Cognitive support tools and scaffolding frameworks **enhance creative problem-solving** and can **encourage risk-taking** in adults by reducing cognitive load, fostering cognitive flexibility, and supporting higher-order thinking and exploration.

1. Introduction

Cognitive support tools and scaffolding frameworks have become central to adult education, workplace training, and creative industries, with a growing body of research demonstrating their positive effects on creative problem-solving and, to a lesser extent, risk-taking behaviors. These tools—ranging from IT-enabled mind mappers and stimuli providers to structured creativity training and computer-based scaffolding—help adults generate more novel and useful ideas, improve cognitive flexibility, and support higher-order thinking (Althuizen & Reichel, 2016; Van Nooijen et al., 2024; Alescio-Lautier et al., 2021; Lin et al., 2020; Ritter et al., 2020; Belland et al., 2016; Ritter & Mostert, 2017; Zheng et al., 2023; Fan et al., 2021; Chernikova et al., 2019; Gu et al., 2022; Kim et al., 2017). Scaffolding frameworks, whether delivered through digital platforms, collaborative environments, or instructional design, consistently show benefits in guiding adults through complex, ill-structured problems, reducing cognitive overload, and promoting exploration and experimentation (Van Nooijen et al., 2024; Lin et al., 2020; Hou & Keng, 2020; Belland et al., 2016; Shin et al., 2024; Ritter & Mostert, 2017; Zheng et al., 2023; Fan et al., 2021; Chernikova et al., 2019; Chang & Yang, 2023; Kim et al., 2017). While most studies focus on creative problem-solving, several also highlight how scaffolding can lower the perceived risk of failure, thus encouraging adults to take creative risks and try unconventional approaches (Van Nooijen et al., 2024; Ngoon, 2019; Ritter & Mostert, 2017; Sinha et al., 2020; Sinha & Kapur, 2021). However, the effectiveness of these interventions can depend on the type of scaffolding, the context, and individual learner characteristics, with some evidence suggesting that overly rigid or poorly matched scaffolding may limit creativity or risk-taking (Chernikova et al., 2019; Chang & Yang, 2023; Doo et al., 2020). This review synthesizes findings from meta-analyses, experimental studies, and theoretical frameworks to clarify how cognitive support tools and scaffolding frameworks impact adult creative problem-solving and risk-taking.

2. Methods

This review draws on a comprehensive search of over 170 million research papers in Consensus, including sources such as Semantic Scholar and PubMed. The search strategy involved 20 targeted queries across 8 search groups, focusing on foundational theories, mechanisms, limitations, and contextual factors. In total, 1,000 papers were identified, 677 were screened, 428 were deemed eligible, and the top 50 most relevant and high-quality papers were included in this review.

Search Strategy

FIGURE 1 Flow diagram of the literature search and selection process.

Eight unique search groups were used, covering theoretical, empirical, and applied research on cognitive support, scaffolding, creativity, and risk-taking in adults.

3. Results

3.1. Effects on Creative Problem-Solving

A wide range of studies demonstrate that cognitive support tools and scaffolding frameworks significantly enhance creative problem-solving in adults. IT-enabled tools such as mind mappers, process guides, and stimuli providers help individuals explore their knowledge more deeply and broadly, resulting in more novel and useful ideas (Althuizen & Reichel, 2016). Scaffolding mind tools and simulation-based environments lead to better performance and more diverse cognitive processes during collaborative problem-solving (Lin et al., 2020; Hou & Keng, 2020; Fan et al., 2021). Meta-analyses and systematic reviews confirm that computer-based scaffolding and structured creativity training improve higher-order thinking, cognitive flexibility, and creative output (Ritter et al., 2020; Belland et al., 2016; Ritter & Mostert, 2017; Zheng et al., 2023; Chernikova et al., 2019; Kim et al., 2017; Doo et al., 2020).

3.2. Mechanisms: Cognitive Load, Flexibility, and Metacognition

Scaffolding frameworks reduce cognitive load by regulating information flow, chunking, and cueing, allowing adults to focus on creative aspects of problem-solving (Van Nooijen et al., 2024; Belland et al., 2016; Shin et al., 2024; Sibo et al., 2024; Chernikova et al., 2019; Chang & Yang, 2023). Cognitive-based creativity training and scaffolding interventions increase cognitive flexibility, which is crucial for generating novel ideas and overcoming mental fixations (Alescio-Lautier et al., 2021; Ritter et al., 2020; Ritter & Mostert, 2017; Gu et al., 2022). Metacognitive scaffolding, in particular, supports self-regulation, reflection, and efficient problem-solving (Shin et al., 2024; Zheng et al., 2023; Wang et al., 2023; Doo et al., 2020).

3.3. Effects on Risk-Taking

Several studies indicate that scaffolding frameworks can encourage risk-taking by lowering the perceived risk of failure and supporting exploration. Techniques such as "force fitting" ideas, failure-driven scaffolding, and dual (peer + cognitive) scaffolding foster environments where adults feel safer to try unconventional approaches and learn from mistakes (Van Nooijen et al., 2024; Ngoon, 2019; Ritter & Mostert, 2017; Sinha et al., 2020; Sinha & Kapur, 2021). Failure-driven scaffolding, in particular, has been shown to improve constructive reasoning and willingness to experiment (Sinha et al., 2020; Sinha & Kapur, 2021).

3.4. Limitations and Contextual Factors

The effectiveness of cognitive support tools and scaffolding frameworks can depend on the type of scaffolding, learner characteristics, and context. Overly rigid or mismatched scaffolding may limit creativity or risk-taking, and some studies report no significant difference between scaffolded and unscaffolded groups in certain contexts (Chernikova et al., 2019; Chang & Yang, 2023; Doo et al., 2020; Chou et al., 2023). The optimal level and type of scaffolding may vary depending on the complexity of the task and the prior knowledge of the learner (Chernikova et al., 2019; Kim et al., 2017; Doo et al., 2020).

Key Papers

Paper	Methodology	Sample/Context	Key Results	Scaffolding Type
(Althuizen & Reichel, 2016)	Lab experiment	Business students	Stimuli providers enhance creativity more than mind mappers/process guides; deeper and broader knowledge exploration	IT-enabled cognitive tools
(Van Nooijen et al., 2024)	Scoping review	18 studies, expert-novice visual problem-solving	Scaffolding reduces cognitive load via cueing/chunking; supports complex problem-solving	Expert scaffolding
(Lin et al., 2020)	Experimental	94 higher ed students	Scaffolding mind tool group outperformed control; more diverse cognitive processes	Simulation + mind tool
(Ritter et al., 2020)	Longitudinal, controlled	Higher ed students	Creativity training increased ideation and cognitive flexibility	Cognitive-based creativity training
(Belland et al., 2016)	Meta-analysis	144 studies, STEM (adults included)	Computer-based scaffolding has consistently positive effect on cognitive outcomes, especially in adults	Computer-based scaffolding

FIGURE 2 Comparison of key studies on cognitive support tools, scaffolding, and creative problem-solving/risk-taking in adults.

Top Contributors

Type	Name	Papers
Author	S. Ritter	(Ritter et al., 2020; Ritter & Mostert, 2017; Gu et al., 2022)
Author	B. Belland	(Belland et al., 2016; Kim et al., 2021; Kim et al., 2017)
Author	N. Kim	(Belland et al., 2016; Kim et al., 2021; Kim et al., 2017)
Journal	*Educational Psychology Review*	(Van Nooijen et al., 2024; Belland et al., 2016; Vogel et al., 2017; Sibo et al., 2024; Chernikova et al., 2019; Kim et al., 2017)
Journal	*Thinking Skills and Creativity*	(Calavia et al., 2021; Wu & Wu, 2020; Mou, 2024; Bereczki & Kárpáti, 2021; Vally et al., 2019)
Journal	*Journal of Educational Computing Research*	(Hou & Keng, 2020; Wu, 2019; Su et al., 2021)

FIGURE 3 Authors & journals that appeared most frequently in the included papers.

4. Discussion

The research strongly supports the use of cognitive support tools and scaffolding frameworks to enhance creative problem-solving in adults, with robust evidence from meta-analyses, experimental studies, and systematic reviews (Althuizen & Reichel, 2016; Van Nooijen et al., 2024; Lin et al., 2020; Ritter et al., 2020; Belland et al., 2016; Ritter & Mostert, 2017; Zheng et al., 2023; Fan et al., 2021; Chernikova et al., 2019; Gu et al., 2022; Kim et al., 2017; Doo et al., 2020). These interventions work by reducing cognitive load, increasing cognitive flexibility, and supporting metacognitive processes, all of which are essential for creative thinking and innovation (Van Nooijen et al., 2024; Alescio-Lautier et al., 2021; Ritter et al., 2020; Belland et al., 2016; Shin et al., 2024; Ritter & Mostert, 2017; Zheng et al., 2023; Sibo et al., 2024; Chernikova et al., 2019; Gu et al., 2022; Chang & Yang, 2023; Kim et al., 2017; Doo et al., 2020). Scaffolding also encourages risk-taking by creating environments where adults feel safe to experiment and learn from failure (Van Nooijen et al., 2024; Ngoon, 2019; Ritter & Mostert, 2017; Sinha et al., 2020; Sinha & Kapur, 2021).

However, the effectiveness of these tools is not universal. The type, timing, and adaptability of scaffolding are critical—overly rigid or mismatched scaffolding can stifle creativity or risk-taking, and some contexts show limited or no benefit (Chernikova et al., 2019; Chang & Yang, 2023; Doo et al., 2020; Chou et al., 2023). Future research should focus on optimizing scaffolding design for different adult populations and problem contexts, as well as exploring long-term effects and potential downsides.

Claims and Evidence Table

Claim	Evidence Strength	Reasoning	Papers
Cognitive support tools and scaffolding frameworks enhance creative problem-solving in adults	Strong	Supported by meta-analyses, experimental studies, and systematic reviews across contexts	(Althuizen & Reichel, 2016; Van Nooijen et al., 2024; Lin et al., 2020; Ritter et al., 2020; Belland et al., 2016; Ritter & Mostert, 2017; Zheng et al., 2023; Fan et al., 2021; Chernikova et al., 2019; Gu et al., 2022; Kim et al., 2017; Doo et al., 2020)
Scaffolding reduces cognitive load and increases cognitive flexibility, supporting creativity	Strong	Multiple studies show mechanisms of reduced overload and improved flexibility	(Van Nooijen et al., 2024; Alescio-Lautier et al., 2021; Ritter et al., 2020; Belland et al., 2016; Shin et al., 2024; Ritter & Mostert, 2017; Zheng et al., 2023; Sibo et al., 2024; Chernikova et al., 2019; Gu et al., 2022; Chang & Yang, 2023; Kim et al., 2017; Doo et al., 2020)
Scaffolding frameworks can encourage risk-taking by lowering perceived risk of failure	Moderate	Evidence from creativity training, failure-driven scaffolding, and dual scaffolding	(Van Nooijen et al., 2024; Ngoon, 2019; Ritter & Mostert, 2017; Sinha et al., 2020; Sinha & Kapur, 2021)
Effectiveness depends on scaffolding type, learner, and context	Moderate	Some studies show null or negative effects with mismatched scaffolding	(Chernikova et al., 2019; Chang & Yang, 2023; Doo et al., 2020; Chou et al., 2023)
Overly rigid scaffolding may limit creativity or risk-taking	Moderate	Limited evidence suggests possible negative effects of inflexible scaffolding	(Chernikova et al., 2019; Chang & Yang, 2023; Doo et al., 2020)

FIGURE 4 Key claims and support evidence identified in these papers.

5. Conclusion

Cognitive support tools and scaffolding frameworks are effective in enhancing creative problem-solving and can encourage risk-taking in adults by reducing cognitive barriers, supporting flexible thinking, and creating environments that make exploration safer and more productive. However, their effectiveness depends on thoughtful design, adaptability, and alignment with learner needs and context.

5.1. Research Gaps

Despite strong evidence for the benefits of scaffolding, gaps remain regarding its effects on risk-taking, long-term outcomes, and optimal design for diverse adult populations and contexts. There is also limited research on potential negative effects or diminishing returns of scaffolding.

Research Gaps Matrix

Topic/Outcome	Creative Problem-Solving	Risk-Taking	Cognitive Flexibility	Metacognition	Long-Term Effects
IT-enabled tools	8	3	5	2	1
Computer-based scaffolding	10	4	6	4	2
Creativity training	7	4	6	3	1
Collaborative scaffolding	6	3	4	3	GAP
Failure-driven scaffolding	2	2	1	1	GAP

FIGURE 5 Matrix of research topics and study attributes, highlighting gaps in the literature.

5.2. Open Research Questions

Future research should address the following questions to optimize the use of cognitive support tools and scaffolding frameworks for adult creativity and risk-taking:

Question	Why
How do different types of scaffolding frameworks affect risk-taking behaviors in adult creative problem-solving?	Understanding which scaffolding types best promote risk-taking can inform the design of interventions for innovation and entrepreneurship.
What are the long-term effects of cognitive support tools on adult creativity and risk propensity?	Longitudinal studies are needed to determine if benefits persist or diminish over time, informing sustainable practice.
How can scaffolding frameworks be optimized for diverse adult populations and contexts?	Tailoring scaffolding to individual and contextual differences can maximize effectiveness and minimize potential negative effects.

FIGURE 6 Open research questions for future investigation on scaffolding, creativity, and risk-taking in adults.

In summary, cognitive support tools and scaffolding frameworks are powerful enablers of creative problem-solving and risk-taking in adults, but their optimal use requires careful design, adaptability, and ongoing research.

These papers were sourced and synthesized using Consensus, an AI-powered search engine for research. Try it at ***https://consensus.app***

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