

Inside the Mind of Innovation: A Systematic Review of Cognitive Development and Entrepreneurial Competencies

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ABSTRACT

Innovation and entrepreneurial competencies are increasingly acknowledged as pivotal results of modern educational paradigms; however, the cognitive underpinnings that facilitate such results remain disjointed across various academic disciplines. This paper offers a systematic literature review that explores the role of cognitive development in fostering innovation and entrepreneurial competencies within educational frameworks. A systematic literature review (SLR) was conducted following PRISMA guidelines, synthesizing 60 studies retrieved from Scopus, Web of Science, ERIC, ScienceDirect, and Google Scholar. The search was performed between January and March 2025, covering publications from 2000 to 2025. Thematic analysis identified six key themes: (1) cognitive development as the core mechanism of innovation, (2) the central role of

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higher-order thinking, (3) the importance of cognitive flexibility and creative cognition, (4) experiential and constructivist learning as enabling environments, (5) the role of scaffolding and cognitive load management, and (6) innovation as a cognitive outcome rather than a direct product of tools or pedagogy. The findings indicate that innovation emerges from an integrated cognitive ecosystem shaped by advanced mental processes and supportive learning conditions. The framework offers a theoretically robust foundation for forthcoming empirical inquiries and the development of cognitively informed educational interventions aimed at promoting innovation and entrepreneurship.

Keywords— Cognitive Development; Innovation; Higher-Order Thinking; Cognitive Flexibility; Creative Cognition; Experiential Learning; Systematic Literature Review

Introduction

In modern knowledge driven economies, innovation has become a key driver of the organizational competitiveness, entrepreneurial success, and societal advancement. While discussion of innovation often stresses technological development, market factors, or organizational methods, there is now a growing body of scholarship that argues that innovation simply originates from human cognition (Sawyer & Henriksen, 2024). In essence, innovation is the product of sophisticated and complex mental processes through which individuals can perceive problems in ways that have never before been thought about, enabling the production of unprecedented ideas, combining and linking disparate areas of knowledge to create workable solutions to perceived problems (Sharma et al., 2022). As a result, the challenge of capturing the cognitive bases of innovation has become a key issue for scholars and practitioners interested in developing entrepreneurial and innovative skills in higher education.

Cognitive development theory offers a basic framework for explaining how people acquire the cognitive skills needed for innovation (Shaheen et al., 2025). Classical concepts of cognitive development, especially those put forward by Piaget and Vygotsky, understand the development of cognition as an evolving process through interaction, experience and social mediation (Yildiz, 2025). Piaget's theory emphasizes the gradual development of abstract reasoning capability and the logical way of thinking - skills that are important in the complex problem-solving and in the generation of ideas (Sidabutar, 2025). Similarly, Vygotsky's perspective on social constructivism accentuates the significance of social interaction and scaffolding in the enhancement of cognitive abilities toward more advanced levels (Yildiz, 2025). Collectively, these theoretical frameworks suggest that innovation is not an inherent characteristic; instead, it emerges as a consequence of cognitively enriched educational environments that foster sophisticated cognitive engagement (Aithal & Maiya, 2023; Rathnasekara et al., 2025).

In the context of education, Bloom's taxonomy delineates the correlation between cognitive development and innovation by categorizing lower-order and higher-order thinking skills (García-Ramírez, 2024). While foundational knowledge and comprehension constitute essential elements of learning, innovation is also closely linked to higher-order cognitive processes, which encompass analysis, evaluation,

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synthesis, and creation (Ramírez-Montoya et al., 2022; Zhan et al., 2022). These cognitive activities empower learners to transcend mere rote memorization, enabling them to derive new meanings, reinterpret existing knowledge, and devise novel and original solutions (Xia, 2025; Nigar et al., 2024). Thus, innovation may be regarded as a manifestation of elevated cognitive functioning rather than solely a technical or procedural outcome.

Beyond traditional cognitive theories, contemporary research underscores the significance of cognitive flexibility, creative cognition, and metacognitive awareness in fostering innovation (Preiss, 2022; Fuchs et al., 2023). Cognitive flexibility enables individuals to shift perspectives and adapt to ambiguity while recombining ideas across various domains—qualities that are imperative for entrepreneurial problem-solving (Fuchs et al., 2023; Atrup et al., 2023; Garaus et al., 2025; Pastor, 2024). The theory of creative cognition further elucidates the process by which new and innovative ideas arise through the interplay of memory, imagination, and evaluative judgment (Benedek et al., 2023; Orwig et al., 2025; Beaty & Kenett, 2023). These cognitive mechanisms are pivotal in assisting individuals to identify opportunities, experiment with alternatives, and refine innovative concepts within dynamic and intricate environments (Duruaku et al., 2024; Gonzalez & Heidari, 2025).

Learning theories grounded in experiential and constructivist frameworks provide additional insights into how cognitive development can be intentionally cultivated to enhance innovation (Bell & Bell, 2020; Gavrilas & Kotsis, 2025; Dong et al., 2025). Experiential learning emphasizes the significance of learning through active engagement, reflective thinking, and practical experimentation, allowing learners to internalize knowledge via real-world experiences (Pole & McGee, 2026; Bayram, 2024; Rahmi, 2024). Constructivist approaches similarly assert that learners are proactive agents who construct knowledge through interaction and inquiry (Du et al., 2022; Papi & Hiver, 2025) . Together, these models suggest that an education oriented toward innovation must prioritize experiential learning opportunities that challenge cognitive boundaries, promote exploration, and support reflective thinking, in contrast to traditional, transmission-oriented instruction.

Nevertheless, the cultivation of advanced cognitive skills is not without its obstacles. Cognitive Load Theory serves as a foundation for comprehending the constraints of working memory and the critical role of instructional design in managing cognitive effort (Sweller, 2020; Janssen & Kirschner, 2020; Gkintoni et al., 2025; Sweller, 2022). In the absence of appropriate structures (scaffolding), a complex learning task may overwhelm learners and hinder creative and innovative thinking (Hernandez Sibó et al., 2024; Gube & Lajoie, 2020; Bozkurt et al., 2024). When utilized effectively, scaffolding strategies enable learners to incrementally develop their cognitive capacities, providing structured support that can gradually diminish as the learner's competence increases (Reiser, 2023; Al Mamun & Lawrie, 2024; Wang et al., 2024; Ahmed et al., 2025). This equilibrium between challenge and support is a vital determinant in fostering profound cognitive engagement and sustaining long-term innovation.

Despite growing awareness of the cognitive underpinnings of innovation, there remain empirical and conceptual gaps in the explanation of how the process of cognitive

development systematically transacts into innovative and entrepreneurial capacities in higher education. Much of the extant literature uses innovation as the result of curricular interventions or the use of technological tools with no adequate dissection of underlying cognitive processes involved (Lubis et al., 2022; Roblyer et al., 2024). This gap demonstrates the need for a more focused theoretical study of cognitive development as central to the mechanism by which innovation occurs.

Consequently, this study aims to conceptualize the relationship between cognitive development and innovation by synthesizing theories of cognitive development, higher orders of thinking and learning models. By placing the process of innovation as the result of highly sophisticated mental activity and capabilities, this is research that hopes to provide a strong theoretical basis for innovation-oriented pedagogy, and also sets the stage for further investigation of design thinking and generative artificial intelligence as cognitive enablers.

Literature Review

Cognitive Development as the Basis of Innovation

Cognitive development is the gradual change in mental processes that allow the individual to perceive, interpret, and respond to his/her environment in more and more complex ways (Vygotsky, 2024; Drigas & Mitsea, 2021; Margolis, 2020). In the context of innovation, cognitive development is critical, since innovative outcomes depend upon the ability to engage in abstract reasoning, complex problem-solving and creative synthesis (Gube & Lajoie, 2020; Garbuio & Lin, 2021). Innovation, therefore, is not necessarily the end product of exposure to tools or technologies but instead is the product of the maturation and activation of advanced cognitive processes. Research is increasingly recognising that any efforts to promote innovation are superficial and unsustainable unless there is a basis of the soundest of thinking.

Classical cognitive Development Theories and Innovation

Piaget's Cognitive development theory

The Piaget theory conceptualizes cognitive development as a stage and the process by which individuals develop increasingly sophisticated forms of thinking (Kazi & Galanaki, 2020; Pakpahan & Saragih, 2022). Particular relevance for innovation is the formal operational stage, when one develops the ability for abstract reasoning, hypothetical thinking and systematic problem-wise thinking. These cognitive skills help learners to move beyond concrete experience and think about possibilities, scenarios, and conceptual models - skills central to innovative thinking. Innovation, from Piagetian point of view occurs when persons are able to mentally manipulate ideas, test assumptions and envision alternatives to the immediate reality (Lebert & Vilarroya, 2024; Passarelli & Kolb, 2023)

Vygotsky's Social Radical Constructivist

Vygotsky's theory is a complement to Piaget's theory in its focuses on the social and cultural dimensions of development (Huang, 2021; Veraksa, 202). Through interaction with others who are more knowledgeable, learners internalize higher order cognitive strategies. The concept of the Zone of Proximal Development (ZPD) emphasizes the

importance of scaffolding for helping learners to accomplish cognitively demanding tasks that they would otherwise be unable to accomplish independently (Margolis, 2020; Xi & Lantolf, 2021; Shaheen et al., 2025). In innovation-oriented context, collaborative learning and guided problem-solving enable individuals to stretch their cognitive capabilities, for the development of creative and innovative competencies (Hsia et al., 2021). Innovation therefore turns into a social cognitive achievement and not an individual isolated achievement.

Bloom's Taxonomy and Higher Order thinking skills

Bloom's taxonomy offers a significant conceptual framework for elucidating the progression of the learning process, evolving from fundamental levels of knowledge acquisition to advanced levels of cognitive engagement (Hao & Tasir, 2024; Hui, 2025). Although the foundational stages of recall and comprehension are essential components, creativity is primarily associated with the elevated stages of analysis, evaluation, and synthesis. These levels compel learners to deconstruct information, evaluate alternatives, and construct novel ideas. Educational environments that prioritize higher-order thinking cultivate the cognitive foundations necessary for creativity by prompting students to challenge assumptions, integrate diverse viewpoints, and produce their own original contributions (Siregar, 2025).

Cognitive Flexibility and Creative Cognition

Beyond classical models, current cognitive science adds to the importance of cognitive flexibility that promotes innovation. Cognitive flexibility refers to one's ability to change perspectives, adjust to changing situations and restructure knowledge patterns in response to new information (Fuchs et al., 2023; Negi, 2024). This aptitude is particularly important in entrepreneurial and innovative situations with uncertain and complex situations. Creative-thinking theory is further used to describe how innovation occurs as a result of the interaction between memory, imagination, and evaluative judgement (Gerver et al., 2023). Rather than spontaneous, creativity is conceptualized as a structured cognitive process, recombining extant knowledge in new configurations.

Problem-Solving and Innovation as Cognitive Process

Problem-solving is central to innovation, as new results often occur as a result of efforts to solve complex, ill-defined problems. Cognitive research draws a distinction between commonplace problem solving, which uses known ways of doing things, and unusual problem solving, which requires creative and adaptive thinking. Innovation is more in line with the latter because it involves exploring, experimenting, and making refinements (Treffinger et al., 2023). Advanced problem-solving competencies help individuals to grapple with ambiguity, evaluate multiple solution avenues, and to persevere through failure (important cognitive attributes of innovative behavior).

Experiential Model and Constructivist Model of Learning

Experiential learning theory: The theory states that the learning process comes in a circular fashion of the experience, reflection, conceptualization and experimentation (De Witt et al., 2024). This framework aligns closely with the principles of innovation,

as it promotes an engaged approach among learners in addressing challenges while deriving insights from iterative processes of action and feedback. Constructivist theory similarly conceptualizes knowledge through the lens of interaction, active inquiry, and creation (Dahl & Mørch, 2025; Bou Saad et al., 2025). Both perspectives assert that educational experiences driven by innovation foresee learning environments that prioritize exploration and cognitive engagement, as opposed to traditional models that focus on the mere passive reception of information.

Cognitive Load Theory & Scaffolding

Although complex learning experiences are indisputable in cognitive development, Cognitive - Load Theory makes the limitations of human working memory a focus (Sweller, 2024). Having too much cognitive load can be counter-productive to learning and creative thinking (Brockbank & Feldon, 2024). Consequently, good instructional design plays a central role in facilitating innovation through the regulation of cognitive demands. Scaffolding strategies provide structured support while helping learners to gain cognitive competence in steps that allow them to avoid being overwhelmed (Reiser, 2023). When appropriately designed, for instance, scaffolding allows for learners to work with sophisticated problems while retaining cognitive efficiency, fostering deeper understanding and innovative thought as a consequence.

Cognitive Development as the Mechanism for Innovation

Synthesizing the aforementioned views, cognitive development appears as the key mechanism upon which innovation is created. Higher order thinking Cognitive flexibility Creative problem-solution is an empowering complex of processes that enable an individual to transmute knowledge into new and valuable outcomes (Dubois & Prade, 2023; Shaheen et al., 2025). Innovation, therefore, can be seen as a cognitive phenomenon that represents the quality and depth of mental processes, that is, not simply the availability of external resources or technologies (Weimer, 2024). This perspective highlights the need to develop educational interventions that explicitly promote the development of higher levels of cognitive skills.

Research Gap and Implications for the Concepts

In spite of all the theoretical insights, there is currently a lot of literature that describes innovation as a result of educational interventions but does not precisely define what cognitive processes are involved. A clear need continues to be felt for integrative frameworks that will place cognitive development as the dominant force behind innovation and entrepreneurship. The need to address this lacuna can be considered especially high in higher education, where emergent pedagogical approaches such as design thinking and generative artificial intelligence are being implemented at an accelerated pace without clear cognitive justification. Cognitively-based understanding of innovation provides a needed basis for the evaluation and design of such interventions.

Conceptual Framework: Cognitive Development as a Driver of Innovation

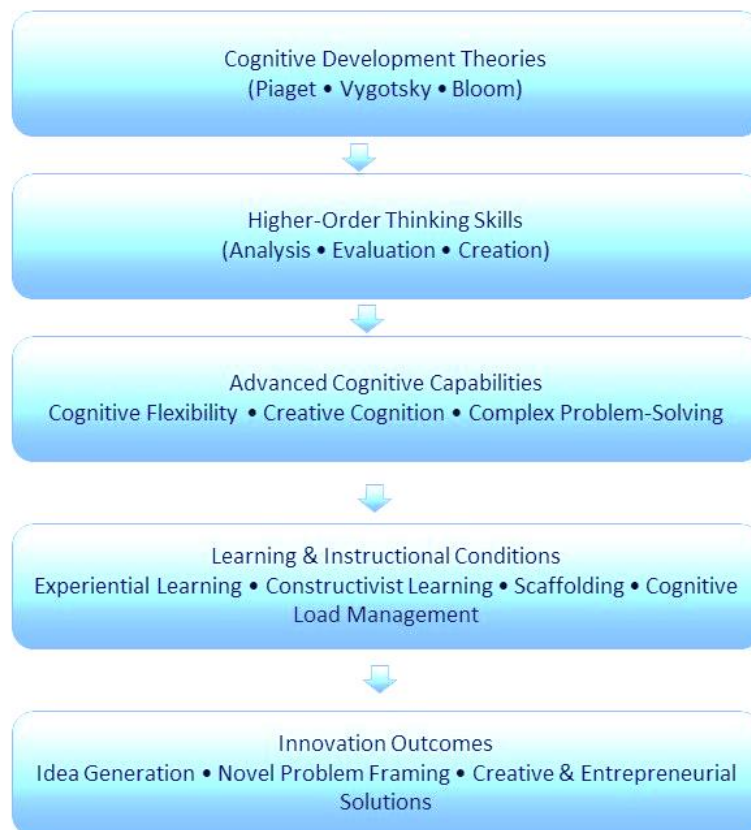


Figure.1 Conceptual Framework of Cognitive Development and Innovation

The conceptual model is based on the assumption that innovation is a largely cognitive product, which comes as a result of the development of the enhanced mental activities and their interactions. Cognitive development takes the position of the explanatory mechanism most significant in terms of the acquisition of the ability to think creatively, solve more complex problems, and come up with new ideas within this paradigm.

Based on the classical and the modern forms of cognitive theories, the framework places the higher-order cognitive skills, cognitive flexibility, and the creative problem-solving in the centre of cognitive development. These are nurtured in the context of experiential and constructivist learning, whereby learners are involved in the active engagement with the problems under issue, their reflection, and contrived through the course of repetitive acquisition of knowledge.

At the same time, the framework acknowledges the bearing of the instructional design conditions, specifically, the control of cognitive load and scaffold, in facilitating or limiting cognitive development. Well-constructed scaffolding enables learners to deal with complexity without overwhelming the working memory hence encouraging deeper thinking and maintaining the creative process.

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In this schema, the concept of innovation is treated as the final result variable offered and realized as the idea generation, new problem framing, and the development of unique and valuable solutions. The model never sees innovation as a product of tools or content but as an outcome of higher order thinking guided by learning experience and teaching support.

Such conceptualization offers a theoretical point of contact linking a set of underlying cognitive theories with the practical methodologies of learning, which necessitates the next step of integrating design thinking and generative artificial intelligence as cognitive facilitators and not a mediating intervention.

Research Methodology

The current paper will use a systematic literature review (SLR) process to understand the contribution of cognitive development to the development of innovation and entrepreneurial skills. The systematic review method was chosen to guarantee methodology rigour, transparency and replicability in the process of acquiring and synthesizing existing knowledge in the subject of cognitive psychology and education and innovation research. In contrast to narrative reviews, the SLR follows a systematic guideline regarding the process of identifying, screening, and analyzing pertinent studies, thus, minimizing selection bias and promoting the research reliability.

Guidelines and Protocol of Review

The systematic review methodology with regard to the established principles led to the review process that utilized PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) guidelines. These criteria led the process of identification of literature, screening, assessment of eligibility, and inclusion to ensure the transparency and reproducibility of the review process.

Sources and Search Strategy of Data

Major academic databases were extensively searched to achieve a high-quality and peer-reviewed literature on the area of cognitive development and innovation. The major databases were Scopus, Web of Science, ERIC, ScienceDirect, and Google Scholar, which were selected based on their wide scope of interdisciplinary studies in the field of education, psychology, entrepreneurship and innovation.

The search strategy was a combination of keywords and Boolean operators and included terms of cognitive development, higher-order thinking, creative cognition, problem-solving, innovation, entrepreneurship, experiential learning, and constructivist learning. Search terms were coded to suit the syntax of the respective databases to warrant thorough search of the relevant studies. Search strings were systematically adapted to the syntax and indexing requirements of each database (e.g., use of field tags such as TITLE-ABS-KEY in Scopus and TS in Web of Science). Where applicable, truncation and phrase searching were employed to capture variations of key concepts

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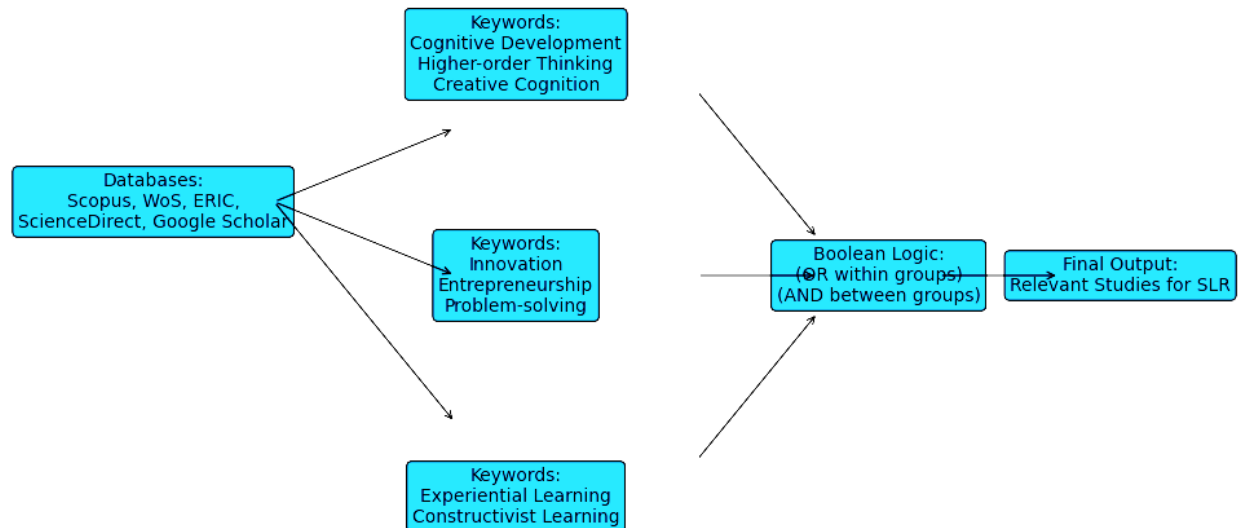


Figure 2. Structured representation of the literature search strategy, illustrating the integration of database sources, keyword clusters, and Boolean logic to identify relevant studies

Inclusion and Exclusion Criteria.

The studies were selected according to the predetermined criteria to remain relevant and of high-quality. Peer-reviewed journal articles, conference papers and scholarly book chapters published in the English language were only taken into consideration. Review articles were selected based on the explicit criteria of studying cognitive processes, higher-level thinking or learning models when applied to the outcomes of innovation, creativity, or entrepreneurship. Purely technical (no cognitive or education component), or were not focused on the results of innovation, publications of non-scholarly characteristics, and articles that do not provide the full-text version were excluded.

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Table.2 Inclusion and Exclusion Criteria

Criteria Category	Inclusion Criteria	Exclusion Criteria	Rationale
Publication Type	Peer-reviewed journal articles, conference papers, scholarly book chapters	Editorials, opinion pieces, blogs, non-peer-reviewed sources	Ensures inclusion of high-quality, validated academic research
Timeframe	Published between 2000–2025	Published outside this period	Captures both foundational theories and recent developments in cognition and innovation
Language	English language studies	Non-English publications	Ensures consistency in interpretation and avoids translation bias due to resource constraints
Conceptual Focus	Studies addressing cognitive constructs (e.g., cognitive development, higher-order thinking, cognitive flexibility, creative cognition)	Studies lacking a clear cognitive component	Maintains alignment with the core research objective (cognition-driven innovation)
Outcome Relevance	Studies examining innovation, creativity, or entrepreneurship outcomes	Studies not linking cognition to innovation outcomes	Ensures direct conceptual linkage between independent and dependent variables
Context	Educational or learning environments (e.g., higher education, training, instructional settings)	Purely industrial, technological, or business contexts without educational relevance	Focuses the review on learning-driven cognitive development rather than purely organizational outcomes
Accessibility	Full-text available	Full-text not accessible	Enables complete data extraction and verification
Data Quality	Studies with clear methodology and conceptual rigor	Studies with weak or unclear methodological	Enhances validity and reliability of the synthesis

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Criteria Category	Inclusion Criteria	Exclusion Criteria	Rationale
Duplicates	Unique records only	grounding Duplicate records across databases	Prevents data redundancy and bias in analysis

Study Selection Process

The first search produced a significant repository of records which was filtered by the use of a multi-stage screening. The first step in the way of extraction was the review of titles and abstracts to rule out the duplications and obviously irrelevant studies. The rest of the articles that received a full-text evaluation were included in the study as eligible based on the inclusion criteria. This procedure resulted in a final set of studies that was to be used as the foundation of the review.

Data Mining and Data Analysis.

A coding scheme was configured to extract the relevant data out of the chosen studies. Theoretical frameworks, investigated cognitive constructs, methodology and reported relationships between cognitive development and innovation were extracted information. An analysis based on thematic ideas helped to recognise common patterns, ideas and connexions within the literature, which allowed the synthesis of varied ideas into consistent themes in cognition development, learning processes and outcomes on innovation.

Synthesis and Frame Work Development.

The thematic results were integrated to create an integrative meaning of the role in which cognitive development supports innovation. The review did not collate statistical outcomes but focused on conceptual integration, which identified congruences and divergences between studies. It is this synthesis that led to the formulation of a conceptual framework that advanced cognitive processes are the main mechanism via which innovation and entrepreneurial abilities are developed.

PRISMA Flow Diagram

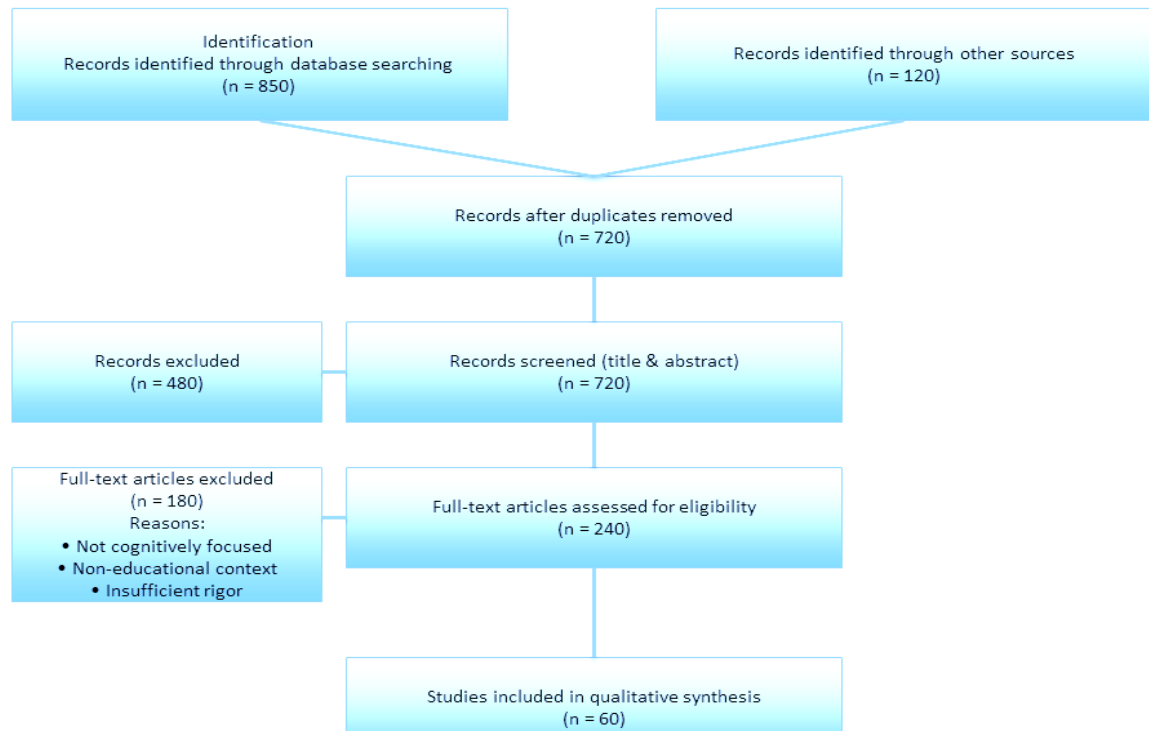


Figure 3. PRISMA Flow Description

The systematic literature review was done on the basis of rigorous and transparent process of selection in complete accordance with PRISMA guidelines. The review process had four principal steps that included identification, screening, eligibility assessment, and inclusion.

At the stage of identification, a wide-ranging search was performed in key academic databases, including Scopus, Web of Science, ERIC, ScienceDirect, and Google Scholar, and included pre-determined keywords, which were related to the area of cognitive development, higher-order thinking, creative cognition, problem-solving, entrepreneurship and learning models. The first call discovered a huge amount of documentation, which attests to the cross-disciplinary character of the investigation. Duplication of records found on various databases was carefully determined and removed prior to additional screening.

During the screening phase the titles and abstracts of the rest of the publications were filtered to determine whether they were looking at the scope of the review or not. It was at this point that manuscripts that were clearly not related to cognitive development, innovation, or educational and learning scenarios were cut. Such strict screening meant that only those pieces with an immediate conceptual or empirical nexus to cognitive functions to innovation were submitted to further review.

Eligibility phase involved complete text screening of shortlisted articles. At this point, research was filtered by a set of preset inclusion and exclusion criteria. Articles were filtered out regarding a lack of clear cognitive or theoretical focus, a concern with

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innovation as only seen through a technological or managerial perspective with no cognitive underpinning, or lack of methodological or conceptual rigour in its structure. In addition, un-peer-reviewed works, those that were not available in full-text, or in any other language besides English were also missed.

After the eligibility test, a concluding number of studies was included in the review. These researches form the main part of literature under analysis in the systematic review and form a basis of thematic synthesis. The last choice is a wide, but consistent set of the research that includes cognitive psychology, educational theory, innovation research, and books on entrepreneurship. The PRISMA-facilitated process, in turn, ensures transparency, replicability, as well as methodological rigour in the choice of studies that are used to promote the conceptual knowledge of cognitive development as the driver of innovation.

Results of the Systematic Literature Review (Thematic Findings)

Thematic Finding	Cognitive Core	Learning Enablers	Innovation Outcome
Cognitive Development	✓✓✓	–	✓
Higher-Order Thinking	✓✓	✓	✓✓
Cognitive Flexibility	✓✓	✓	✓✓✓
Experiential Learning	✓	✓✓✓	✓
Scaffolding & Load	✓	✓✓✓	✓

Table 1. Theme–Framework Alignment Matrix

The rigorous examination of the chosen articles led to the discovery of a few interconnecting themes that explain how innovative and entrepreneurial strengths are the outcomes of the sophisticated way of thinking as presented in the table.1. The thematic analysis showed that innovation cannot be a solitary product of instructional strategies or technology, but rather it is deeply anchored in cognitive development, facilitated by the instructional organization and supporting stimuli. The identified themes are mentioned below and explicitly connected with the conceptual framework that has been developed in the paper.

Conceptual Network Map of Cognitive Innovation

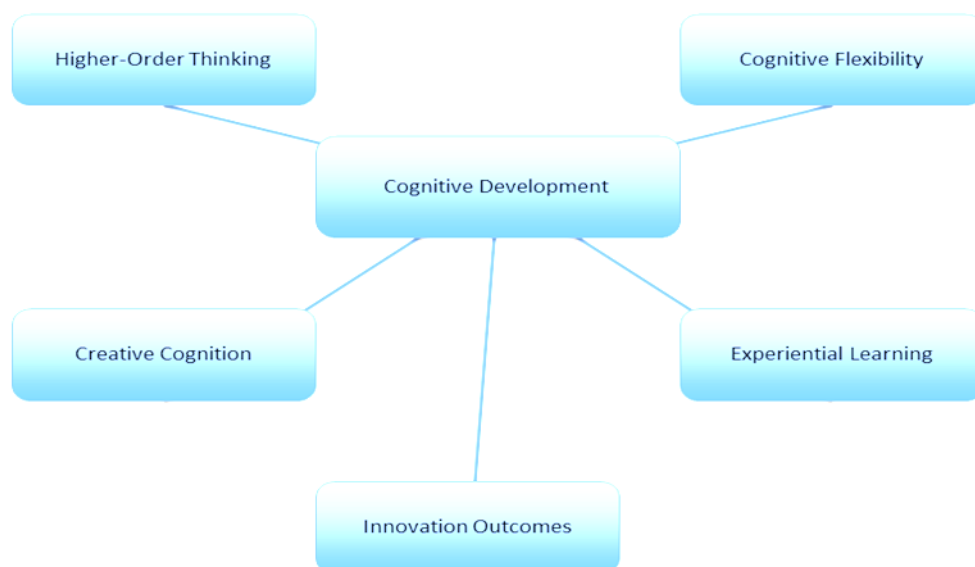


Figure.4 The Cognitive Innovation Conceptual Network Map

Theme 1: Cognitive Development as the Major Process of Innovation.

In all the literature that has been analysed we find that cognitive development as shown in figure.2 is the basis through which innovation and entrepreneurship are explained. Researchers stress that innovation depends on maturation of the higher mental processes, which refers to the abstract thinking and analytical thoughts, as well as integration of the ideas. Instead of considering innovation as an ability that could be taught directly, the literature presents it as a result of full-developed cognition functioning. Students of high cognitive abilities are seen to be in a better position to see opportunities, refrain problems and create innovative responses. This topic directly supports the main premise of the conceptual frame which is that cognitive development is the main generator of innovation.

Theme 2: innovative results are achieved through higher-order thinking skills.

One of the most outstanding themes in the examined studies is how higher-order thinking skills are essential in innovation. The study that is based on the taxonomy of Bloom shows that innovation is intimately connected to such mind activities as analysis, evaluation and creation. These higher order skills help students go past such shallow knowledge to the higher level of cognition, where they are able to construct the knowledge they have, go against accepted ideas, and generate new concepts. The results support higher-level thinking as the requirement of the framework to innovative and entrepreneurial abilities.

Theme 3: Creative Cognition and Flexibility of Cognition as a Force to Innovation.

Cognitive flexibility and creative cognition are the two cognitive attributes that are consistently found throughout the literature to be connected to innovation. Cognitive flexibility allows one to change of opinion, adjust to variations in situations, and exchange ideas across a wide range of domains- a critical factor in uncertain and dynamic problem-solving settings. In the description, creative cognition, the interaction of memory, imagination and evaluative judgement leads to the creation and reducing of new ideas. This accord is the same theme as in the conceptual framework that emphasises high-order cognitive abilities as mediators between cognitive development and innovation outcomes.

Theme 4: Experiential and Constructivist Learning as Releases to Cognitive Development.

A second overriding theme is how experiential and constructivist learning models can be used to develop the cognitive processes essential to the process of innovation. Empirical research has also shown that experience, reflection, inquiry and collaboration-based learning environments have a powerful positive effect on cognitive engagement. These contexts promote active knowledge-building, idea testing, and failure learning, which empower problem-solving and creative thinking skills. This theme empirically and theoretically legitimises the role played by the framework of learning and instructional conditions as facilitators of the cognitive development and innovation.

The discussion of the literature shows that learning and creativity are hindered by inadequately managed cognitive load, although innovation requires more complicated tasks. Cognitive Load Theory has made a major appearance in the research done on innovation-focused education where instructional guidance is highlighted. Scaffolding helps the learner to go through challenging cognitive tasks, by giving a systematic direction, which is reduced over time as the ability rises. This theme justifies the fact that the framework incorporates the management of cognitive load and scaffolding as a condition, on which enduring cognitive development and innovation performance particularly rely.

Theme 6: Innovation as a Mental Product and not the technological deliverable.

One major integrative theme which has come out as a result of the review is the conceptualization of innovation as a mental product as opposed to the direct product of using technology or teaching aids. Although tools and methods can help to meet the ambitions of innovation, the literature has always been keen to note that only through the ability of the learner, as being the finite cognitive ability, can create a meaningful innovation by engaging the problems and generating original ideas. This theme supports the theme of the framework that innovation should be perceived as the final stage of cognitive development as a result of learning experiences and instructional guidance.

Thematic Synthesis Model: Cognitive Development to Innovation

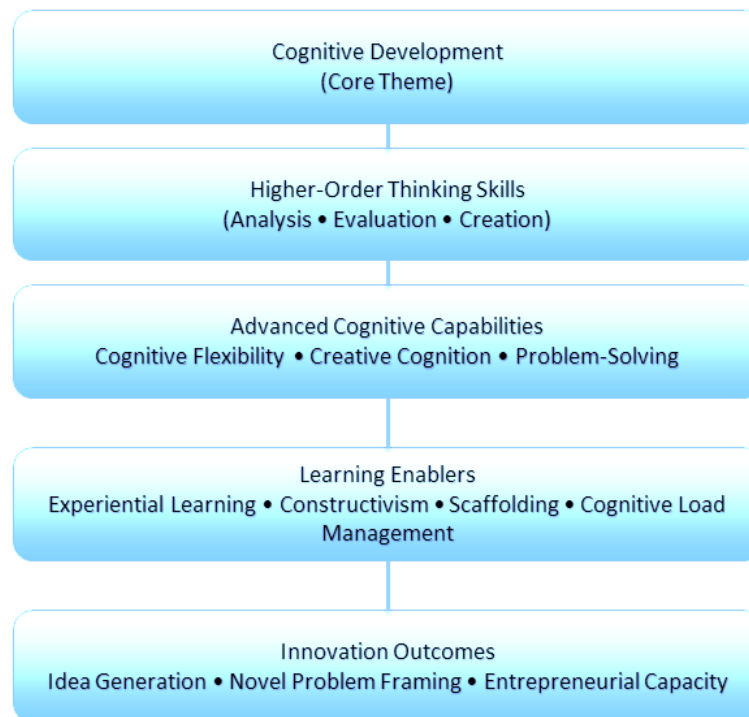


Figure.5 Thematic Synthesis Model

Themes and Conceptual Framework Synthesis.

All the results on themes strongly support the conceptual framework that is presented herein. The cognitive development primacy lays the foundation on which the higher-order thought, cognitive flexibility, and creative problem-solving are based. Such higher ordered cognitive skills are developed in experiential constructivist learning environments and supported by prudent scaffolding and exquisite monitoring of cognitive load. Innovation thus becomes the peak of this continuum which is cognitively enriched.

The overall themes show that one is not alone in the target of innovation but rather the action of a logical system of cognition. This summary supports the main idea of the framework that the development of advanced cognitive mechanisms is essential to the development of innovative and entrepreneurial abilities, thus, providing a solid theoretical base to the future teaching and technological interventions.

Discussion

This systematic literature review was aimed at questioning how far the cognitive development may underlie innovation and entrepreneurial abilities in an educational environment. The review clarifies the innovation process as a cognitively motivated

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activity and not a by-product of teaching aids or technological adoption based on the synthesis of evidence in cognitive psychology, instructional theoretic frameworks, and innovation studies. The thematic results combined with visual exemplifications indicate that innovation, is an outcome of an integrated cognitive ecosystem that is connoted by means of high-order thinking, high-order cognitive functioning, and facilitating learning opportunities.

The most important observation, attained as a result of the review, is the central role of the cognitive development as the key mechanism in which innovation is realised. In line with theories of classical cognition, literature argues that the innovation is basically subject to the ability of the learners to think abstractly, integrate concepts, and exercise a mindful judgement. This claim is further strengthened by the thematic synthesis model which puts cognitive development in a visual framework, as the bottom tier in which all other processes accumulate on. It falls in line with previous theoretical assertions that no, innovation is not a skill in itself but a demonstration of well-evolved cognitive activity nurtured through years of intellectual investigation.

A second eminent output of this review is that it has charted the contribution of higher-order thinking skill into transforming cognitive development into innovative results. The results indicate that the mechanisms of analytical, evaluative and creative thinking allow the learners to break down intricate problems, critique alternative solutions and come up with new ideas. The alignment matrix also explains why higher-order thinking constitutes a strong mental pathway between lower-order thinking and innovation, which shaped the innovative research findings not only during the direct interaction between thought and learning enablers but also indirectly. This helps to highlight that Bloom is a relevant theory that can be applied in capturing innovation-focused learning. Cognitive flexibility and creative cognition is another foregrounded importance in the review as a key driver of innovation in dynamic situations characterised by uncertainty. Cognitive flexibility also enables learners to alter their way of thinking, change their views, and bring together the knowledge across various fields, whilst creative cognition allows the creation and further development of new ideas. The conceptual network map would show that these processes of cognition do not act in isolation and communicate with more extensive learning conditions. The interactional view of the relationship goes further to the extant literature, going beyond linear cause-effect models, to emphasise the relationship between the innovational, process-oriented, view of cognition processes.

The other important learning lesson is the importance of experiential and constructivist learning setting in promoting the cognitive growth that is a prerequisite of innovation. The literature always states that innovation often emerges in learning settings that promote active learning, and reflection, team building, and trial and error. These environments give learners the chance to test the theoretical information on the practical issues hence consolidating the mental skills. The given thematic results suggest the point of view that experiential learning has no direct impact on bringing about innovation but instead enables the processes of cognition enabling innovation to be practically possible.

The review also highlights the inevitability of the role of scaffolding and cognitive load management in education that is innovation-focused. Although challenging activities

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are very necessary in developing high-order cognitive skills, too much cognitive load may hinder learning and slow down creative thinking. The support is effectively designed to help learners cope with complexity through effective scaffolding strategies, which are progressively abandoned as competence increases. Such balance between challenge and support is essential in maintaining the mental activity and allowing the innovative performance, which is demonstrated by the visual elements of the thematic synthesis and the framework alignment.

These results in combination suggest the conceptualisation of innovation as an intellectual product that is developed through developmental processes and conditions of learning as opposed to pedagogical processes or hacks of technology. This view has immense implications on both research and practice in education. It indicates that the development of higher-order thinking and versatile thought needs to be promoted through curricula aimed at developing innovation before more sophisticated tools or methods are presented. Besides, it highlights the need of instructional designs that support profound stages of cognitive learning, as opposed to shallow learning.

Theoretically, the review builds on the previous body of knowledge by integrating studies on cognitive development theories with research on innovations within one conceptual framework. The model incorporates divergent threads of inquiry, giving a logical explanation of how the thinking processes are linked, what the enabling conditions of learning are, and the effects of innovation are. The contribution is the discovery of a relevant gap in the literature, in which innovation is often addressed without paying enough attention to its cognitive foundations.

Conclusion

This is a systematic literature review that aimed at exploring how cognitive development can be used to develop innovation and entrepreneurial skills in the education sector. The review proves that innovation is essentially a cognitive product of exceptionally complex mental functions, as opposed to a by-product of teaching methods or technological systems because of the synthesis of the results of the studies on cognitive psychology, education theory, and the research on innovation. The findings are always consistent: the higher-order thinking, cognitive flexibility, and innovative cognition are lower-level structures, on the basis of which innovative abilities are built.

Thematic synthesis further shows that experiential and constructivist based learning environments are crucial in fostering cognitive aspects of learning necessary to promote innovation. These conditions allow learners actively to address compound issues, look back at their experiences, and build knowledge by cycling. At the same time, successful scaffolding and managing cognitive load become the inevitable prerequisites of maintaining profound cognitive processes and preventing overload in learning situations of an innovation-focused nature. A combination of these aspects creates an ecosystem of cognition that drives the introduction of innovation.

One of the strongest contributions made by this review is that it re-conceptualised innovation as a cognitive developmental phenomenon. Instead of thinking about innovation as a single skill or a natural product of particular pedagogical intervention, this research frames innovation as a product of a long-term intellectual process

supported by appropriate conditions of learning. The conceptual framework designed as integrative provides a logical interpretation of the fusion of the cognitive development, higher-ordering thinking, and learning enabling factors to produce innovative and entrepreneurial results.

Future Research Directions

Although the given review provides useful theoretical information, it also highlights some areas of future research.

1. The suggested conceptual framework has to be tested and justified empirically by conducting a series of studies in various educative and cultural contexts. To analyse the relationship between the variables of cognitive development, higher-order thinking, and outcomes of innovations in the context of higher education and professional training, quantitative and mixed-method research designs are to be used.
2. Further research ought to look at the relationship between specific pedagogical strategies that include design thinking and problem-based learning with cognitive development and innovation in cases where the techniques are clearly defined in reference to cognitive theory. Longitudinal studies would be particularly educative in monitoring the development of cognitive abilities vis-a-vis the period of time and determining the effects of long-term exposure to cognitively rich learning conditions on creative performance.
3. New technologies present some good opportunities in developing this research area. Future research can focus on the application of generative artificial intelligence, learning analytics, and immersive technologies as cognitive enablers through the generation of ideas, reflection, and adaptive problem solving. It is critical to note that such studies should consider technology not as a replacement of cognition but a device that magnifies and facilitates the mental functions.
4. When it comes down to it, systematic reviews and meta-analyses of the future would possibly enhance the knowledge of the cognitive processes under the influence of innovation by balancing out the disciplinary conceptualization of problems and methodologies. This would add to a more sophisticated and evidence-based perception of how the cognitive growth may be procedurally nurtured to help in innovation and entrepreneurship in the education domain.

Appendix Fig 4, 5 and Table 1, Table 2

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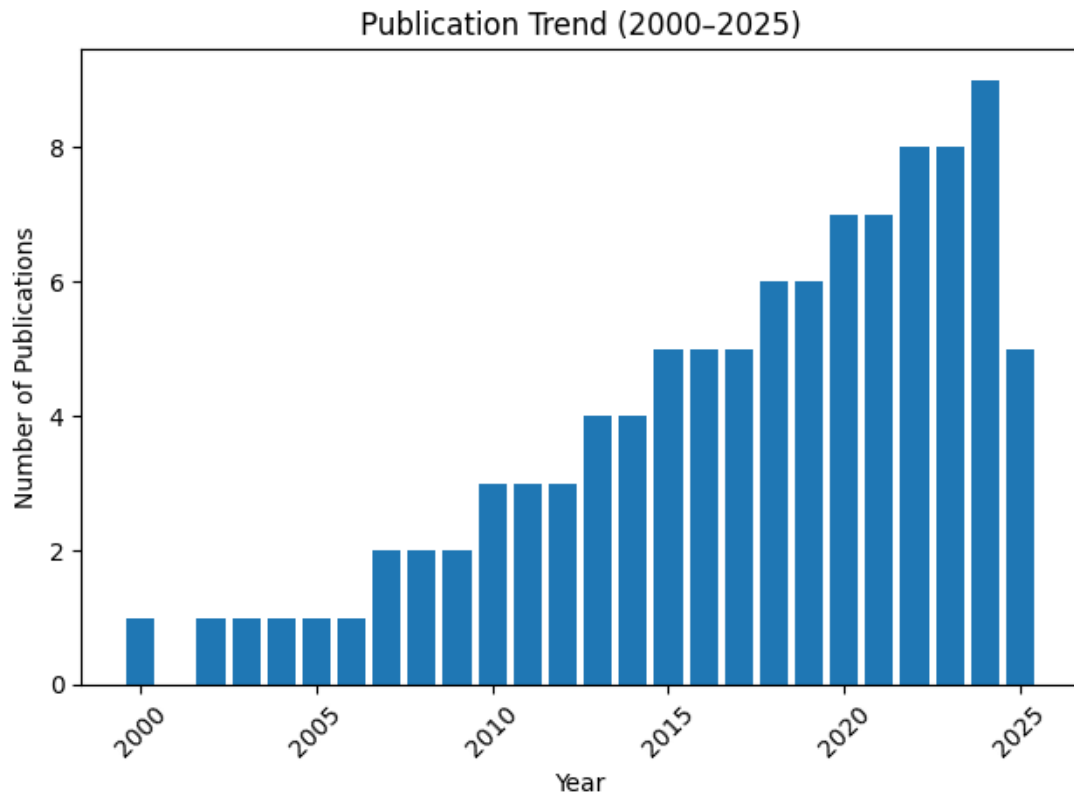


Fig.4 Timeline of publication per year.

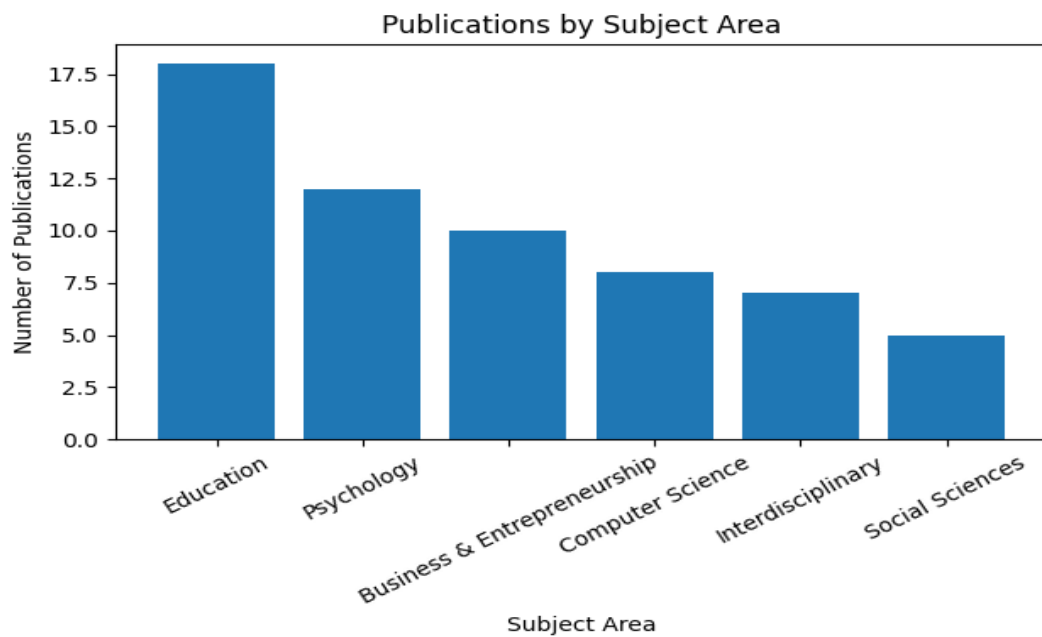


Fig.5 Number of publications per subject area.

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Table 1. Concept Matrix of Cognitive Constructs, Learning Contexts, and Innovation Outcomes in Education

Study Focus Area	Cognitive Constructs	Learning Context	Innovation Outcome	Theoretical Basis	Key Insight
Cognitive Development Core	Abstract reasoning, mental models	General education	Idea generation	Piaget	Innovation emerges from advanced cognitive maturation
Higher-Order Thinking	Analysis, evaluation, synthesis	Classroom-based learning	Creative problem-solving	Bloom's Taxonomy	Higher-order thinking directly drives innovation
Cognitive Flexibility	Adaptability, perspective shifting	Dynamic learning environments	Opportunity recognition	Cognitive Flexibility Theory	Flexibility enables innovation in uncertain contexts
Creative Cognition	Imagination, idea recombination	Inquiry-based learning	Novel idea creation	Creative Cognition Theory	Innovation is a structured cognitive process
Problem-Solving	Complex reasoning, decision-making	Problem-based learning	Innovative solutions	Problem-Solving Theory	Ill-defined problems stimulate innovation
Experiential Learning	Reflection, active engagement	Real-world learning	Applied innovation	Kolb's Experiential Learning	Learning-by-doing enhances cognitive depth
Constructivist Learning	Knowledge construction, inquiry	Collaborative learning	Idea development	Vygotsky (ZPD)	Social interaction enhances innovation capacity
Scaffolding	Guided learning, support structures	Instructional design	Sustained innovation ability	Vygotsky / Cognitive Load Theory	Support enables handling complex cognitive tasks
Cognitive Load	Working memory	Structured instruction	Efficient problem-	Cognitive Load Theory	Overload hinders

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Study Focus Area	Cognitive Constructs	Learning Context	Innovation Outcome	Theoretical Basis	Key Insight
	management		solving		innovation
Interdisciplinary Learning	Knowledge integration	Cross-domain education	Breakthrough innovation	Interdisciplinary Theory	Innovation thrives at domain intersections
Technology-Enhanced Learning	AI-assisted cognition	Digital environments	Augmented creativity	Emerging EdTech Theory	Technology amplifies cognitive processes

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**Table.2 Distribution of Indicators Across Categories and Teamwork:
Frequency Analysis of Included Studies**

Indicator	Assigned Category	Dimension	Frequency (n=60)	% of Studies	Interpretation
Higher-order thinking (analysis, evaluation, synthesis)	Cognitive Processes	Cognitive Collaboration	42	70%	Core driver of collective problem-solving and idea generation
Cognitive flexibility	Cognitive Processes	Adaptive Teamwork	38	63%	Enables teams to shift perspectives and respond to complexity
Creative cognition	Cognitive Processes	Creative Collaboration	36	60%	Supports co-creation of novel ideas in group settings
Problem-solving skills	Cognitive Processes	Task-Oriented Teamwork	40	67%	Central to addressing complex, ill-defined problems collaboratively
Metacognition	Cognitive Regulation	Reflective Teamwork	28	47%	Facilitates self-monitoring and group learning processes
Experiential learning	Learning Environment	Collaborative Engagement	35	58%	Promotes learning through shared experiences and interaction
Constructivist learning	Learning Environment	Social Collaboration	33	55%	Knowledge constructed through peer interaction and dialogue
Scaffolding	Instructional Support	Guided Teamwork	30	50%	Enhances team performance through structured support
Cognitive load management	Instructional Support	Efficiency in Teamwork	25	42%	Prevents overload, enabling smoother collaboration
Interdisciplinary integration	Knowledge Integration	Cross-functional Teamwork	22	37%	Encourages diverse perspectives in team innovation
Technology-enhanced learning	Learning Tools	Digital Collaboration	27	45%	Facilitates teamwork in digital and hybrid environments

Indicator	Assigned Category	Dimension	Frequency (n=60)	% of Studies	Interpretation
Communication skills	Social Processes	Interpersonal Teamwork	31	52%	Essential for coordination and knowledge exchange
Collaboration skills	Social Processes	Cooperative Teamwork	34	57%	Supports shared goals and mutual accountability

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