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Does education improve managers' use of thinking skills during creative problem-solving? A moderation analysis

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Without effective problem-solving (EPS), along with divergent thinking (DT) and convergent thinking (CT) skills, managers' creative problem-solving process (CPS) may be rendered deficient. Their efforts will not equip them to exploit opportunities or address issues. Since CPS relies on the effective integration of these cognitive strategies, understanding how education shapes their use is vital. By surveying managers in South Africa's agricultural industry, the findings reveal that individuals leverage DT in ways that significantly enhance CT in the pursuit of effective problem solving (EPS). Education is traditionally seen as enhancing thinking and problem-solving. However, this study finds that as education levels rise, the positive interplay between DT and CT diminishes, suggesting that advanced education, while enhancing structured analytical reasoning, may inadvertently suppress flexible, creative thinking. These findings underscore the importance of designing educational and professional development programs that nurture both analytical rigor and cognitive adaptability, ensuring that increased education enhances rather than limits innovative inclination in complex managerial contexts.

Keywords: divergent thinking, convergent thinking, thinking skills, effective problem-solving, managerial competencies, Einstellung effect, cognitive bias, agricultural businesses, education

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Introduction

The modern business environment is constantly evolving, demanding agile and skilled managers to navigate its complexity (Vasylyk et al. 2023). In Africa's particularly volatile context, managerial competencies often determine whether businesses succeed or fail. Creative thinking supports lateral reasoning by drawing from relevant information, generating diverse ideas, and anticipating outcomes (Mdaka & Longweni 2025). DT produces a broad range of ideas, enabling managers to address complex and unfamiliar problems with innovative solutions (Longweni & Mdaka 2024, Puccio 2015). DT is measured through fluency, flexibility, originality, and elaboration (Puccio et al. 2020). CT, in contrast, refines and evaluates ideas, especially for familiar problems, and is praised for its analytical, structured approach

(Puccio 2015, Runco 2024). Although DT enriches decision quality, it is often undervalued, while CT is overemphasized in both practice and research (Luchini et al. 2023, Webb et al. 2017). A balanced methodology, where EPS depends on both DT and CT, is therefore most suitable. Yet this balance may also be conflictual: CT can hinder creativity (Zhu et al. 2019), and incentives that enhance CT may reduce DT (Huo 2020). DT alone is also insufficient (Neubauer & Martskvishvili 2018). This study, therefore, proposes that CT mediates the influence of DT on EPS. Problem-solving preferences are also shaped by education (Puccio et al. 2010). Although education is assumed to foster advanced thinking skills (Tolova-Stoimenova & Rasheva-Yordanova 2023) higher education often advances CT through standardized assessments, which in turn limit DT (Nusbaum & Silvia 2011, Silvia et al. 2013). Education may thus weaken, rather than strengthen, the DT–CT relationship (Beghetto 2010). Despite growing scholarly interest, empirical research remains limited, particularly in Africa (Luchini et al. 2023).

In the South African context, this relationship between DT and CT is especially consequential. Managers in South Africa often operate within conditions characterized by institutional voids, socio-economic instability, and resource limitations, which necessitate innovative adaptability (Longweni & Mdaka 2024). While convergent thinking (CT) aligns with traditional managerial practices focused on operational control and risk aversion, the emerging challenges associated with complex decision environments increasingly necessitate the ideational openness enabled by divergent thinking (DT). This study, therefore, anticipates that DT enhances EPS by enabling the exploration of alternative solutions, but that its influence becomes practically valuable once refined through CT. Consequently, the role of CT is expected to be stronger among South African managers, who must balance creativity with pragmatic implementation in a context where decision-making involves navigating uncertainty, regulatory dynamics, and limited support structures.

The theoretical foundation of this expectation draws on creative problem-solving theory (Puccio et al. 2015) and dual-process cognition, which argues that effective decision-making emerges when ideation (DT) precedes evaluation (CT). The study is therefore expected to offer practical value to managerial development in South Africa by highlighting the need to cultivate cognitive agility that combines generative and analytical thinking. This has notable implications for organizations and training institutions: leadership development programmes, performance appraisal mechanisms, and academic curricula should actively foster DT competencies alongside structured analytical capabilities. For managerial practice, the findings may guide the design of decision-making frameworks that promote exploration before judgement, thereby strengthening innovation capacity and strategic responsiveness. Ultimately, the study contributes to enhancing problem-solving effectiveness across South African organizations.

This paper examines how education influences managers' use of DT and CT, finding that both collectively improve EPS, but education negatively moderates the relationship between DT and CT. It provides the first empirical model in which CT mediates the positive relationship between DT and EPS. Moreover, due to managers' social, occupational and tertiary conditioning, it also highlights the negative role of education.

Background and Theory

Although interest in thinking skills dates to Dewey (1910), many gaps remain. Managers often favor CT, with reliance increasing with experience, whereas DT does not show a similar increase (Doroodi & Mohammadi 2015). Risk-taking enhances DT, while CT thrives in low-risk contexts (Shu et al. 2018). Effective problem-solvers also maximize experience by linking ideas (Hagtvedt et al. 2019). These distinctions are significant in agriculture, where uncertainty, scarce resources, and sustainability imperatives necessitate effective thinking (Negrão 2020). South Africa's agricultural sector, which is critical for food security and employment, faces volatility and complex organizational structures (Ortmann & King 2007, Pivtorak 2024). This makes it an appropriate context to explore how managers apply DT and CT.

Education is traditionally a trigger of EPS competencies (Haddon & Lytton 1971). Case studies and teamwork enhance DT (Lu & Xie 2024, Mdaka & Longweni 2024), while structured tests favor CT (Lee et al. 2022). Yet education generally rewards analytical reasoning, advancing CT over DT (Toleva-Stoimenova & Rasheva-Yordanova 2023), which may constrain expansive thinking (Silvia et al. 2013).

This study is guided by dual-process cognitive theory, which seeks to explain human thought by dividing it into two distinct yet interdependent systems that are susceptible to cognitive biases. System 1 is fast-paced, intuitive, and reactive; System 2 is slow, deliberate, and logical (Luoma & Martela 2021). Dual-process cognitive theory is applicable within the South African managerial context, where complex socio-economic dynamics demand both intuitive responsiveness and deliberate analytical evaluation. Managers frequently operate under volatile environmental conditions and institutional uncertainty, necessitating rapid, adaptable decision-making (System 1), while simultaneously balancing compliance, risk management, and operational efficiency (System 2), particularly within regulated sectors such as agriculture and cooperative-based enterprises. Consequently, South African managers are required to engage in ideational exploration (DT) during strategy formulation to overcome contextual constraints, yet must also employ structured reasoning (CT) to ensure feasibility and alignment with operational limitations. This duality reflects the cognitive demands of managerial responsibilities in South Africa, where innovative solutions are essential for navigating systemic challenges, but successful implementation relies on rational evaluation and strategic discipline. Figure 1 depicts the variables and their linkages leading to effective problem solving.

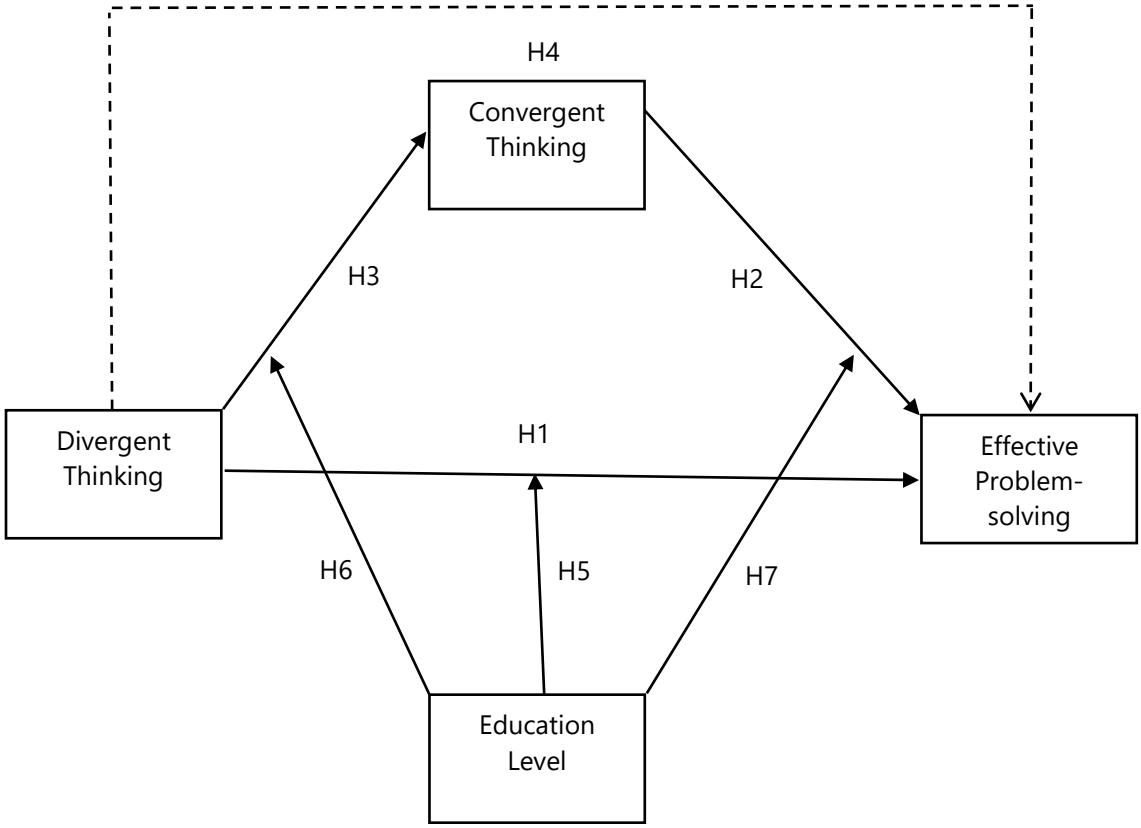

Figure 1. Conceptual Model
Source: the author

Hypothesis Development

Divergent Thinking and Effective Problem-Solving

DT typically manifests when managers face heuristic problems that cannot be solved through established routines and instead rely on expertise (Puccio, 2015). This expansive process generates a wide variety of ideas, producing creative, novel, and context-specific solutions (Neubauer & Martskvishvili 2018, Puccio 2015). DT enhances flexibility by broadening the search space and equipping managers to handle ambiguity. Crucially, DT is not innate but instead can be developed. Training interventions have improved DT across industries, cultures, and managerial levels. A Chilean study confirmed a strong association between DT and problem-solving competency (Preiss et al. 2016), while Joel (2014) showed that deliberate DT activities enhanced problem-solving capacity in managerial roles. Managers should therefore not treat DT as peripheral but as a central competency. Neglecting DT undermines the creative problem-solving process (Puccio 2015, Runco & Acar 2012).

In the South African business context, the role of DT is particularly pertinent. Managers frequently confront challenges characterized by uncertainty, institutional inefficiencies, and rapid environmental change, where established procedures are often insufficient. They require adaptive thinking to address resource constraints, climate-related risks, and shifting stakeholder demands. DT positions managers to reframe such problems, break path-dependent thinking patterns, and explore innovative responses rather than relying exclusively on traditional mechanistic decision-making logics. Consequently, South African managers who invest in divergent ideation processes are better equipped to respond creatively to context-specific challenges, such as fluctuating market dynamics, socio-political pressures, and sustainability imperatives. Allocating time for divergent exploration ensures that richer alternatives are considered before final decisions. Thus the first hypothesis to be tested is,

H1. Divergent thinking leads to effective problem-solving competency.

Convergent Thinking and Effective Problem-Solving

CT ideally follows DT, refining multiple alternatives into a single workable solution. In algorithmic or familiar situations, experienced managers default to CT, relying on structured reasoning and rules (Doroodi & Mohammadi 2015). CT is strongly associated with intelligence, logic, and efficiency, enabling managers to filter, organize, and evaluate ideas systematically (Puccio 2015). It strengthens feasibility by ensuring coherence and clarity, and research shows performance-based incentives can enhance CT use (Huo 2020). CT is indispensable for solution-finding, though context matters. In highly complex environments, CT alone may prove insufficient unless complemented by DT. Managers are encouraged to apply both synchronistically, ensuring creativity is channeled into actionable outcomes. Nonetheless, CT contributes significantly to EPS even when used in isolation (Luchini et al. 2023). Nonetheless, CT supports South African managers' ability to integrate various interdisciplinary knowledge when seeking workable solutions. It grounds creativity by focusing on practicality, which is an invaluable approach in resource-sparse environments. CT also encourages data-driven, structured problem-solving, which may increase the timeliness of decision-making and enhance ethical and sustainable business practices.
Therefore, the second proposed hypothesis is,

H2. Convergent thinking leads to effective problem-solving competency.

South African organizations should prioritize leadership and managerial development interventions that promote cognitive adaptability. Structured reflection, innovation workshops, and problem-based learning activities that nurture DT can serve as valuable precursors to CT-driven evaluation. This sequential

integration of thinking modes would not only improve EPS but also strengthen managerial resilience, competitiveness, and strategic responsiveness within uncertain environments.

Divergent Thinking and Convergent Thinking

EPS relies on both DT and CT. Arsih et al. (2023) find that improving DT also enhances CT, confirming their interdependency. Collaborative learning develops both (Shettar et al. 2020), yet education often favors the enhancement of CT, leading to an overreliance on it in practice (Arsih et al. 2023, Silvia et al. 2013). Some scholars highlight tensions between DT and CT. However, overcoming confirmation bias strengthens both thinking skills (Schwind et al. 2012), while sociocultural factors may discourage DT in favor of CT (Joel 2014). Cultural influences, however, may reinforce CT dominance, constraining creativity. CT is overly relied on in African countries, thus highlighting the reciprocal role between them is important in the South African context. Regardless, both DT and CT contribute to EPS. Puccio (2015) argues that harmonizing DT and CT is essential, and Sanders and Rand (2019) observed improved decision quality when both were used. Using DT, South African managers can generate new, unusual ideas by making novel mental connections. Through CT, these managers evaluate new ideas and, at times, integrate them to find the most suitable solutions. This back-and-forth creates a feedback cycle in which exploring diverse ideas (DT) stimulates new connections to advance effective convergence, and structured evaluation (CT), which in turn enhances the next CPS's idea-generation phase.

Thus, the next hypothesis to be tested is,

H3. Divergent thinking leads to Convergent Thinking.

Mediation Effects

DT is often the initial step in solving heuristic or ill-structured problems, providing expansive input that is later refined by CT (Huo 2020, Puccio et al. 2020). Without DT breadth, managers have little material for evaluation. Empirical work confirms that integration yields superior outcomes: students who used DT before CT performed better than those who relied only on CT (Singer 2016). Sequencing DT before CT ensures novelty and feasibility. Overreliance on CT may stifle innovation, narrowing the scope of problem identification. Managers must first foster DT to generate options, then apply CT to refine them into actionable solutions. Industries typified by conceptual, interpersonal, and technical complexities, such as agriculture and manufacturing, require problem-solving approaches that incorporate ideation before analytical refinement. Effective decisions must therefore emerge from integrating DT during initial exploration and CT during subsequent evaluation. This aligns with dual-process cognitive theory and the CPS framework, which emphasize the sequential yet complementary role of both processes. In the South African business context, managers face complex challenges, including economic volatility, regulatory shifts, climate-related risks, and institutional inefficiencies. These problem environments are often ill-structured, requiring an initial ideational expansion through DT to identify context-sensitive strategic alternatives. However, the feasibility and operational viability of such alternatives are typically constrained by resource limitations, risk-aversion tendencies, and compliance requirements prevalent in South African organizations. Consequently, CT becomes essential in the second stage of problem-solving, refining divergent insights to produce implementable solutions aligned with organizational capabilities and external constraints. Therefore, the fourth hypothesis is as follows.

H4. Convergent thinking skills mediate the relationship between divergent thinking skills and effective problem-solving competency.

The Moderating Role of Education Level

Divergent Thinking and Effective Problem Solving

Nusbaum and Silvia (2011) found that higher educational attainment improved convergent reasoning but lowered originality and fluency. Similarly, Silvia et al. (2013) observed that education enhances crystallized intelligence and domain knowledge but not creativity. By reinforcing conventions, education may limit expansive thinking and even heighten susceptibility to bias. Ben-David et al. (2013) found that miscalibrated decisions increased with education among top financial managers. The role of education is thus highly contextual. Education enhances thinking skills, but conventional systems often overstimulate CT, leaving DT underdeveloped (Abbasi 2011). Students are conditioned to seek "correct" answers rather than explore. This is particularly true in South Africa, where educational activities are optimized for assessments and grading rather than deep exploration and creativity. In addition, DT and CT are developed separately since they are seen as antagonistic rather than complementary skills in educational settings. Webb et al. (2017) further found that DT had weaker links to insight problems than CT, suggesting its relevance decreases with education. Therefore, the fifth hypothesis to be tested is,

H5. Education level moderates the relationship between divergent thinking skills and effective problem-solving competency, such that the relationship is weakened as education level increases.

Divergent Thinking and Convergent Thinking

DT and CT are distinct yet complementary (Luoma & Martela 2021): DT expands options, CT narrows them. Their interplay ensures creativity becomes practicality. However, formal education often unevenly cultivates them, favouring CT through standardized assessments (Abbasi 2011). While CT is strengthened, DT is sidelined. As learners progress, this imbalance may weaken the DT-to-CT relationship, as skills are developed in isolation. Tabbron (1980) notes that education reinforces convergent dominance while constraining divergent exploration. For managers, this reliance on CT limits novelty, narrowing problem-solving capacity. Though DT and CT should complement each other, their uneven cultivation in education undermines EPS. In the South African business environment, this imbalance may be particularly limiting. Local managers frequently operate in complex, volatile conditions characterized by institutional gaps, regulatory uncertainty, and resource constraints. In such contexts, rigid, purely analytical approaches often prove insufficient, as solutions rarely align with established norms or procedures. Overreliance on CT in these circumstances may narrow the scope of problem-solving, resulting in incremental rather than transformative solutions. Not only can the relationship between DT and CT be adversarial, but education can also weaken it. This is because the education system prioritizes outcome-based learning, which adheres to rules and boundaries at the expense of creative and divergent thought. Moreover, South African managers tend to have specialized qualifications which narrow academic and cognitive flexibility. Conforming to (over) assessments limits scholarly risk-taking. Therefore, the sixth hypothesis to be tested is,

H6. Education level moderates the relationship between divergent thinking and convergent thinking skills, such that the relationship is weakened as education level increases.

Convergent Thinking and Effective Problem Solving

Education strengthens CT by encouraging structure and precision, yet its effects are context-dependent. In ill-structured problems lacking clear solutions, CT's influence on EPS diminishes (Lee et al. 2022). CT relies on rules and knowledge structures that can restrict flexibility, leading to premature convergence on suboptimal solutions. Ill-structured challenges require DT to generate a wide range of alternatives before CT is applied. Additionally, overreliance on CT narrows the scope too quickly, thereby undermining CPS.

While CT remains critical for feasibility, it cannot sustain innovation without prior DT. Education's dominance in CT is problematic, especially in contexts that demand creativity. Balanced cultivation of DT and CT is required to ensure CT strengthens rather than constrains EPS. There is also a lack of guidance and pedagogical models that promote the integration of CT and DT. These are circumstances where existing knowledge structures are insufficient. In such scenarios, CT alone may lead to premature decision closure, limiting adaptability and innovative response. Knowledge of this may increase as education levels rise, making highly educated South African managers more considerate of additional factors that influence their solutions and are affected by their decisions. The local education system also tends to emphasize critical thinking as analysis, instead of action to be taken. Therefore, the final hypothesis is,

H7. Education level moderates the relationship between convergent thinking skills and effective problem-solving competency, such that the relationship is weakened as education level increases.

Methodology

This article investigated the direct and indirect relationships among DT, CT, and EPS, along with the impact of educational level, by conceptualizing previous publications (Neuman 2014). A cross-sectional, quantitative, survey-based approach was employed in this exploratory study (Burns et al. 2016). This design enables the collection of self-reported data from a diverse group of agricultural managers, allowing for a robust analysis of hypothesized relationships. Given its strategic importance to national food security, employment, and industrial collaboration, South Africa's agricultural sector warrants closer academic scrutiny, particularly about managerial competencies (Longweni & Mdaka 2024, Ortmann & King 2007). This study targeted middle and lower managers due to their critical yet underrepresented roles in the existing literature. Non-probability convenience sampling was employed. A total of 859 managers received the survey link; 342 complete and usable responses were returned. The study's sample frame consisted of the employee lists of each business's lower-level and middle-level managers. Non-response bias is a potential concern in quantitative research, as reluctant managers can lead to inaccurate interpretations. In this study, late responders were investigated as signals of non-response. Independent-samples t-tests were conducted to assess significant differences between the first 50 and the last 50 participating managers. The non-significant *p*-values indicate that non-response bias was not a major concern in this study.

Operationalization of the Variables

We used the questionnaire to collect data on managers' perceptions of their problem-solving and thinking effectiveness. The five-point scales were used. Participants were instructed to indicate their level of mastery with 15 statements: EPS competency (seven items), DT (four items), and CT (four items). The survey was adapted from validated published scales: EPS competency (α=.78), Titus & Koppitsch (2018); DT skill (α=.80), Callan et al. (2021); CT skill (α=.94) Park (2016); and single-item education level (α=.94)—Grade 12, Diploma or degree, Honors degree, Master's degree, and PhD. Participants were male/female (254/85) and middle/lower managers (202/140), the mean EPS scores for PhD/4.29, Honors degree/4.22, Masters/4,19, Grade 12/4.10 and diploma or degree (4.06).

Analyses

Data were analyzed using *Jamovi* and Hayes' PROCESS macro (Model 59) to assess the hypothesized mediation and moderated mediation effects. The Preacher and Hayes (2008) bootstrapping method was employed, using 5,000 bootstrapped samples from the dataset. Reliability and validity were assessed using Cronbach's *alpha* and confirmatory factor analysis (CFA). The CFA was estimated using maximum

likelihood in *Jamovi*. The model showed an acceptable fit: *CFI*=.92, *IFI*=.90, *TLI*=.90, *RMSEA*=.05 and *SRMR*=.07. The *CMIN/df* ratio of 2.79 (243/87) was acceptable. To address common method bias, the researcher employed procedural measures, such as dividing the survey into multiple sections and collecting data from five distinct organizations, as well as statistical checks using Harman's single-factor test. Non-response bias was evaluated by comparing early and late respondents, with no significant differences observed (p>.05). Acquiescence bias was mitigated through reverse-coded questions, and haphazard responses were excluded from the final sample.

Results and Discussion

As no fully validated instrument covering all constructs could be located, the survey was compiled from established sources and subjected to validity testing. Content validity of the instruments was confirmed by expert reviewers using Kline's (2016) method. Construct validity was determined using exploratory factor analysis (EFA). The EFA was based on managers' perspectives of their EPS and the use of DT and CT during the CPS. The Kaiser-Meyer-Olkin (KMO) statistic was .95, and Bartlett's test was significant across all measures. Principal component analysis with Oblimin rotation and Kaiser normalization was applied. Items with factor loadings above .30 and eigenvalues greater than one were retained. The first three factors (EPS, DT, and CT) represented 57% of the variance in the data. The AVE (Average Variance Extracted) scores are within an acceptable range. The Heterotrait-Monotrait (HTMT) ratio of correlations among different constructs was used to assess discriminant validity. Table 1 reports the correlations. All the HTMT ratios are less than 1, indicating a positive discriminant validity. Furthermore, all ratios are also below .90, indicating practical discriminant validity. Consequently, the researcher found the measuring instrument to have adequate levels of reliability, construct validity, and discriminant validity.

Table 1. HTMT Ratio of Correlations and Reliability

Constructs	*EPS*	*DT*	*CT*	*α*	*CR*	*AVE*
EPS	1			.82	.82	.41
DT	.65	1		.76	.77	.46
CT	.79	.71	1	.80	.80	.50

Structural Model

Table 2 reports statistics relating to the following paths associated with this study's hypotheses.

Table 2. Direct Relationship Hypothesis Testing

	Paths	*β*	*S.E*	*p*	*Hypotheses*	*Result*
Direct effect	DT→EPS	.27	.04	.00	*H1*	Supported
	CT→EPS	.48	.05	.00	*H2*	Supported
	DT→CT	.56	.04	.00	*H3*	Supported
Indirect effects	DT▪CT→EPS	.27	.03	.00	Indirect effects were fully analyzed by considering confidence intervals after applying bias-corrected bootstrapping.	
	DT*Education level→EPS	.05	.05	.92		
	DT*Education level→CT	-.10	.04	.03		
	CT*Education level→EPS	.21	.06	.67		

The analysis of the direct relationships reveals three supported hypotheses: The standardized path coefficient supporting *H1* is significant (β=.27, p=.00). This suggests that there is a positive relationship between divergent thinking and effective problem-solving. The result means that deferring judgment to generate as many creative ideas as possible is essential in the CPS process within businesses. Effective

problem-solving depends on how well managers use their divergent thinking. This is to be expected, as it aligns with results from previous publications (Joel 2014, Preiss et al. 2016). The path coefficient is significant, confirming *H2* (β=.48, p=.00). This implies a positive relationship between convergent thinking and effective problem-solving. This suggests that narrowing down ideas to the most logically sound ones is crucial for successful managerial problem-solving. Luchini et al. (2023) also found a significant positive relationship between convergent thinking and problem-solving, reinforcing the importance of this skill in various business settings. This path coefficient is also significant, supporting *H3* (β=.56, p=.00). This indicates a positive relationship between divergent thinking and convergent thinking; specifically, one in which divergent thinking leads to convergent thinking. This suggests that expansive (DT) and narrowing thinking (CT) can coexist and complement each other, contributing to a well-rounded problem-solver's profile. This finding aligns with the sentiments of previous authors that both divergent and convergent thinking are necessary for high-quality decision-making and problem-solving (Puccio 2015, Sanders & Rand 2019). *H1* to *H3* confirm that both divergent and convergent thinking significantly contribute to effective problem-solving competency, both individually and interdependently. Table 3 presents the indirect relationships among the constructs of this study, as determined through bias-corrected bootstrapping.

Table 3. Indirect Effect after Bootstrapping

Paths	*β*	*S.E*	*p*	*Hypothesis*	*Result*
DT→CT→EPS	.27	.03	.00	*H4*	Supported
DT*Education level→EPS	.02	.04	.65	*H5*	Unsupported
DT*Education level→CT	-.10	.04	.03	*H6*	Supported
CT*Education level→EPS	-.00	.01	.96	*H7*	Unsupported

The indirect path hypotheses are discussed and interpreted below. The path coefficient for the mediation relationship for *H4* (DT→CT→EPS) is significant (β=.27, p=.00) and thus supported. It indicates that convergent thinking mediates the relationship between divergent thinking and effective problem-solving. Partial mediation is implied, meaning that the effect of divergent thinking on effective problem-solving is partially explained by its influence on convergent thinking. The addition of other, less traditional thinking models may lead to a more comprehensive understanding of managers' use of thinking skills during the creative problem-solving process (Longweni & Mdaka 2024). Divergent thinking involves generating a wide range of creative ideas. The breadth and originality of these ideas provide the raw material for problem-solving. However, divergent thinking alone is insufficient for translating creativity into actionable solutions, as it lacks the evaluative component required for implementation (Sanders & Rand 2019). This path coefficient for *H5* (DT*Education level→EPS) is not statistically significant (β=.02, p=.64), thus it is unsupported. It suggests that education levels have no bearing on the relationship between DT and EPS. This finding contrasts with previous publications that suggest education should influence the use of divergent thinking, whether positive or negative (Ben-David et al. 2013, Haddon & Lytton 1971, Lu & Xie 2024).

This moderation relationship for *H6* (DT*Education level→CT) is significant (β=-.10, p=.03) and thus supported. It suggests that managers' educational level influences the relationship between divergent and convergent thinking, such that the higher the level of education, the weaker the relationship will be. This moderation is illustrated in a simple slope analysis, as shown in Figure 2. This phenomenon could be attributed to an overreliance on convergent thinking, a cognitive bias, or the non-linear development of the two thinking skills in education (Abbasi 2011, Arsih et al. 2023, Ben-David et al. 2013, Silvia et al. 2013). Tabbron (1980) finds that the weakening relationship dissipates as education reaches its peak. This may lend more credence to this observation being caused by a cognitive bias instead (Ben-David et al. 2013). Similar to *H5*'s result, the path coefficient for *H7* (CT*Education level EPS) is insignificant (β=-.00, p=.96),

and thus unsupported. It indicates that although education impedes managers' use of convergent thinking for effective problem-solving, its impact is negligible. There may be other unexplored influences, such as personal and business-level stumbling blocks, that limit the effects of convergent thinking on effective problem-solving (Puccio 2015). Figure 2 below illustrates the only significant moderation analysis, in which the relationship between divergent and convergent thinking is weakened as managers' level of education increases.

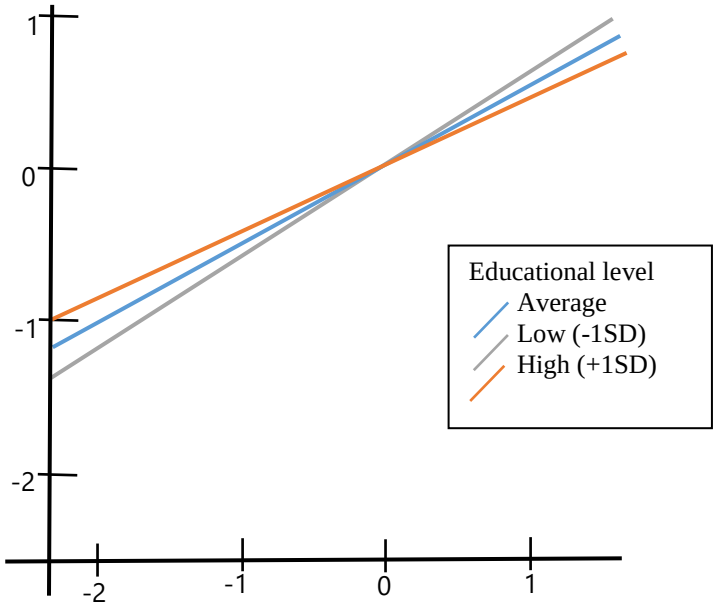

Figure 2. Interactions: Education, Divergent and Convergent Thinking Skills
Source: the author

Implications for Managers

Based on the results of this research, some actionable suggestions can be provided to organizations and managerial development initiatives. The study indicates that education may hinder the shift from divergent to convergent thinking. This observation underscores the importance of cultivating cognitive flexibility and metacognitive awareness in management training, particularly for highly educated professionals. Consequently, organizations should promote more adaptable thinking practices among highly educated managers by integrating 16 habits of mind, design thinking, interdisciplinary problem-solving tasks, and collaborative innovation initiatives that merge analytical and intuitive thought processes (Longweni & Mdaka 2023). Organizational culture should prioritize both creativity and logical reasoning. Managers should be rewarded not only for generating original ideas but also for efficiently refining and implementing them. This equilibrium can be fostered through incentive systems, innovation centers, and cross-functional teams that support diverse cognitive viewpoints (Sanders & Rand 2019).

Limitations and Future Research Directions

Some measures, particularly those related to convergent validity, did not meet the traditional thresholds, suggesting potential issues with the scale used and indicating a need for further validation of the

measurement instruments. The level of education was measured as a single demographic item that gauged managers' highest qualification, whereas education can arguably be a multifaceted construct. In addition, while the study outlines the negative impact of educational levels, it does not fully explore how education and training affect thinking skills and managerial competencies. Some may also argue that education, when measured as a level of qualification, may serve only as a control variable. Future studies should include larger samples (especially PhD holders), use only highly validated scales, and incorporate more theoretical models and inhibitors.

Conclusion

In conclusion, this research provides empirical evidence that effective managerial problem-solving stems from the dynamic interplay between divergent and convergent thinking, with education subtly influencing this cognitive integration. While education enhances general problem-solving proficiency (as indicated by mean scores), it may also introduce a degree of mental rigidity that hampers the mental flexibility needed to turn ideation into execution. This could be attributed to over-dependence on analytical thinking patterns cultivated through formal education, which may inhibit more intuitive and expansive cognitive processes. It may also be due to the Einstellung Effect, a recognized cognitive bias where individuals tend to rely on familiar methods even when superior, novel approaches are available. These findings suggest a need for customized training programs that help managers, particularly those with advanced formal education, bridge their creative and analytical cognitive processes.

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