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REVIEW ARTICLE

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A SWOT analysis of integrating cognitive and non-cognitive learning strategies in education

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Abstract

Students must receive the knowledge and skills they require for succeeding in a constantly changing world. Meeting each student's diverse needs, nevertheless, is difficult. For the purpose to promote student development and improve educational outcomes, this review study attempts to give a thorough conceptual framework for integrating both cognitive and non-cognitive learning methodologies. While non-cognitive learning focuses on social and interpersonal skills, emotional intelligence, and resilience, cognitive learning involves the acquisition of intellectual skills and critical thinking. Both types of education are essential for children's holistic development. Integrating non-cognitive and cognitive approaches in education sector has several advantages. It promotes a well-rounded education by offering a balanced approach that addresses the intellectual, emotional, and social elements of student progress. To support the suggested conceptual framework, a thorough analysis of recent research on the subject is conducted. The implementation of cognitive and non-cognitive learning in the present condition is examined through a bibliometric analysis, which identifies research trends and gaps. In addition, a SWOT analysis has been done to assess the advantages, disadvantages, opportunities, and threats related to these strategies. The issues and areas that require additional research and development are better understood due to this analysis. The research's conclusions demonstrate the importance of adopting a well-rounded

educational strategy which considers various demands of students. The education system can encourage academic performance, critical thinking, socio-emotional well-being, and prepare students for success in a variety of spheres of life by integrating cognitive and non-cognitive learning. It also points out the research gaps and underlines the value of further study for enhancing comprehension and cognitive and non-cognitive learning methodologies' application.

KEYWORDS
academic achievement, cognitive learning, education system, non-cognitive learning, SWOT analysis

1 | INTRODUCTION

In the ever-evolving landscape of global education, the integration of cognitive and non-cognitive learning strategies emerges as a pivotal factor for comprehensive educational development. This integration is not only instrumental in addressing the multifaceted challenges faced by the education sector—such as adapting to technological advancements, legal changes, and competitive pressures (Zhang & Aslan, 2021)—but also plays a crucial role in aligning educational practices with the contemporary demands of society. The essence of this integration lies in harmonizing intellectual skill development, including critical thinking and subject-specific knowledge (cognitive learning), with the cultivation of personal and social skills, resilience, and emotional intelligence (non-cognitive learning). Such an approach is increasingly recognized as indispensable for preparing students to succeed in diverse life scenarios and to thrive in a rapidly transforming world.

To enhance the effectiveness of this integrated approach, incorporating elements from the Organization for Economic Co-operation and Development (OECD)'s social emotions program can provide a more nuanced context. This program emphasizes the development of social and emotional skills, which are vital for personal well-being and societal engagement. Integrating these elements into educational strategies ensures a more holistic development of learners, equipping them with the tools necessary to navigate both academic and life challenges effectively (Figure 1).

Educational theorists and practitioners advocate for a curriculum foundation that is informed by a blend of transformative, social, and experiential learning theories, collectively encompassing the spectrum of cognitive and non-cognitive aspects (Mousavinasab et al., 2021). Such a curriculum aims to engage students actively in their learning journey, fostering a deep, intrinsic interest in education (Reinders et al., 2021). Furthermore, understanding the developmental trajectory of individuals from childhood to adulthood allows educators to tailor their pedagogical approaches to the varying cognitive and emotional needs of their students (Kem, 2022; Post et al., 2019).

The strategic focus on dynamic and interactive learning environments, combined with an emphasis on self-reflection, goal setting, and self-regulated learning, aligns well with the principles of the OECD's social emotions program. These approaches collectively contribute to closing gaps in the teaching-learning process and enhancing the overall educational experience. This synthesis of cognitive and non-cognitive strategies, enriched by insights from social–emotional learning frameworks, sets the stage for an education system that is adaptive, inclusive, and forward-looking (Abu Saa et al., 2019; Cinquin, et al., 2019; Deák et al., 2021; Haque et al., 2023; Sharma & Arora, 2020; Shekh-Abed & Barakat, 2022). The goal of this work is to support continued advancements in educational practices by merging research-based techniques and the observations reported in Table 1.

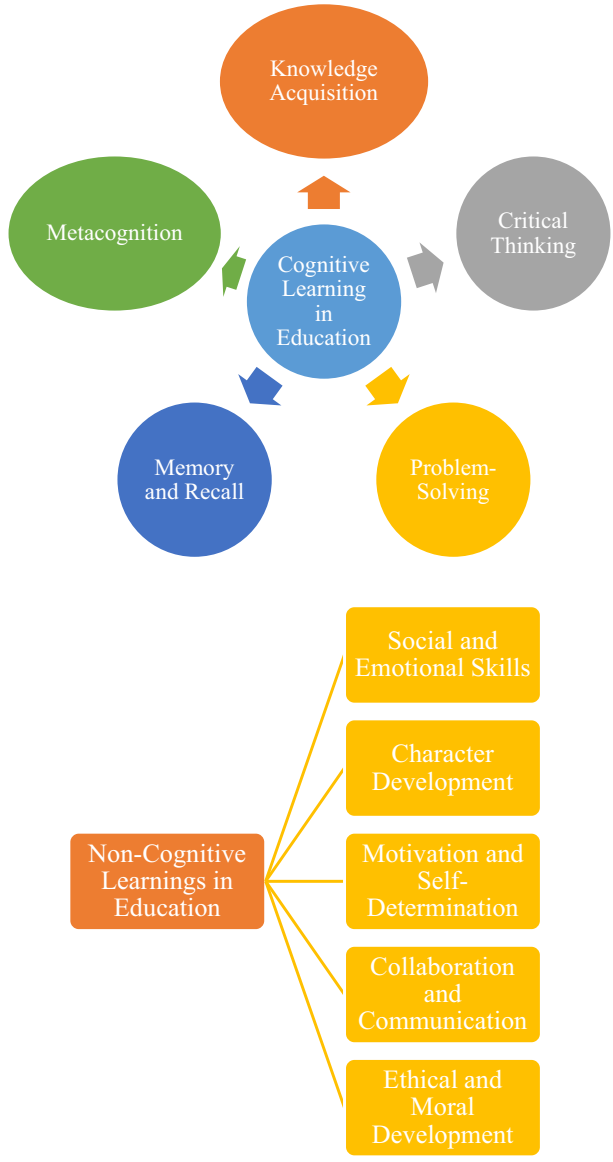


FIGURE 1 Cognitive and non-cognitive learning in education.

The study makes the following contributions to these research questions:

- The paper aims to conduct a comprehensive bibliometric analysis and SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis for both cognitive and non-cognitive learning approaches.
- This paper aims to evaluate existing literature and research trends related to cognitive and non-cognitive learning through bibliometric analysis, identifying key themes, influential authors, and publication patterns.
- By applying a SWOT analysis, the paper examines the strengths, weaknesses, opportunities, and threats associated with cognitive and non-cognitive learning approaches.
- This analysis provides insights into the advantages, limitations, potential growth areas, and challenges for both cognitive and non-cognitive learning in education sector.

TABLE 1 Research questions and research contributions.

Research questions	Research contributions
1. What are the trends and patterns in research publications related to the SWOT analysis of cognitive and non-cognitive learning in education sector?	Comprehensive Bibliometric Analysis: Identify trends, patterns, and gaps in the existing research to understand the current state of knowledge in the field
2. What are the key topics and subtopics within the field of cognitive and non-cognitive learning in education sector that have been explored in the literature?	Identification of Key Topics and Subtopics: Identify focal areas of research to understand the extent of exploration and identify gaps for further investigation
3. What are the strengths, weaknesses, opportunities, and threats (SWOT) associated with cognitive and non-cognitive learning approaches in education sector?	SWOT Analysis of Learning Approaches: Provide a comprehensive assessment of the advantages, limitations, and potential opportunities and threats of these approaches
4. How does the application of SWOT analysis contribute to the understanding and improvement of cognitive and non-cognitive learning in education sector?	Contribution to Educational Improvement: Derive strategies and recommendations for enhancing the implementation of cognitive and non-cognitive learning approaches in education
5. What are the potential strategies and recommendations derived from SWOT analysis that can enhance the implementation of non-cognitive along with cognitive learning in educational settings?	Implications for Future Research and Practice: Inform future research directions and practical applications to enhance the effectiveness of these learning approaches

TABLE 2 Unique contributions of the recent review paper in comparison to existing literature.

Ref.	A1	A2	A3	A4	A5	A6	A7	A8
Zhang and Aslan (2021)	×	✓	×	✓	×	×	×	×
Sharma and Arora (2020)	×	×	×	×	×	×	×	×
Shekh-Abed and Barakat (2022)	✓	×	✓	×	×	×	×	×
Abu Saa et al. (2019)	✓	×	×	×	×	×	×	×
Mousavinasab et al. (2021)	✓	×	×	×	✓	×	×	×
Reinders et al. (2021)	×	×	×	×	×	✓	×	×
Kem (2022)	×	×	×	×	×	×	✓	×
Post et al. (2019)	✓	×	×	×	×	×	×	×
Ours	✓	✓	✓	✓	✓	✓	✓	✓

Note: A1, cognitive learning theories; A2, non- cognitive learning theories; A3, critical thinking; A4, social and emotional development; A5, challenges of teaching-learning in education; A6, bibliometric analysis; A7, SWOT analysis; A8, limitations.

- While integrating bibliometric and SWOT analyses, the paper seeks to provide an understanding of future directions along with current landscape in cognitive and non-cognitive learning.

Informing evidence-based decisions about educational practices and directing the policy formulation, the review paper's conclusions have a substantial impact. This review provides unique insights and viewpoints that set it apart from other related publications in the field by methodically reviewing and synthesizing pertinent material. Table 2 provides an overview of these noteworthy contributions, emphasizing the innovative features of this review. This table's inclusion highlights the distinctive features of this work and the novel viewpoints it gives in the field of educational research and practice.

The study is divided into various sections that meticulously examine the incorporation of non-cognitive and cognitive learning into educational techniques. Section 2 covers both non-cognitive and cognitive learning models in detail, outlining their guiding principles and conceptual frameworks. The methodology for the analysis is outlined in Section 3, which also covers the collection and evaluation of relevant data utilizing bibliometric analysis and SWOT analysis. In Section 4, the effectiveness of both cognitive and non-cognitive learning approaches is carefully assessed in light of the analysis findings. Section 5 highlights the primary advantages and benefits of incorporating both cognitive and non-cognitive learning into educational activities, outlining the benefits and potential outcomes of these strategies. Section 6 introduces a conceptual framework that offers a structured approach for integrating both cognitive and non-cognitive learning into curriculum design and instructional strategies. Finally, the paper concludes, by summarizing the key findings and highlighting the significance and implications of implementing cognitive and non-cognitive learning in educational settings.

2 | LITERATURE REVIEW

2.1 | Non-cognitive and cognitive theories of learning

Cognitive and non-cognitive learning theories offer a theoretical framework to understand the processes and mechanisms underlying the cognitive and non-cognitive skills development. These theories help educators and researchers gain insights into how individuals acquire and adapt social–emotional competencies, character strengths, and other non-cognitive skills and cognitive skills. In this study, initially non-cognitive learning theories will be discussed after that this study shed light on cognitive learning theories. Emotional intelligence, social skills, motivation, resilience, and attitudes are all included in non-cognitive theories. These are essential for the holistic growth of students as well as their capacity for productive interaction both inside and outside of the classroom (Figure 2).

- Social and Emotional Learning Theory—This theory focuses on the development of crucial skills related to understanding and managing emotions, setting and achieving positive goals, feeling and showing empathy for others, establishing and maintaining positive relationships, and making responsible decisions. It emphasizes the integral role these competencies play in a student's overall development, both within the classroom and in life. Varghese and Natsuaki (2021) highlight the negative mental health impacts on California's K-12 students due to COVID-19 school closures, advocating for the implementation of Social and Emotional Learning (SEL) across schools for mental health recovery. Corcoran et al. (2018) conducted a systematic review and meta-analysis of 40 studies, revealing that school-based social and emotional learning (SEL) interventions positively affect reading, mathematics, and science achievement in pre-K-12 students, though the impact is less significant in more rigorous studies. Dusenbury et al. (2014) summarize findings from CASEL's State Scan, highlighting efforts to develop high-quality social and emotional learning (SEL) standards from preschool through high school across various states, including examples from Idaho, Washington, Illinois, and Pennsylvania. Effrem and Robbins (2019) critically analyse the history and implementation of Social–Emotional Learning (SEL) in K-12 education, highlighting its deep roots in progressive education and raising concerns about its efficacy, impact on student privacy, and potential for psychological manipulation (Figure 3).

- Grit and Growth Mindset (Duckworth, Dweck)—Grit, as conceptualized by Angela Duckworth, refers to the perseverance and passion for long-term goals, emphasizing sustained effort and interest over time. The growth mindset, as defined by Carol S. Dweck, is the idea that intelligence and ability can be improved with hard work and perseverance, as opposed to a fixed mindset that views abilities as fixed attributes. These ideas emphasize the value of tenacity, diligence, and an optimistic outlook on education and self-improvement. In their 2017

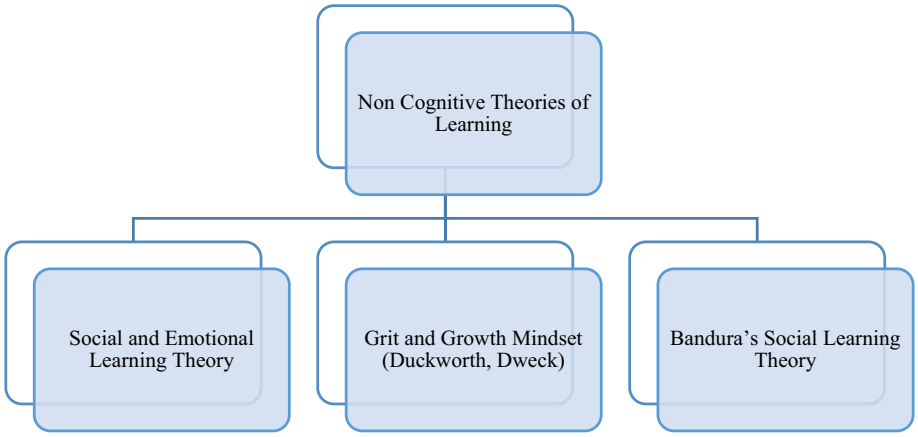


FIGURE 2 Non-cognitive theories of learning.

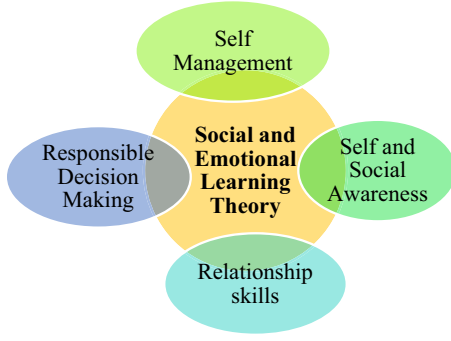


FIGURE 3 Social and emotional learning theory.

study, McClendon et al. investigated the connection between student retention in online learning and non-cognitive traits including growth mindset and grit. They concluded that intentional practice techniques could improve perseverance and performance in online courses. To investigate this relationship, Lam and Zhou (2019) carried out a systematic review and meta-analysis including more than 60,000 individuals from 44 articles. According to their research, grit and academic success are positively correlated, with persistence in effort having the biggest influence. They also discovered that the relationship changes based on the pupils' grade levels. Affective or non-cognitive traits like motivation have been the subject of more recent research in engineering education, which may provide more insight than more conventional cognitive metrics like high school GPA. A pivotal aspect of this research is the exploration of students' mindsets, which can be categorized as either 'fixed' (believing success is due to inherent intelligence) or 'growth' (believing success stems from effort). Reid and Ferguson's (2014) study found that integrating open-ended design projects into engineering courses helps promote a growth mindset among students. Those not participating in such projects tended to lean more towards a fixed mindset. This suggests that early exposure to practical, relevant projects in engineering and STEM education can enhance student preparedness and success in these fields (Table 3).

Learning is defined in terms of information processing in cognitive learning theories. In simple words, as soon as we receive external data, our minds either store it or process it for later usage. Working memory (WM) is where

TABLE 3 Literature survey.

Non-cognitive theories	Study/work done	Features	Findings	Limitations
Social and emotional learning (SEL)	Varghese and Natsuaki (2021)	Mental health impacts due to COVID-19 school closures	Identified SEL as a key tool for improving students' emotional and social coping skills during the pandemic	Limited scope to California; lack of empirical data supporting SEL efficacy
	Corcoran et al. (2018)	Analysis included 40 studies with high methodological standards	Positive effect on academic performance in reading, mathematics, and science, though the impact on science was smaller	Not fully confirm the effectiveness of SEL
	Effrem and Robbins (2019)	Critique of SEL's roots in progressive education and its alignment with educational movements like Common Core	Highlighted issues with SEL's unclear definition, questionable research support, and risks to student privacy and autonomy	Potential bias towards negative aspects of SEL and reliance on theoretical critique over empirical evidence
Grit and growth mindset (Duckworth, Dweck)	McClendon et al. (2017)	Highlighted the need for faculty training in strategies like deliberate practice, emphasizing engagement, risk-taking, and reflection	Suggested that grit, a growth mindset, and deliberate practice could improve retention in online courses	Diverse student population is not introduced
	Lam and Zhou (2019)	Investigated both overall grit levels and its components – consistency of interest and perseverance of effort	Found a positive association between grit and academic achievement	Inconsistent findings in past research and did not address the potential impact of external factors on grit
	Reid and Ferguson's (2014)	Focused on the shift from growth to fixed mindset among engineering students, proposing open-ended design projects as a solution	Open-ended projects may help maintain a growth mindset	The long-term impact of open-ended projects was not fully explored
Bandura's Social Learning Theory	Bembenutty et al. (2016)	Self-regulated learning (SRL) in K-12 education, focusing on Bandura's social cognitive theory and Zimmerman's models of SRL	Highlighted the need for incorporating SRL strategies to enhance psychosocial development	Potential challenges in translating SRL theoretical models into practical classroom applications
	Rumjaun and Narod (2020)	Analysed Social Learning Theory (SLT) as a framework for science education, exploring its position between behaviourism and cognitive theory	SLT is highlighted as a relevant and effective method for active and interactive science education	Lack of detailed exploration and empirical validation of SLT

information is initially processed. Long-term memory (LTM) is then utilized for storing information which has to be remembered.

Dual coding theory suggests that using imagery and pictures alongside verbal methods can enhance learning. Factors such as concreteness, context, and phonetic regularity impact the speed of word learning. A study found that concrete words in story contexts were learned faster than abstract words presented in isolation. In terms of learning styles, research indicates preferences for auditory or visual learning. Cognitive load theory focuses on managing cognitive load by minimizing distractions and optimizing intrinsic and germane load. Elaboration techniques aid in transferring information to long-term memory. Multimedia learning's cognitive theory highlights cognitive processes in multimedia learning and emphasizes an active involvement of learners in activities utilizing subtitles. Research is needed to explore effective engagement strategies with subtitles in language development (Table 4).

3 | METHODOLOGY

This study adopts a systematic methodology to review and analyse literature published within the last three years, focusing on the promotion of cognitive and non-cognitive learning theories among students, as illustrated in the methodology flowchart (Figure 4). The review commenced with the careful selection of data sources, specifically Science Direct, Google Scholar, and ERIC, chosen for their extensive coverage in educational research. A comprehensive search approach was created, utilizing Boolean operators to combine particular search phrases like "instructional methods", "cognitive learning", "non-cognitive learning", and "student learning outcomes". The goal of this approach was to gather the most current and pertinent research in the area.

TABLE 4 Comparative overview of cognitive learning theories.

Cognitive learning theories	Dual coding theory	Cognitive load theory	Cognitive theory of multimedia learning
Citation	Paivio and Clark (2006), Paivio (2014), Sadoski (2005), Cuevas and Dawson (2018)	Sweller (2019, 2020), Plass and Kalyuga (2019)	Mutlu-Bayraktar, Cosgun, and Altan (2019), Almasseri and AlHojailan (2019)
Description	Describes learning as information processing	Identifies verbal and nonverbal cognitive systems	Explains how people learn from multimedia materials
Key processes	Information processing, working memory, LTM	Verbal and nonverbal cognitive skills	Attention, perception, memory in multimedia learning
Focus	Concretization through imagery and pictures	Load management for effective learning	Aligning multimedia design with cognitive processes
Vocabulary acquisition	Concreteness and context impact word learning	Emphasizes optimizing learning by minimizing load	Optimize learning by managing cognitive load
Learner involvement with subtitles	Active involvement for language development	Research needed for active involvement with them	Potential for engaging language development
Practical applications	Digital tools with films and subtitling	Instructional design and technology-assisted learning	Designing multimedia presentations for effective learning
Gender consideration	–	–	Limited to male participants, future research needed

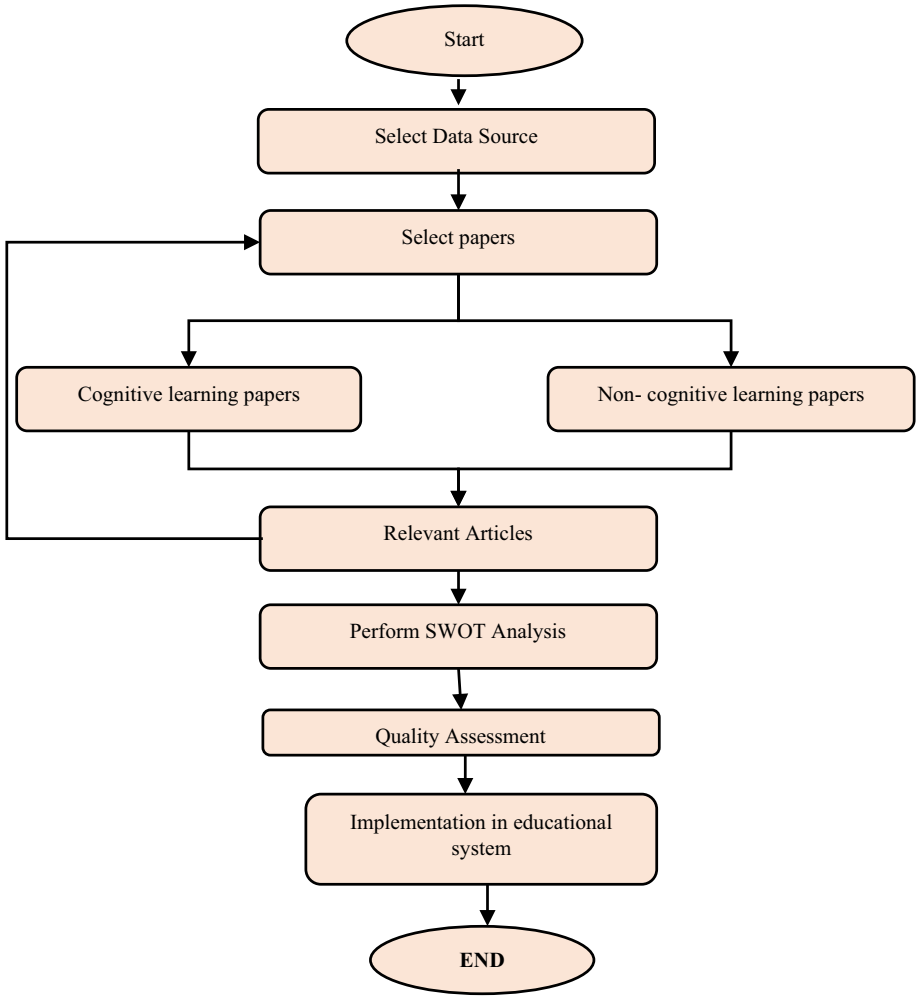


FIGURE 4 Flowchart of methodological approach.

The first search produced a sizable amount of articles. To make sure these papers were pertinent to our study goals, they went through a stringent screening procedure that was first focused on titles, abstracts, and keywords. During this procedure, particular selection criteria were established, such as academic rigour, publication within the last three years, and topic relevancy. After that, we carefully examined each of the chosen articles, emphasizing how they added to our knowledge of both cognitive and non-cognitive learning in educational settings. 81 of the 365 publications that were originally under consideration for our study satisfied our strict inclusion criteria and made up the majority of our review. Every article that was chosen was thoroughly examined, and each study's strengths, weaknesses, opportunities, and threats were assessed using a SWOT analysis. The rigorous examination had a pivotal role in guaranteeing that our review encompassed solely noteworthy and superior research, therefore furnishing a sturdy and all-encompassing comprehension of the amalgamation of cognitive and non-cognitive learning theories in K-12 education. Tables and graphs were utilized to illustrate and compare the data after the conclusions from these publications were methodically gathered. We were able to derive thorough insights into the patterns, obstacles, and prospects for combining cognitive and non-cognitive learning processes in educational settings because of our methodical methodology. It is anticipated that the review's conclusions will provide educators and policymakers with useful recommendations for improving the educational experiences of their students (Figure 5).

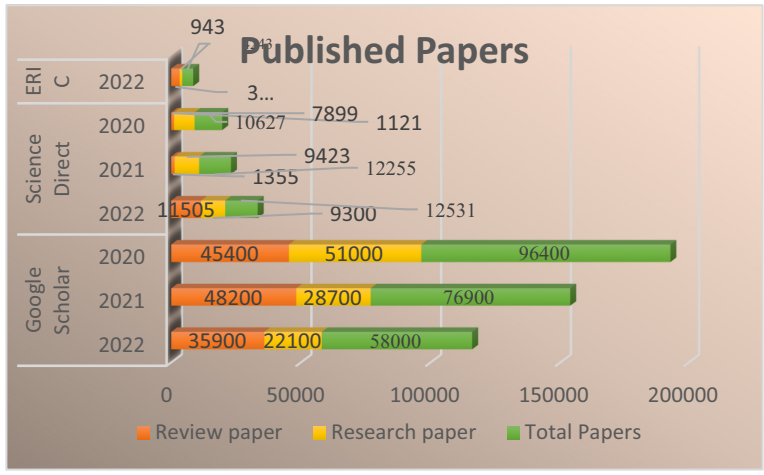


FIGURE 5 Published papers.

The graph presents an overview of the availability of articles for the years 2022, 2021, and 2020 based on multiple data sources. In all three years, Google Scholar had a sizable number of review papers, research papers, and overall papers. Science Direct also provided a considerable number of papers, while ERIC had a smaller number of papers available. These figures reflect the volume of research and review material accessible through each data source (Figure 6).

The graph illustrates the distribution of review papers, research papers, and total papers available across different data sources for the years 2022, 2021, and 2020. Notably, Google Scholar exhibited a substantial number of papers, reaching its peak count in 2021. In contrast, Science Direct presented a relatively smaller number of papers consistently over the years, while the ERIC database showed a moderate number of papers throughout the same period. In this study, a SWOT analysis will be conducted for assessing the effectiveness of fostering cognitive and non-cognitive learning skills in students. This analysis aims to explore the strengths, weaknesses, opportunities, and threats associated with implementing non-cognitive and cognitive learning interventions in education. This analysis seeks to determine opportunities for enhancing student learning outcomes and supporting educators in their teaching practices by delving into these strategies' efficacy. Additionally, the analysis will shed light on the limitations and challenges that need to be addressed to successfully integrate both learning skills into the education system.

Strengths like accuracy, accessibility, versatility and increased student engagement, weaknesses like generalizability, sample sizes, comparative analysis, implementation constraints, opportunities like applicability, education integration, relevance in cross-domain, and threats like dataset, scalability, specificity in age/subjects, and empirical validation are important components to consider when doing a SWOT analysis on the integration of cognitive and non-cognitive learning methodologies in education. Implementation challenges the requirement for specialized teacher training, and handling a variety of educational demands are among the weaknesses. Possibilities include developing cutting-edge instructional approaches, supporting pedagogical efficacy research, and equipping students with a variety of abilities to meet demands in the future. Potential opposition to change, unequal access to these integrated tactics in various educational contexts, and challenges in quantifying non-cognitive outcomes are some of the threats. Understanding the possibility and effects of this integrated strategy in education is made possible by this examination.

4 | SWOT ANALYSIS ON FOSTERING COGNITIVE LEARNING IN STUDENTS

There are multiple researchers who have shown their interest in implementing cognitive learning skills in education sector to examine the impact. For example, Obergriesser and Stoeger (2020) delve into the application of

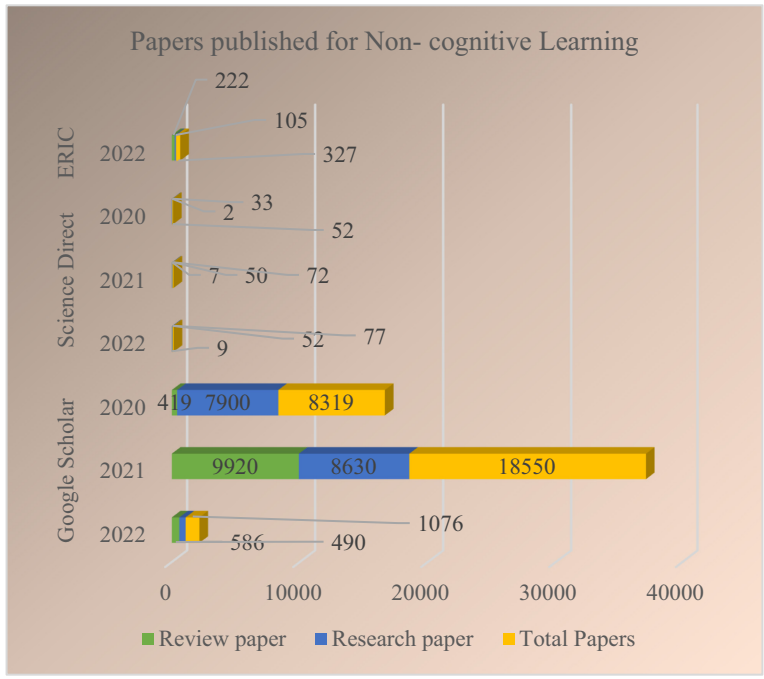


FIGURE 6 Paper published for non-cognitive learning.

collaborative cognitive load theory (CCLT) in computer-supported collaborative learning (CSCL). They emphasize the significance of considering cognitive load in collaborative learning environments and propose a research agenda for further exploration. Shi et al. (2021) investigate student-centered learning in higher education, focusing on the challenges, perceptions, and cognitive gaps experienced by both students and teachers. The analysis highlights the understanding of student-centered learning and provides insights into its implementation. Barbieri et al. (2020), Isohätälä et al. (2020) explore the socio-emotional interaction in collaborative learning, specifically examining variations in participation of students. Paulsen and Feldman (2007) examine the correlation between students' English proficiency test scores and cognitive reading approaches. Their study explores how the use of cognitive reading strategies impacts students' performance in English proficiency tests (Table 5).

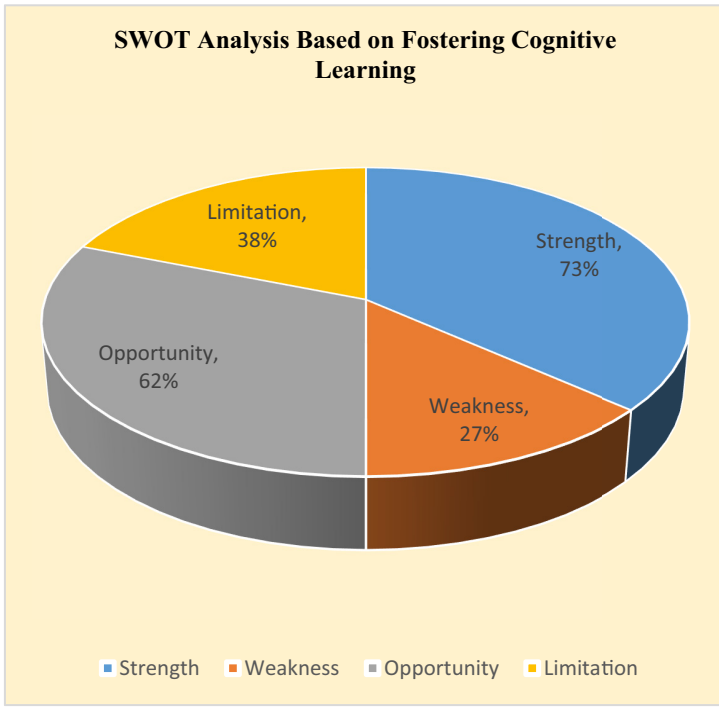
Deimel et al. (2020) delve into the correlations between emotions and cognitive processes during learning, shedding light on how emotions impact students' learning behaviour. Okay-Somerville et al. (2022) focus on enhancing cognitive and effective domains of students via teaching development, highlighting the role of educators in shaping students' learning experiences. Peng et al. (2020) contribute to the understanding of how different cognitive styles influence conceptual understanding levels among students. Jin et al. (2020) examine the impact of schools on political participation, touching upon the social and educational factors influencing students' engagement. Furthermore, Chetty et al. (2014) explore the effect of social demerit on the transition from university to work for STEM students, emphasizing the significance of social contexts in shaping career trajectories. Additionally, Nagaoka et al. (2013) take a bidirectional perspective to analyse the association between cognitive skills and academic achievement, showcasing the interplay between these factors in students' developmental pathways. Egalite et al. (2016) discuss innovative approaches in cognitive assessment and therapy, demonstrating the potential of technology in supporting individuals with neurocognitive disorders in their learning and cognitive functioning. These studies collectively contribute to our understanding of the complex interactions and influences that shape students' learning journeys (Figure 7).

TABLE 5 Studies on cognitive learning skills: For SWOT analysis.

Study	Work done	Dataset	Strengths	Weaknesses	Opportunities	Limitations	Performance metrics
Lin et al. (2017)	Neural Cognitive Diagnosis (neuralcd)	Math, ASSIST	Accurate and interpretable diagnosis, neuralcdm is available on github, Multiple implementations	Lack of comparison with existing approaches, Limited details on neural network architecture	Potentially be applied to other domains and educational settings	Dataset limitations, Limited scalability information	Model Accuracy: 0.804, RMSE of 0.371, AUC of 0.835
Hong et al. (2017)	Adaptive learning approach based on Fuzzy expert system	From one elementary school, six classes of fourth-graders in southern Taiwan	Adaptive Learning Approach with affective and cognitive performance analysis	Limited Generalizability, Subject-Specific Application, Limited Consideration of Personal Factors	Extension to Higher Education, Integration of Personal Factors	Specific age group of participants and the subject-specific, Competing Approaches	Reducing students' mathematical anxiety ($F=5.59$, $p<.01$) improving learning achievement ($F=3.12$, $p<.05$)
Janssen and Kirschner (2020)	Relationship between enjoyment emotions and boredom of students	From 18 classrooms in 17 different primary schools, sample size of 338 fourth-grade students in Germany	Temporal Order of Effects, Intraindividual Analysis, Linear mixed impacts models for analysing data	Single Subject Area – efficient utilization of text-reduction approaches	Develop targeted interventions, reduce boredom to promote effective learning	Potential Confounding Factors, Self-Report Measures to response biases or inaccuracies	Intraindividual level, $\beta=-0.021$; $p=.171$, nor on the interindividual level, $\beta=-0.071$; $p=.228$
Trinidad (2020)	Exploring Functioning mechanism between cognitive engagement and BSLE with a mediating role of motivation	385 high school surveyed, conducted thorough measurement of 43 students in West High School	Authentic reliability of responses from students with high level of judgement	Insufficient sample size for generalizability	Through blended synchronous courses, capable of extending access to high-quality learning resources	Variables are self-reported at a single time, lacking longitudinal design	Chi-square value: 631.31, $\chi 2/df$: 1.91, RMSEA: 0.05, CFI: 0.93, TLI: 0.92, SRMR: 0.06
Isohätälä et al. (2020)	Efficiency assessment of a number line-centered intervention incorporating principles from the science of learning	51 sixth graders struggling with fraction concepts were randomly assigned to experimental intervention ($n=28$) or control group ($n=23$)	Meaningful impact sizes on fraction concepts, magnitude comparison, and number line estimation	Relatively small sample size and limited to two public middle schools in the Northeast region of the United States	Experimental intervention' buffering impact on negative effect of low attentive behaviour on learning	Lack of information on SES at the student level	Fraction concepts ($g=1.09$), number line estimation ($g=-.85$), magnitude comparisons ($g=.82$) AUC value of .881 for the fraction concepts screener

TABLE 5 (Continued)

Study	Work done	Dataset	Strengths	Weaknesses	Opportunities	Limitations	Performance metrics
Gustanti and Ayu (2021)	Epistemological beliefs and Motivational Learning Strategies	502 students of Humanities, Natural Sciences, Social Sciences, Education	Large sample size enhances statistical power and generalizability of findings	Self-reported data may be subject to biases	Identify effective teaching methods to promote students' motivational learning strategies	Limited to one institution, generalizability may be restricted	$R^2 = 18.88\%$ (full model)
Taub et al. (2021)	Examined effects of spelling aids on ESL students' performances	Dataset from 88 ESL students in Taiwan	Error detection and correction learning induced by all spelling aids. Reduction of error detection load positively correlated with high performance	Difficulty in justifying the criterion for feedback quality	Enhance feedback quality, inclusion of confidence survey questions to distinguish alternative explanations	Limited retention period (1 day)	Accuracy regarding treatment score range (93.28% to 99.6%) to the posttest score range (83% to 87.35%), significant negative correlation ($r = -.47$, $p < .001$) between error detection load and performance
Kurniati et al. (2020)	Generated POE, in the Why app. Conducted pretest and posttest with 152 grade 5 elementary school students over 6 weeks	Grade 5 elementary school students from 1 school in Taipei City	The relationship between ILS and CA accounted for 36.5% of the variance, ILS and CA on ECL accounted for variance of 18.5%, CA and ECL on SCE accounted for variance of 55.2%, and SCE on learning progress accounted for variance of 48.0%	Single group quasi-experimental design lacks a control group	Examination of identity mechanisms for effects of the POE model	Limited generalizability to broader population	152 effective questionnaires were returned and validated, with 88 (57.9%) males and 74 (42.1%) females. GFI & AGFI >0.80, RMSEA<0.08
Salih et al. (2020)	Biodiversipreneurship Learning Method Study, Quantitative method with a pre-experimental design	15 students from Natural Science Education department UNHASY Jombang, 5th semester, 2018 class	Effective in increasing students' learning outcomes and interest	Small sample size (15 students)	Application of biodiversipreneurship learning method, sustainable application of entrepreneurship-based learning	Biotechnology course	Pretest significance value = .378, Posttest significance value = .951, Entrepreneurship interest: Early interest significance value = .774, Final interest significance value = .998



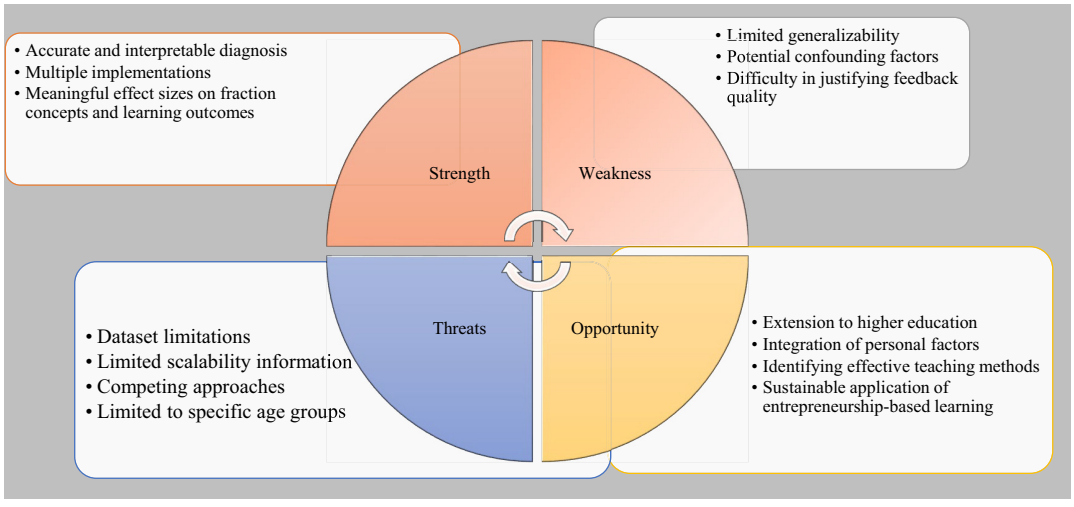


FIGURE 7 SWOT analysis of fostering cognitive learning skills in students.

4.1 | Performing SWOT analysis on fostering non-cognitive learning in students

Non-cognitive skills are essential for students' overall development and success. This analysis looks at strategies for improving these skills, identifies prospects for implementation within education, and discusses any potential drawbacks or challenges. Gaining knowledge about the benefits and drawbacks of developing non-cognitive skills might help students grow personally and achieve their goals in the future. Due to their tremendous impact on student success, non-cognitive elements have attracted a great interest in educational research. Numerous studies demonstrated that non-cognitive elements have a direct, favourable impact on students' academic achievement

and long-term consequences, looked at the role of non-cognitive elements on college readiness in a study with an emphasis on urban education. Their findings highlighted the significance of non-cognitive skills in predicting college performance, including drive, self-control, and social skills. The study also highlighted the substantiality of conceptual elements, like community resources and school environment.

Brunello and Schlotter (2011) examined the utility of self-report surveys and teacher evaluations to the non-cognitive skills' measurement. They emphasized the challenges in evaluating non-cognitive skills like tenacity, restraint, and grit. Strong assessment techniques are required, the report highlighted. The self-report measures' utility in this study, however, may result in response bias and social desirability effects. Brunello and Schlotter (2011), West et al. (2016) examined labour market applicability of non-cognitive skills and personality characteristics, emphasizing the significance of these talents in determining employment outcomes and pay. They also looked into how education and training institutions can promote the growth of non-cognitive skills. It has to be noted that this study's emphasis on labour market results might not adequately represent the larger educational and social implications of non-cognitive skills. The measuring of non-cognitive skills and their connection to education were the subjects of a study by Fletcher and Wolfe (2016). They looked at how schooling affects the development of these skills while evaluating the validity and reliability of the current measurements. Although the study revealed promise in evaluating non-cognitive skills, it also acknowledged difficulties with interpretation and standardization. However, it is worth noting that the study heavily relied on self-reported measures and had a limited focus on specific non-cognitive skills.

Cornwell et al. (2013) examined the family income impact on making and development of non-cognitive skills during childhood. They highlighted the significant role of socioeconomic factors in shaping these skills and their long-term implications for educational attainment and labour market outcomes. However, the study's reliance on observational data limited its ability to establish causal relationships between family income and non-cognitive skill development. Beckmann and Minnaert (2018) studied the association between non-cognitive skills, teacher assessments in primary schools, and gender disparities in test scores. Their findings suggested that non-cognitive skills play a crucial role in explaining the gender gap in academic performance. The study indicated that girls tend to exhibit stronger non-cognitive skills, which contribute to their higher teacher-assigned grades. However, it is significant to note that the study's focus on primary school students restricts its generalizability to higher education contexts. The study given by Jacob (2002) focuses on the non-cognitive features of gifted students with learning disskills (G/LD). The review identifies common traits such as negative emotions, low self-perception, adverse relationships, motivation, coping skills, and perseverance. The study shows limitations that include variations in identification criteria and the inclusion of successful students. Further research is suggested to explore gender, age, different types of disskills, and cultural differences.

Non-cognitive skills play a substantial role in several educational outcomes, including closing the gender gap in higher education (West, 2016). Self-discipline and motivation are highlighted as significant non-cognitive skills that contribute to educational attainment. In line with this, incorporating non-cognitive skills into school accountability systems provides valuable insights into student outcomes and school performance (Holmlund & Silva, 2014). Addressing non-cognitive skills, like self-confidence and perseverance, through targeted interventions improves academic performance and cognitive outcomes (Bassi & Nansamba, 2022). This emphasizes necessity of considering non-cognitive elements beyond cognitive skills in education. Further research explores different aspects of non-cognitive skills. For example, Sparkman et al. (2022) investigated the effectiveness of screening and signalling non-cognitive skills and Dee and West (2011) investigate the predictors of student success in college, focusing on various non-cognitive factors. Howard (2011) analyses the influence of class size on non-cognitive outcomes, such as student behaviour and engagement.

Additionally, Mühlenweg et al. (2012) examine the correlation between non-cognitive performance at school and food insecurity at home, specifically in terms of behaviour of student in elementary classroom. Mühlenweg et al. (2012) and Román-González et al. (2018) investigate the long-term consequences of age at school entry on

non-cognitive skills development. Kautz et al. (2014) extend the computational thinking understanding by exploring its connections with various non-cognitive factors in the context of digital learning (Figure 8).

The analysis of papers discussing the strengths, weaknesses, opportunities, and threats related to fostering non-cognitive skills in students reveals interesting insights. Approximately, 45% of the papers emphasize the strengths associated with non-cognitive skills, highlighting their positive impact on academic performance, college readiness, and future outcomes. On the other hand, around 25% of the papers shed light on the challenges and weaknesses in assessing non-cognitive skills, including the subjective measurement nature, limited focus, and potential confounding factors that affect establishing causal relationships. Furthermore, approximately 20% of the papers explore the opportunities available for integrating non-cognitive skill development within educational systems.

In the SWOT analysis of cognitive and non-cognitive learning in education, key elements include the strengths of cognitive research and its impact on academic performance, and the positive influence of non-cognitive skills on college readiness. Weaknesses involve challenges in implementing student-centered learning and assessing non-cognitive skills. Opportunities are seen in exploring new cognitive theories and integrating non-cognitive skill development in education. Threats include the emotional impact on learning, resistance to change, and issues in standardization and sustainability of educational interventions (Figure 9).

These opportunities involve offering teachers training and support, developing specialized intervention plans, and taking contextual considerations into account. Lastly, almost 10% of the papers discuss potential threats and challenges associated with developing non-cognitive skills, such as a lack of resources, resistance to change, problems with standardization, and the requirement to assure the long-term sustainability of interventions. These results add up to a thorough grasp of the state of non-cognitive skill development in students today.

Insightful implications can be drawn from the SWOT analysis of studies on cognitive and non-cognitive learning. Findings suggest that both cognitive and non-cognitive learning have unique advantages, disadvantages, opportunities, and threats. The significance of including both cognitive and non-cognitive learning in the educational system is shown by these findings. By combining the benefits of each learning style while addressing the shortcomings of each, one can achieve successful outcomes. A thorough and well-balanced approach to education that encourages students' holistic development is provided by combining cognitive and non-cognitive learning. Education professionals can convey knowledge and foster critical thinking skills more successfully by including cognitive learning. Meanwhile, incorporating non-cognitive learning promotes the development of crucial socio-emotional skills like resilience, communication, teamwork, and self-control. The chances indicated for cognitive

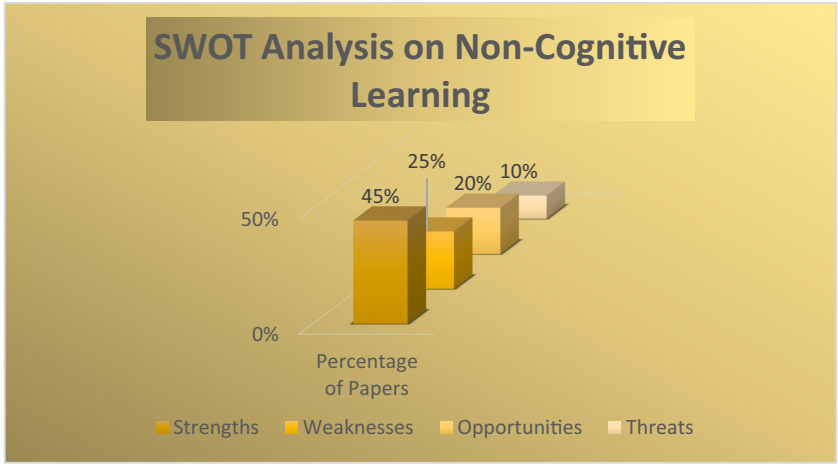


FIGURE 8 SWOT analysis based on percentage of papers.

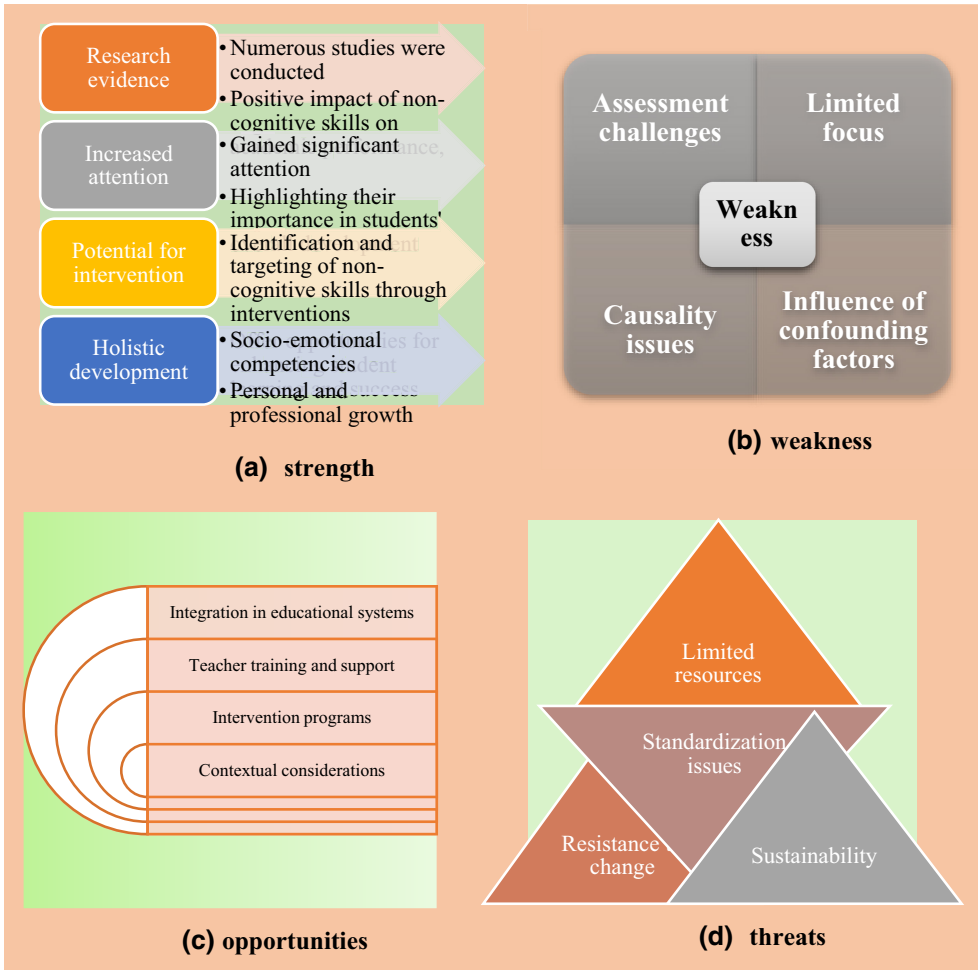


FIGURE 9 SWOT analysis based on key features.

and non-cognitive learning indicate that each approach offers unique prospects for enhancing student learning experiences and outcomes.

5 | PROPOSED CONCEPTUAL FRAMEWORK FOR IMPLEMENTING BOTH COGNITIVE AND NON-COGNITIVE LEARNING IN EDUCATION SYSTEM

It is crucial to review the available research on this subject before recommending a conceptual framework for including both cognitive and non-cognitive learning in the educational system. The efforts undertaken to integrate these two types of talents in educational settings will be better understood with a detailed review of pertinent studies. Growing interest in developing and evaluating both cognitive and non-cognitive skills to support lifelong success has been observed in recent years. According to research, these skills are essential for people to succeed in a variety of areas of life, such as education, career, and personal well-being (Mýtna Kureková et al., 2016). The terms "cognitive skills" and "non-cognitive skills" both refer to intellectual skills like problem-solving, critical thinking, and academic knowledge, but the former refers to socio-emotional and behavioural characteristics like motivation, self-control, and social skills (Cunha & Heckman, 2008). The relevance of both cognitive and

non-cognitive skills in the labour market has been highlighted by research on employers' skill preferences across Europe. According to an analysis of online job advertisements by Fonteyne et al. (2017), the service industry places a high priority on non-cognitive skills. In order to demonstrate how domestic factors influence labour demand, specific skill requirements differ among nations. Academic success has also been examined in relation to cognitive and non-cognitive qualities. According to a study by Protsch and Solga (2015), it is crucial to consider both cognitive and non-cognitive components when making predictions about a specific program's outcomes. It is critical to comprehend how companies use indicators of non-cognitive and cognitive skills when candidates first enter the workforce. In their field studies, Vanbecelaere et al. (2020) highlighted the value of both types of talents and provided insights into how employers make decisions. Digital educational games' impacts on both cognitive and non-cognitive outcomes have been studied in the context of education. In their 2020 study, Vanbecelaere et al. examined the effects of two digital educational games on math and reading outcomes, encompassing both cognitive and non-cognitive dimensions.

The study done on combining both cognitive and non-cognitive learning into the educational system emphasizes the value of a holistic approach to student development. The benefits and challenges of integrating non-cognitive and cognitive skills have been the subject of numerous research. Numerous challenges have been encountered when attempting to relate cognitive and non-cognitive skills to a variety of outcomes, such as academic success, child development, and crime prevention. When evaluating the impacts of living in a fatherless home on cognitive and non-cognitive skills, Radl et al. (2017) met the difficulty of disentangling the impacts of family structure from other factors. The difficulty for Khanam and Nghiem (2016) was to consider the complex interplay of socioeconomic determinants while establishing a causal relationship between family income and cognitive and non-cognitive development. Separating the effects of genetic and environmental factors on how skills are passed down during adolescence and early adulthood was a challenging obstacle that Anger (2012) successfully overcame, who discussed the difficulty of determining the effect of socioeconomic position and family history on skill gaps among kindergarten classmates.

These studies emphasize the necessity for careful examination of confounding variables, causal linkages, and the interaction of genetic and environmental factors and demonstrate the methodological challenges in determining the relationship between cognitive and non-cognitive skills. The development of evidence-based policies and interventions can be influenced by having a thorough understanding of the advantages of both cognitive and non-cognitive skills. Education systems can help people become more resilient, better prepare for success in the workforce, and have a good impact on society by encouraging a balanced approach that places equal emphasis on developing cognitive and non-cognitive skills. Additionally, acknowledging the value of these skills can result in more inclusive educational methods that support various learning requirements of the students along with promotion of their overall growth (Garcia, 2015) This study proposes a conceptual framework for the integration of both cognitive and non-cognitive learning in the educational system. The framework attempts to make it easier to include these two aspects of learning in curriculum development and teaching methods. This framework provides a complete approach to education by emphasizing the importance of both non-cognitive skills (socio-emotional and behavioural competencies) and cognitive skills (academic knowledge and intellectual skills). The combination of cognitive and non-cognitive learning has the potential to improve the educational process, promote students' holistic development, and prepare them for success in a variety of areas of life (Figure 10).

The requirement of a balanced educational system that meets cognitive and socio-emotional needs of students has been emphasized by conceptual framework for integrating both cognitive and non-cognitive learning into educational system. By incorporating cognitive and non-cognitive skills into curriculum design, assessment procedures, teacher professional development, and instructional strategies, this effort seeks educational outcomes enhancement for all students. Educators might help students become well-rounded individuals who possess the information, skills, and competencies essential for success in their careers, in their academic, and in relationships.

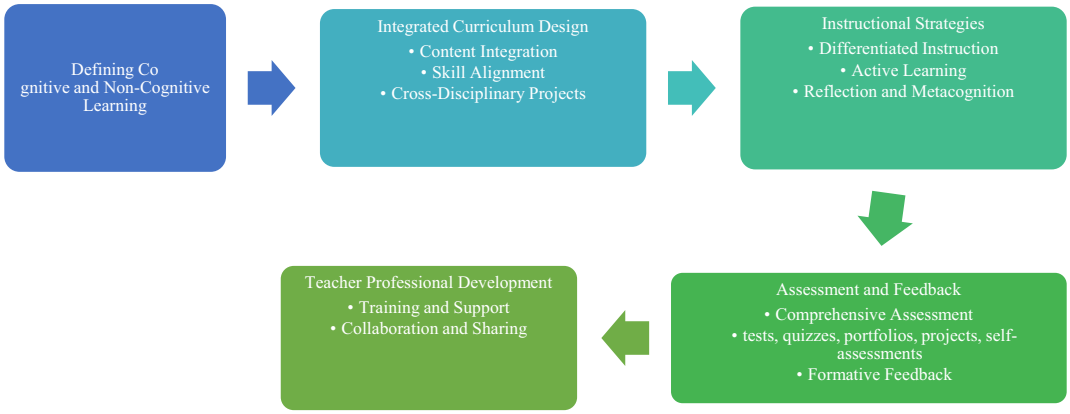


FIGURE 10 Framework to implement both cognitive and non-cognitive learning.

6 | CONCLUSION

Our study's systematic review involved an extensive examination of 365 articles, out of which 81 were meticulously chosen and included for a comprehensive analysis over the past three years. This in-depth review has shed light on the implementation of cognitive and non-cognitive learning theories, underscoring their significant benefits for students in K-12 education. The insights gained from these 81 articles, analysed through a SWOT analysis, reveal the profound impact of integrating both cognitive and non-cognitive theories in educational settings. Such integration not only bolsters academic knowledge but also nurtures key non-cognitive skills like resilience, emotional intelligence, and social skills, which are vital for the well-rounded development of students in the K-12 sector.

The findings underscore the importance of a balanced educational approach that combines cognitive learning strategies, known for improving academic performance, with non-cognitive learning strategies, which contribute to the overall well-being and socio-emotional development of students. Despite challenges in implementation and generalizability, especially in varied educational environments, the opportunities for enhancing pedagogical practices are substantial. The study suggests that innovative teaching methods incorporating both cognitive and non-cognitive aspects can lead to more effective learning experiences.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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