertile ground for honing metacognitive skills. Incubation programs often stress experiential learning, continuous feedback, and iterative project evaluation, as necessary elements to boost metacognitive awareness (Kolb, 2014). Accelerator programs, on the other hand, while focusing on rapid scaling and networking, may offer fewer opportunities for self-reflection and deliberate cognitive monitoring. This aligns with the findings of Rasmussen and Wright (2015)'s study, where they underscored the import of longer incubation periods in upgrading more robust cognitive and strategic competences among early-stage entrepreneurs.

Regarding the third hypothesis, which examined gender-based differences in metacognitive thinking, no statistically significant differences were found. This outcome corroborates previous studies reporting minimal or no gender effect on metacognitive ability when individuals operate in similar learning and professional contexts (O'Neil & Abedi, 1996; Schraw & Dennison, 1994). It is possible that both male and female founders in this study were exposed to comparable entrepreneurial experiences and educational resources, leading to equivalent development of metacognitive competencies. This suggests that entrepreneurship education and business incubation in the Saudi context may be effectively reducing gender disparities in cognitive development, a result that aligns with the inclusivity goals of Saudi Vision 2030 (Saudi Vision 2030, 2016).

Overall, these findings reinforce the theoretical view that metacognitive thinking represents a critical higher-order cognitive process influencing entrepreneurial learning, decision-making, and resilience (Flavell, 1979; Haynie et al., 2010). The results contribute to expanding metacognitive theory into the domain of entrepreneurship psychology, supporting the argument that reflective cognition serves as a bridge between knowledge and action. Moreover, they have important practical implications for university entrepreneurship programs. For instance, business accelerator programs should be redesigned to comprise metacognitive training within business incubator curricula in view of developing metacognitive thinking skills, such as planning, performance monitoring, and evaluating problem-solving strategies. Entrepreneurship programs,

be they incubation or accelerator, should also be assessed on a periodic basis to explore the impact of such programs on participants' overall benefits and specifically on the development of their metacognitive thinking skills. The aim is to improve and update the implemented programs if need be.

Conclusion

The present study examined the level of metacognitive thinking among university startup founders benefiting from a university-based business incubator. The findings revealed that participants demonstrated a high level of metacognitive awareness, indicating that entrepreneurship education and incubation environments can promote self-regulatory and reflective thinking skills essential for effective business decision-making. No statistically significant differences in metacognitive thinking were observed between participants from incubation and accelerator. These results reinforce the argument that metacognition plays a crucial role in entrepreneurial success, enabling founders to monitor, evaluate, and adapt their cognitive and strategic processes in challenging business contexts.

The present study, though being insightful, has several limitations. First, participants' sample size ($N = 27$) was relatively limited, interfering thereby with the generalizability of the findings. Indeed, such a small sample may not elicit the diversity of experiences among university entrepreneurs across different disciplines or institutions. Second, the cross-sectional nature of the research precludes causal inferences regarding the relationship between incubation participation and metacognitive development. Another limitation lies in the reliance on self-report measures, which may be subject to social desirability bias or inaccurate self-assessment of cognitive abilities. Future research should, therefore, employ mixed-method or longitudinal designs to identify and trace the evolution of metacognitive thinking over time and in varied entrepreneurial stages.

In light of these limitations, future investigations could expand the sample to include multiple universities and diverse entrepreneurial ecosystems, allowing for comparative analyses across cultural and institutional contexts. Researchers may also investigate the interaction between metacognitive thinking, emotional intelligence, and entrepreneurial resilience to better understand how cognitive and affective dimensions jointly shape startup success. Experimental and intervention-based studies could further test the efficacy of training programs designed to explicitly enhance metacognitive regulation in entrepreneurship programs. Such endeavors would not only strengthen the theoretical understanding of cognitive mechanisms in entrepreneurship, but also provide strategies for policymakers and educators to cultivate reflective, adaptive, and self-directed entrepreneurs aligned with the innovation goals of national visions such as Saudi Vision 2030.

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Declarations

Conflict of interest: The author has no relevant financial or non-financial interests to disclose. The author declares no conflict of interest.

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References

- Abdulaziz, K. (2020). Barriers to faculty participation in university startup formation and strategies to overcome them. *Journal of Education*, 2, 298–350.
- Access Initiative for Entrepreneurship. (2020). *Report on the entrepreneurial ecosystem in Saudi universities: Current situation, challenges, statistics, maturity, and sustainability*.
- Al-Humaidien, N., & Yaqub, A. (2019). Predictive ability of metacognitive thinking strategies and processing level in problem-solving skills among tenth-grade female students in Al-Jami'a District. *Journal of Educational Sciences*, 46(4), 329–341.
- Al-Jarrah, A., & Obeidat, A. (2011). Metacognitive thinking among Yarmouk University students in light of selected variables. *Jordanian Journal of Educational Sciences*, 7(2), 115–138.
- Al-Mahdawi, A. (2016). The relationship between metacognitive thinking and problem-solving styles among Saudi university students. *Journal of Educational and Psychological Sciences*, 4(2), 67–90.
- Al-Momeen, S. (2021). The relationship between decision-making and problem-solving skills among innovative thinkers and startup founders at Imam Muhammad bin Saud Islamic University. *Journal of Humanities and Social Sciences*, 1(64), 373–450.
- Al-Mukhlafi, A. (2014). The reality of entrepreneurship education in Saudi public universities: An analytical study. *Proceedings of the First Conference of Colleges of Business Administration in GCC Universities*, 17–18.
- Al-Mukhlafi, A. (2017). Entrepreneurship education in Saudi public universities and its role in achieving Vision 2030 objectives: A survey study. *Conference on the Role of Saudi Universities in Implementing Vision 2030*, Qassim University, Saudi Arabia.
- Al-Shuraida, H. (2019). The predictive power of metacognitive thinking for entrepreneurial skills among postgraduate students. *Arab Universities Journal for Education and Psychology*, 17(4), 141–17F2.
- Al-Zaghloul, R., & Al-Zaghloul, I. (2003). *Cognitive psychology* (1st ed.). Dar Al-Shorouk, Amman, Jordan.
- Al-Zubair, A., & Abu Dief, S. (2018). The role of promoting entrepreneurial skills among female students at Imam Muhammad bin Saud Islamic University in supporting small projects. *Amarapak Journal*, 9(30), 45–64.
- Arasti, Z., Fakhrisadat, N., & Narges, I. (2014). Explaining the role of managerial skills of entrepreneurship in business success. *International Journal of Management Sciences*, 4(1), 42–52.
- Argaam. (2019, November 15). *Pillars entrepreneurs need to overcome challenges*. Retrieved November 8, 2025, from <https://www.argaam.com>
- Arnaout, A. (2017). A comparative study of entrepreneurship education programs in universities in the United States and Malaysia and their applicability in Egypt. *Journal of Comparative and International Education*, (7), 189–303.
- Audretsch, D. B., & Theodoraki, C. (2024). The role of incubators in university-based entrepreneurial ecosystems through knowledge spillovers. In *Entrepreneurial ecosystems in cities and regions: Emergence, evolution and future* (pp. 134–148). Oxford University Press.
- Bărbulescu, O., Tecău, A. S., Munteanu, D., & Constantin, C. P. (2021). Innovation of startups: The key to unlocking post-crisis sustainable growth in the Romanian entrepreneurial ecosystem. *Sustainability*, 13(2), 671.
- Bastian, B., & Zucchella, A. (2022). Entrepreneurial metacognition: A study on nascent entrepreneurs. *International Entrepreneurship and Management Journal*, 18(4), 1775–1805.
- Chan, Y. E., Krishnamurthy, R., & Sadreddin, A. (2022). Digitally-enabled university incubation processes. *Technovation*, 118, 102560.
- Cope, J. (2011). Entrepreneurial learning from failure: An interpretative phenomenological analysis. *Journal of Business Venturing*, 26(6), 604–623.
- Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. *European Psychologist*, 13(4), 277–287.
- Etzkowitz, H. (2017). *Innovation in innovation: The triple helix of university-industry-government relations*. Routledge, London.
- European Commission. (2018). *Entrepreneurial learning for the future of work*. Publications Office of the European Union.
- Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, 34(10), 906–911.
- Florin, J., Karri, R., & Rossiter, N. (2007). Fostering entrepreneurial drive in business education: An attitudinal approach. *Journal of Management Education*, 31(1), 17–42.
- Foda, F., & Radwan, M. (2020). A proposed digital module for developing decision-making skills in administrative business among commercial secondary students. *Arab Studies in Education and Psychology*, (118), 65–105.
- Guerrero, M., Cunningham, J. A., & Urbano, D. (2016). Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom. *Research Policy*, 45(3), 748–764.
- Harrison, J. R. (1984). Decision making and post-decision surprises. *Administrative Science Quarterly*, 29(1), 1–24.
- Haynie, J. M., Shepherd, D., Mosakowski, E., & Earley, P. C. (2010). A situated metacognitive model of the entrepreneurial mindset. *Journal of Business Venturing*, 25(2), 217–229.
- Haynie, J., & Shepherd, D. (2009). A measure of adaptive cognition for entrepreneurship. *Entrepreneurship Theory and Practice*, 33(3), 695–714.
- Heller, F. (1988). *Decision making: Social and creative dimensions*. Springer, London.

- Hussein, T., & Fakhro, A. (2002). *Thinking skills guide: 100 thinking skills* (1st ed.). Dar Al-Durar, Amman.
- Jarwan, F. (2007). *Teaching thinking: Concepts and applications* (3rd ed.). Dar Al-Fikr, Amman.
- Kim, Y., Choi, S., Sung, S., & Park, Y. (2018). The role of problem-solving ability on innovative behavior and opportunity recognition in university students. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(4), 47.
- Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development* (2nd ed.). Pearson Education, New Jersey.
- Livingston, J. A. (1997). *Metacognition: An overview*. State University of New York at Buffalo.
- O'Neil, H. F., Jr., & Abedi, J. (1996). Reliability and validity of a state metacognitive inventory: Potential for alternative assessment. *The Journal of Educational Research*, 89(4), 234–245.
- Ormrod, J. E. (1995). *Human learning* (2nd ed.). Prentice Hall, New Jersey.
- Qamara, S. (2023). The impact of business incubators on developing creative capacities of small projects in Saudi Arabia. *IUG Journal of Economics and Business*, 1(31), 74–101.
- Rasmussen, E., & Wright, M. (2015). How can universities facilitate academic spin-offs? An entrepreneurial competency perspective. *The Journal of Technology Transfer*, 40(5), 782–799.
- Riyadh Center for Information and Consulting Studies. (2015, November 13). *Al-Riyadh Newspaper*, Economic Section, Issue 17308.
- Saudi Vision 2030. (2016). *Vision 2030 of the Kingdom of Saudi Arabia*. Retrieved September 5, 2025, from <https://vision2030.gov.sa>
- Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, 19(4), 460–475.
- Sternberg, R. (1988). Mental self-government: A theory of intellectual styles and their development. *Human Development*, 31(4), 197–224.
- Swartz, J., & Perkins, R. (1990). *Teaching thinking: Issues and approaches*. Midwest Publications.
- Tahiri, A., Kovaci, I., & Shabani, S. (2020). Planning, problem solving, and decision-making process: Case study in small and medium enterprises in Kosovo. *European Academic Research*, 7(11), 5528–5538.
- Urban, B. (2020). Entrepreneurial alertness, metacognition and firm performance: The moderating role of entrepreneurial orientation. *Journal of Entrepreneurship in Emerging Economies*, 12(2), 179–197.
- Veenman, M. V. J. (2011). Learning to self-monitor and self-regulate. In Zimmerman, B., & Schunk, D. (Eds.), *Handbook of self-regulation of learning and performance* (pp. 197–212). Routledge, New York.