

Designing an Artificial Intelligence–Based Cognitive Empowerment Package to Enhance Entrepreneurial Skills in Gifted and Creative Adolescents

Soroush. Javidnia^{1*}, Saeed. Rezaei²

¹ Ph.D., Department of Psychology and Education of Exceptional Children, Allameh Tabataba'i University, Tehran, Iran

² Associate Professor, Department of Psychology and Education of Exceptional Children, Allameh Tabataba'i University, Tehran, Iran

* Corresponding author email address: soroushti75@gmail.com

Article Info

Article type:

Original Research

How to cite this article:

Javidnia, S., & Rezaei, S. (2026). Designing an Artificial Intelligence–Based Cognitive Empowerment Package to Enhance Entrepreneurial Skills in Gifted and Creative Adolescents. *International Journal of Education and Cognitive Sciences*, 7(6), 1-17.

<https://doi.org/10.61838/kman.ijecs.452>



© 2026 the authors. Published by Iranian Association for Intelligence and Talent Studies, Tehran, Iran. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

ABSTRACT

Purpose: This study aimed to design an artificial intelligence–based cognitive empowerment package for enhancing entrepreneurial skills in gifted and creative adolescents through the qualitative identification and integration of relevant cognitive, psychological, motivational, interpersonal, and technological components.

Methods and Materials: The study employed a qualitative exploratory-developmental design. Data were obtained through an analytical review of relevant literature, examination of previous student entrepreneurship workshop experiences, and semi-structured interviews with students, mentors, workshop facilitators, and accelerator managers selected through purposive sampling. Data collection continued until conceptual saturation was achieved. Interview transcripts, field observations, documentary evidence, and analytical notes were examined using thematic analysis.

Findings: The qualitative analysis indicated that sustained entrepreneurial action among gifted and creative adolescents depends on a multidimensional configuration of entrepreneurial intention and identity, self-efficacy, opportunity recognition and problem identification, executive functioning, tolerance of ambiguity, applied creativity, fear of failure and perfectionism, intrinsic motivation and psychological ownership, teamwork and psychological safety, proactive agency, resilience, future orientation, and reflective readiness to use artificial intelligence. The findings further suggested that entrepreneurial difficulties differ across adolescents and therefore require profile-based rather than uniform intervention. Integration of the themes resulted in a six-session package encompassing profile awareness and goal setting, problem identification and value creation, conversion of ideas into action plans, presentation and feedback utilization, teamwork and agency, and final presentation with a continuation plan.

Conclusion: The findings suggest that entrepreneurial empowerment in gifted and creative adolescents should extend beyond creativity and business knowledge by strengthening the cognitive and psychological capacities required to transform ideas into sustained action, while using artificial intelligence as a supervised reflective and personalized learning support rather than as a substitute for adolescent judgment and agency.

Keywords: *Artificial Intelligence, Cognitive Empowerment, Entrepreneurial Skills, Gifted Adolescents, Creative Adolescents, Entrepreneurship Education, Qualitative Research*

1. Introduction

Entrepreneurship is increasingly understood not merely as the establishment of a business but as a complex capacity for recognizing meaningful problems, generating value-oriented solutions, mobilizing personal and interpersonal resources, making decisions under uncertainty, and transforming ideas into purposeful action. This broader conception has particular relevance during adolescence, when cognitive, motivational, social, and identity-related capacities are undergoing substantial development and when young people begin to formulate more coherent representations of their educational and occupational futures. For gifted and creative adolescents, the issue is especially significant because high cognitive ability and creative potential can provide important foundations for opportunity recognition, problem solving, ideation, and innovation, yet these capacities do not necessarily culminate in sustained entrepreneurial behavior. The transition from having an original idea to taking responsibility for its development requires additional capacities, including self-efficacy, goal regulation, tolerance of uncertainty, persistence, collaboration, and the ability to learn from imperfect outcomes. Contemporary perspectives on adolescent development further emphasize that identity is increasingly constructed in interaction with digital environments, changing social expectations, and emerging technological systems, making educational programs for adolescents inseparable from the broader digital context in which they learn, communicate, explore possible selves, and make future-oriented decisions (Sirin et al., 2024).

This distinction between potential and sustained entrepreneurial action is particularly important in the case of gifted and creative adolescents. Gifted learners may demonstrate rapid learning, sophisticated reasoning, originality, and a strong capacity to generate alternatives, but high ability does not automatically provide the psychological readiness required to expose an incomplete idea to criticism, tolerate uncertain outcomes, coordinate with peers, or continue after an unsuccessful attempt. Perfectionism is particularly relevant in this population because it cannot simply be regarded as an exclusive or defining characteristic of giftedness; rather, its adaptive and maladaptive manifestations require careful differentiation, especially when high personal standards become associated with concerns about mistakes or evaluation (Jiménez Morales & Checa Fernández, 2024). In an entrepreneurial context, excessive concern about errors may become

functionally important because entrepreneurship routinely requires individuals to reveal provisional solutions, test assumptions, receive criticism, and modify ideas before an ideal solution is available. Growth-oriented approaches may therefore be especially relevant when adolescents interpret difficulty or failure as evidence about the improbability of a strategy rather than as a fixed judgment about competence. Evidence concerning growth-mindset interventions with young people indicates the importance of examining how beliefs about change relate to broader social-emotional developmental outcomes (Jiang et al., 2024), while research on effective social-emotional learning programs demonstrates that adolescent development can be supported through deliberately structured components targeting emotional, interpersonal, and behavioral competencies (Shi & Cheung, 2024). These perspectives suggest that entrepreneurship education for gifted and creative adolescents must move beyond creativity training alone and address the cognitive and psychological processes that allow creativity to become action.

This need is reinforced by qualitative evidence arising from student entrepreneurship workshops. Previous investigation of these workshops indicated that limited entrepreneurial continuation could not be adequately explained by insufficient knowledge of business concepts or inadequate exposure to startup terminology. Instead, recurring barriers included low entrepreneurial self-efficacy, weak entrepreneurial intention and identity, limited tolerance of ambiguity, fear of failure, perfectionistic concerns, difficulties in executive functioning, insufficient intrinsic ownership of ideas, problems in teamwork, limited resilience, and dependence on external structures and mentor direction (Javidnia, 2026). Such findings suggest that adolescents who appear similarly disengaged after an entrepreneurship program may have substantially different underlying needs. One adolescent may have a promising idea but hesitate to act because of fear of evaluation, whereas another may possess strong motivation but struggle to divide a goal into manageable steps. A third may engage effectively when a mentor provides explicit instructions but fail to initiate action independently, while another may generate highly original ideas without perceiving entrepreneurship as part of a plausible future identity. This heterogeneity challenges standardized models of entrepreneurship instruction in which all learners receive the same activities, feedback, pacing, and developmental emphasis. It instead supports a profile-oriented model in which entrepreneurial empowerment begins with understanding the particular

configuration of cognitive, motivational, emotional, and interpersonal strengths and barriers characterizing each adolescent.

The concept of personalization has gained substantial prominence in contemporary educational and psychological intervention research, particularly as digital technologies have increased the feasibility of adapting educational experiences to individual learner characteristics. Systematic evidence on artificial intelligence-based personalized learning indicates that AI can support the adaptation of content, feedback, learning pathways, and educational activities according to individual needs (Farhood et al., 2025). Reviews of adaptive education similarly show that artificial intelligence techniques are increasingly being incorporated into personalized learning environments to modify learning experiences according to patterns in learner performance and engagement (Hariyanto et al., 2025). From a cognitive perspective, AI-enhanced e-learning and adaptive assessment may also facilitate more responsive alignment between learner characteristics, cognitive processes, and instructional demands (Voulgari et al., 2024). More broadly, empirical research on generative AI in education has documented rapidly expanding applications across teaching, learning, feedback, content generation, and learner support (Zhang et al., 2024). At the same time, the educational value of generative AI cannot be inferred merely from its technical capacity to produce rapid and sophisticated responses. Its usefulness depends on instructional design, the learner's active cognitive involvement, the quality of feedback processes, and the extent to which AI interaction strengthens rather than replaces human reasoning (Yan et al., 2024). Thus, personalization should not be understood as simply giving adolescents machine-generated answers that correspond to their presumed profile; rather, it should involve using AI to create differentiated opportunities for reflection, questioning, planning, and cognitive practice.

These possibilities are particularly relevant to entrepreneurship education. Recent scholarship indicates growing interest in the role of generative AI and large language models in supporting entrepreneurship learning, including opportunity exploration, ideation, business-related knowledge construction, feedback, simulation, and problem solving (Yu et al., 2025). Systematic examination of AI and creativity in entrepreneurship education similarly demonstrates that large language models are becoming increasingly relevant to entrepreneurial learning environments, particularly where creativity, iterative

ideation, and interactive learning are central instructional processes (Park et al., 2025). Conversational agents and prompt-based interaction can support learners in moving from broad entrepreneurial questions toward more structured exploration of problems, opportunities, and possible venture-related decisions (Thanasi-Boçe & Hoxha, 2024). For adolescents, however, the educational objective should not be reduced to accelerating the production of entrepreneurial ideas or business plans. The more important developmental question is whether AI can be incorporated in a way that strengthens the adolescent's capacity to identify a problem independently, articulate an initial interpretation, compare alternatives, plan a feasible action, evaluate feedback, and assume responsibility for the resulting decision. Under this conception, AI functions as cognitive scaffolding within entrepreneurship education rather than as an automated entrepreneur acting on behalf of the learner.

The potential contribution of generative AI to creativity illustrates both the promise and the complexity of this approach. Empirical evidence suggests that generative AI can enhance aspects of individual creative production, yet this benefit may be accompanied by reduced diversity across generated outputs, indicating that greater creativity at the individual level does not necessarily translate into greater collective originality (Doshi & Hauser, 2024). Experimental research has likewise demonstrated meaningful effects of ChatGPT on creative performance (Lee & Chung, 2024), while other evidence indicates that ChatGPT-assisted brainstorming can decrease idea diversity when users converge around similar machine-supported suggestions (Meincke et al., 2025). These findings are highly relevant for gifted and creative adolescents because an intervention intended to cultivate entrepreneurial cognition should not inadvertently standardize their thinking or encourage premature acceptance of AI-generated alternatives. Human agency during creative collaboration therefore remains essential. Research on co-creation with AI has highlighted the significance of self-efficacy and the user's perception of meaningful participation in creative collaboration (McGuire et al., 2024). Accordingly, an AI-based cognitive empowerment package should require adolescents to produce their own initial ideas, interpretations, and decisions before seeking AI assistance, thereby positioning AI-generated output as material to question, compare, revise, or reject rather than as an authoritative final answer.

This emphasis on active human participation is consistent with the broader literature on human-AI collaboration. Human and artificial intelligence systems do not invariably

produce superior outcomes simply because their capabilities are combined; the effectiveness of human–AI configurations depends on the task, the distribution of roles, and the conditions under which complementary strengths can actually be realized (Vaccaro et al., 2024). Human–AI collaboration may also involve a reciprocal learning process in which users alter their reasoning and behavior in response to AI output while the structure of interaction shapes subsequent collaboration (Lu et al., 2025). For educational settings, this dynamic makes role definition especially important. Human-in-the-loop approaches emphasize the continuing importance of human judgment and oversight within artificial intelligence in education (Memarian & Doleck, 2024). In an adolescent entrepreneurship intervention, therefore, the adolescent should retain responsibility for goals and decisions, the mentor should maintain responsibility for developmental guidance and contextual interpretation, and AI should operate within a limited support role involving questioning, option generation, reflection, structured feedback, and assistance with breaking complex tasks into manageable steps. Such role differentiation is not simply an ethical safeguard; it is directly related to the developmental objective of increasing agency rather than producing technological dependence.

The same principle is evident in the rapidly developing literature on AI-supported psychological and developmental services for children and adolescents. A systematic review of AI-based interventions involving children and adolescents demonstrates expanding applications ranging from psychotherapy-related functions to broader developmental support, while simultaneously underscoring the need for developmentally appropriate implementation and responsible oversight (Mutluer et al., 2026). Reviews specifically addressing adolescent mental health applications similarly show considerable potential for AI-supported screening, monitoring, interaction, and intervention, but also identify important challenges surrounding safety, evidence, privacy, and appropriate human involvement (Sharma et al., 2025). Large language models have also been examined across mental health applications, where their conversational and analytic capabilities coexist with significant concerns about reliability and clinical interpretation (Guo et al., 2024). Although entrepreneurial cognitive empowerment is not a mental health intervention, these findings are directly informative because they demonstrate that the deployment of AI with young people must be bounded by developmental appropriateness, transparency, human supervision, and clear

limits on what automated systems are permitted to infer or decide.

Assessment represents another crucial element in any profile-based empowerment approach. If an intervention is to be personalized according to adolescents' cognitive and psychological needs, those needs must first be represented through methods that are sufficiently meaningful, developmentally appropriate, and interpretable. Emerging research suggests that conventional assessment formats can increasingly be supplemented with direct, technology-mediated, and performance-oriented approaches. Innovative methods for the direct assessment of social and emotional skills offer possibilities for moving beyond exclusive reliance on traditional self-report scales (Linzarini & Catarino da Silva, 2024), while conceptual work concerning digital transformation of functional cognitive assessments for children and adolescents demonstrates both the opportunities and the methodological questions associated with digitizing assessment processes (Fogel et al., 2025). Evidence concerning technology-mediated assessments in youth further indicates that validity must be demonstrated rather than presumed merely because an assessment is delivered digitally (Oddleifson et al., 2025). In the era of generative artificial intelligence, this requirement becomes even more important because AI can alter task demands, response processes, and interpretations of performance, requiring explicit attention to the validity of newly designed assessments (Kaldaras et al., 2024).

Large language models also create new possibilities for interpreting complex psychological and behavioral information, but these possibilities require particularly careful boundaries. Research has proposed that, under targeted evaluation conditions, large language models may contribute to psychological assessment beyond conventional rating scales (Kjell et al., 2024). More recent systematic evidence examining AI-powered approaches to psychological assessment in adolescence likewise demonstrates the expanding methodological scope of computational assessment techniques (Liu et al., 2026). Nevertheless, the capacity of an AI system to recognize linguistic or behavioral patterns should not be equated with authority to label a gifted adolescent's personality, entrepreneurial potential, or developmental future. In the present context, the appropriate function of AI is therefore supportive rather than diagnostic: it can help organize information, pose reflective questions, summarize patterns for human review, and support the adaptation of exercises, while interpretation remains embedded in a broader process

involving the adolescent, researcher, and mentor. This distinction is essential to avoid converting a developmental profile into a deterministic classification of who is or is not capable of entrepreneurship.

Personalized intervention research provides further support for designing flexible rather than uniform developmental pathways. Meta-analytic and scoping evidence indicates that personalized psychological interventions for adolescents constitute a growing area of research and can be conceptualized around adaptation to individual characteristics and changing needs (Li et al., 2024). Just-in-time adaptive interventions similarly illustrate how support can be modified according to context, state, or momentary need rather than being delivered identically across all individuals and situations (Hsu et al., 2024). More recent work on participatory precision approaches with adolescents and young adults highlights the value of co-designed recommendations and the importance of including young people's perspectives in adaptive intervention systems (Guan et al., 2026). These principles are highly compatible with entrepreneurship empowerment because an adolescent's most important barrier may change over time. Initial difficulty may involve defining a meaningful problem, whereas later challenges may concern presenting an imperfect prototype, resolving team conflict, recovering after rejection, or continuing activity when external supervision decreases. A cognitively oriented package should consequently retain a coherent developmental structure while allowing the focus, prompts, feedback, and exercises to be adjusted according to the adolescent's profile and progression.

Within this framework, the central educational problem is not whether artificial intelligence should be present in adolescents' entrepreneurial learning, but how it should be designed so that its presence strengthens the psychological and cognitive competencies that entrepreneurship requires. An AI tool that immediately supplies a polished idea, complete plan, or definitive solution may improve the apparent quality of an immediate product while weakening opportunities to practice problem identification, decision making, ambiguity tolerance, planning, error correction, and independent agency. Conversely, an AI system configured to ask limited questions, request the adolescent's own answer first, generate alternatives for comparison, simulate constructive criticism, help divide goals into feasible steps, and encourage reflection after action may function as a scaffold for cognitive empowerment. Such a design is especially appropriate for gifted and creative adolescents

because it preserves space for originality while introducing structure where executive, emotional, or motivational obstacles interfere with translating potential into action. The resulting intervention must therefore integrate individualized profiling, experiential entrepreneurial tasks, psychologically informed cognitive exercises, human mentoring, and critically supervised AI interaction into a coherent developmental process rather than treating AI as an independent instructional agent.

Accordingly, the aim of the present study was to design an artificial intelligence-based cognitive empowerment package for enhancing entrepreneurial skills in gifted and creative adolescents through a qualitative identification and integration of the cognitive, psychological, motivational, interpersonal, and AI-supported components required for sustained entrepreneurial action.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a qualitative research design with the primary aim of designing an artificial intelligence-based cognitive empowerment package for enhancing entrepreneurial skills among gifted and creative adolescents. The qualitative approach was selected because the development of such a package required an in-depth understanding of the cognitive capacities associated with entrepreneurial competence, the developmental characteristics and educational needs of gifted and creative adolescents, and the potential functions of artificial intelligence in facilitating cognitive empowerment. The study therefore focused on identifying, organizing, and integrating the conceptual and practical components required for the proposed intervention package rather than examining predetermined relationships among variables. The research process was conducted through an exploratory and developmental qualitative framework in which relevant scientific evidence and expert perspectives were systematically examined to determine the major dimensions, components, and instructional strategies of the cognitive empowerment package. The study population consisted of specialists whose academic and professional expertise was directly related to the principal domains of the research, including educational psychology, gifted education, creativity, entrepreneurship education, cognitive psychology, educational technology, and artificial intelligence in education. Participants were recruited through purposive criterion-based sampling so that

individuals with sufficient theoretical knowledge, research experience, or professional expertise relevant to the objectives of the study could contribute to the development of the package. Eligibility was determined on the basis of academic specialization, research or professional experience in at least one of the relevant fields, familiarity with the psychological and educational characteristics of gifted and creative adolescents, and willingness to participate in the study. Particular attention was given to selecting participants who could provide information-rich perspectives concerning cognitive skills, entrepreneurial competencies, creativity, problem solving, decision making, opportunity recognition, innovation, and the educational applications of artificial intelligence. Sampling and data collection continued until conceptual saturation was achieved, meaning that additional data no longer generated substantively new concepts, categories, or components relevant to the structure of the proposed package. Throughout participant selection, heterogeneity of expertise was considered important because the interdisciplinary nature of the proposed package required the integration of psychological, educational, entrepreneurial, and technological perspectives.

2.2. Data Collection Tools

Data were collected using a combination of systematic document examination and semi-structured expert interviews designed specifically in accordance with the objectives of the study. Documentary data included relevant scholarly literature, conceptual models, educational frameworks, and research findings concerning cognitive empowerment, entrepreneurial skills, giftedness, creativity, adolescent cognitive development, and the educational applications of artificial intelligence. The documentary review was conducted to establish the theoretical foundation of the package and to generate an initial pool of concepts, competencies, cognitive processes, and educational strategies that could potentially be incorporated into its structure. Particular attention was directed toward cognitive competencies that are especially relevant to entrepreneurial functioning, such as divergent and convergent thinking, creative problem solving, cognitive flexibility, opportunity recognition, analytical reasoning, strategic thinking, decision making under uncertainty, planning, metacognition, self-regulated learning, information evaluation, innovation, and adaptive problem solving. The review also examined the ways in which artificial intelligence could be incorporated as an instructional and

cognitive support mechanism, including personalized learning activities, interactive problem scenarios, idea generation and refinement, adaptive feedback, simulation of entrepreneurial decisions, information analysis, reflective questioning, and guided problem-solving experiences. On the basis of the preliminary conceptual framework derived from the documentary review, a semi-structured interview protocol was developed for the expert participants. The interviews were designed to elicit detailed perspectives concerning the most important entrepreneurial skills required by gifted and creative adolescents, the cognitive competencies underlying those skills, the developmental appropriateness of proposed instructional activities, the potential contribution of artificial intelligence to cognitive empowerment, the risks and limitations associated with AI-supported learning, and the appropriate organization of the intervention content. Open-ended questions were used to provide participants with sufficient flexibility to elaborate on their professional experiences and conceptual viewpoints, while supplementary probing questions were employed when clarification or further elaboration was required. Interviews also addressed the proposed objectives, content, sequencing, instructional processes, AI-assisted activities, cognitive exercises, expected learning outcomes, and procedures for organizing the components of the empowerment package. With participants' permission, interviews were recorded and subsequently transcribed verbatim to preserve the completeness and accuracy of the qualitative data. Field notes and analytic memos were also maintained during the data collection process to record emerging interpretations, conceptual relationships, and observations relevant to package development. The preliminary components extracted from the literature and interviews were repeatedly compared and refined so that overlapping concepts could be integrated and components lacking sufficient conceptual relevance could be reconsidered. Credibility of the qualitative data was strengthened through prolonged engagement with the data, repeated comparison between documentary evidence and expert perspectives, peer examination of emerging categories, and participant-based clarification of ambiguous interpretations when necessary. Dependability was supported by maintaining a transparent record of data collection, coding, category development, and decisions made during the process of constructing the final package.

2.3. Data Analysis

Qualitative data were analyzed through an inductive-deductive thematic analysis process aimed at identifying the conceptual dimensions and operational components required for the artificial intelligence–based cognitive empowerment package. Analysis began concurrently with data collection so that emerging concepts could inform subsequent interviews and facilitate deeper exploration of insufficiently developed categories. Interview transcripts, documentary materials, field notes, and analytic memos were reviewed repeatedly to achieve immersion in the data. During the initial coding stage, meaningful units of information related to entrepreneurial competencies, cognitive empowerment, giftedness and creativity, adolescent developmental needs, instructional strategies, and applications of artificial intelligence were identified and assigned descriptive codes. Coding remained sufficiently open during the early stages of analysis to avoid forcing the data into predetermined classifications. Similar codes were subsequently compared and grouped into broader subcategories according to their conceptual similarities and functional relationships. Through continued comparison, these subcategories were organized into higher-order themes representing the principal dimensions of the proposed empowerment package. Particular attention was paid to relationships between cognitive capacities and entrepreneurial skills so that the resulting package would not merely introduce entrepreneurial concepts but would systematically strengthen the cognitive processes required for entrepreneurial thinking and behavior. The role of artificial intelligence was analyzed as an integrated instructional and cognitive facilitation mechanism rather than as an independent technological component. Accordingly, AI-supported activities were examined in terms of their capacity to facilitate personalized cognitive challenges, stimulate creative ideation, provide adaptive feedback, support information processing, create decision-making scenarios, encourage reflective thinking, and expose adolescents to complex entrepreneurial problems. Throughout the analysis, constant comparison was used to examine similarities and differences among expert perspectives and documentary findings, while emerging categories were continuously revised until a coherent conceptual structure was obtained. Candidate themes were reviewed in relation to the entire dataset to ensure that each theme was internally consistent, conceptually distinguishable from other themes, and sufficiently supported by the qualitative evidence. The final

themes and subthemes were then translated into practical educational components, including package objectives, cognitive competencies, entrepreneurial learning targets, AI-assisted exercises, instructional activities, reflective processes, and expected developmental outcomes. The organization and sequencing of these components were determined according to conceptual progression, developmental appropriateness for gifted and creative adolescents, and the logical movement from foundational cognitive capacities toward more complex entrepreneurial competencies. The resulting framework was subjected to expert review to examine the relevance, clarity, comprehensiveness, coherence, and practical applicability of its components. Feedback obtained during this stage was incorporated through iterative revision until conceptual agreement was achieved regarding the structure and content of the package. The final qualitative synthesis therefore provided the conceptual foundation for an integrated artificial intelligence–based cognitive empowerment package specifically designed to cultivate the cognitive foundations of entrepreneurial skills in gifted and creative adolescents.

3. Findings and Results

The qualitative analysis revealed that the central challenge in entrepreneurship education for gifted and creative adolescents was not primarily a lack of familiarity with entrepreneurial concepts. Participants were generally able to engage with concepts such as ideation, teamwork, product development, presentation, and feedback; however, familiarity with these concepts did not necessarily translate into sustained entrepreneurial action. The findings indicated that the gap between participation in entrepreneurship workshops and persistent entrepreneurial behavior was formed through the interaction of psychological, cognitive, emotional, interpersonal, and contextual processes. At the individual level, important issues concerned self-efficacy, motivation, fear of failure, perfectionism, self-regulation, and future orientation. At the interpersonal level, communication, role distribution, conflict management, responsibility, trust, and the ability to receive feedback were prominent. Contextual factors included the structure of the workshops, the style of mentoring, family and school expectations, dominant definitions of success, and the availability of continued support after the completion of the program. Consequently, entrepreneurial readiness emerged

as a multidimensional profile rather than a single ability or stable personal characteristic.

A major theme concerned **initial interest without internalization of the entrepreneurial pathway**. The adolescents frequently demonstrated enthusiasm at the beginning of entrepreneurship activities, particularly when they encountered a novel workshop environment, group-based activities, interaction with mentors, and opportunities to express creative ideas. Nevertheless, this situational enthusiasm did not consistently develop into a personally meaningful commitment to entrepreneurship. Some adolescents participated actively while the external structure of the workshop was present but reduced their engagement once scheduled sessions, mentor expectations, presentation deadlines, and organized tasks were removed. The qualitative data therefore distinguished between temporary interest in entrepreneurial activities and the internalization of entrepreneurship as a personally meaningful mode of action. Continued engagement appeared to require a stronger sense that the selected problem and proposed idea belonged to the adolescent rather than simply constituting an assigned workshop task. This finding highlighted the importance of autonomy, personal meaning, and psychological ownership of the idea in transforming initial excitement into sustained entrepreneurial engagement.

Closely associated with this pattern was **weakness in entrepreneurial intention and identity formation**. Although many adolescents perceived entrepreneurship as interesting, educational, or socially valuable, they did not necessarily imagine themselves as individuals capable of occupying an entrepreneurial role in the future. When discussing future educational and occupational pathways, familiar trajectories such as university education, professional specialization, employment in established organizations, and secure occupations were more readily incorporated into their future self-image. Entrepreneurship, by contrast, often remained an interesting external phenomenon rather than an identity-relevant possibility. The findings therefore suggested a distinction between appreciating entrepreneurship and perceiving entrepreneurship as something that one can personally undertake. Entrepreneurial identity became evident when adolescents could imagine themselves identifying a problem, proposing a solution, accepting responsibility for its development, collaborating with others, and continuing to pursue the idea beyond the workshop environment. Accordingly, strengthening entrepreneurial skills required not only teaching entrepreneurial procedures but also

helping adolescents integrate agency, value creation, initiative, and problem ownership into their emerging conception of themselves and their future.

Another prominent theme was **low entrepreneurial self-efficacy when moving from ideas to actual action**. Gifted and creative adolescents could appear highly competent during discussion, ideation, and conceptual analysis while displaying considerably greater hesitation when required to present an incomplete idea, make an independent decision, respond to critical feedback, tolerate uncertainty, or take responsibility for a concrete task. The qualitative material suggested a meaningful discrepancy between potential ability and perceived ability to act. Low self-efficacy was reflected in hesitation before presenting ideas, excessive reliance on mentor approval, sensitivity to others' judgments, withdrawal following criticism, difficulty making independent decisions, and reduced persistence after encountering obstacles. Thus, cognitive ability and creativity were insufficient when adolescents did not believe that they could effectively use those capacities in uncertain entrepreneurial situations. The findings pointed toward the importance of creating structured opportunities for small mastery experiences, manageable independent actions, gradual exposure to feedback, and visible experiences of revising rather than abandoning imperfect ideas.

A further theme involved **low tolerance for ambiguity together with fear of failure, evaluation anxiety, and maladaptive perfectionism**. Some adolescents functioned effectively when tasks, success criteria, and expected answers were clearly specified, yet experienced uncertainty when confronted with open-ended problems containing several possible solutions and no guaranteed outcome. They sought precise instructions, definitive judgments regarding whether an idea was correct or incorrect, and reassurance concerning what would happen if the proposed solution failed. This need for certainty was particularly consequential because entrepreneurial activity necessarily involves incomplete information, experimentation, modification, and decisions without guaranteed outcomes. At the same time, some gifted and creative adolescents were reluctant to expose incomplete work to external evaluation. Presenting an unfinished idea, receiving critical feedback, or producing a prototype that might not work could be interpreted as a threat to a positive self-image associated with achievement and competence. The combination of intolerance of ambiguity and perfectionistic concern could therefore produce avoidance precisely at the stage where experimentation was required. The findings consequently

supported cognitive empowerment activities that normalize incompleteness, encourage controlled experimentation, distinguish the failure of an attempt from failure of the person, and treat feedback as information for revision rather than as a judgment of personal worth.

The qualitative findings also revealed **difficulty in executive functioning and in transforming creativity into organized action**. Some adolescents demonstrated substantial strength in generating ideas, discussing possibilities, and understanding problems, but encountered difficulty when they had to specify a first step, divide a broad objective into smaller tasks, establish responsibilities, determine deadlines, monitor progress, or alter their strategy in response to feedback. This pattern suggested an important distinction between creative idea generation and entrepreneurial execution. Entrepreneurial behavior required adolescents to maintain a goal, organize multiple tasks, regulate attention and behavior, monitor implementation, and flexibly revise their plans. Problems became especially visible when teams were required to answer concrete questions such as what should be done first, who should perform each activity, when the activity should be completed, and what should change following new information. Therefore, the intervention needed to convert broad aspirations into short and executable actions and provide cognitive scaffolding for planning, monitoring, prioritizing, and adjusting behavior. This finding became a central basis for including explicit goal decomposition and action planning within the empowerment package.

A related pattern was **dependence on external structure and insufficient proactive agency**. The previous entrepreneurship experiences provided schedules, mentor presence, group meetings, assignments, and presentation expectations that effectively stimulated initial activity. However, the qualitative data suggested that some adolescents struggled to maintain comparable levels of action when these external structures were reduced. Rather than independently determining the next step, seeking information, requesting feedback, or initiating contact with team members, they waited for another person to define what should happen next. This pattern was intertwined with motivation and psychological ownership: when an idea was experienced primarily as part of the educational program, completion of the program could also mark the end of engagement with the idea. The findings therefore emphasized proactive behavior, initiative, and personal agency as essential components of entrepreneurial readiness. The intended cognitive empowerment process needed

gradually to shift responsibility from mentor-directed action toward student-directed decision making, while still maintaining sufficient scaffolding to prevent uncertainty from becoming overwhelming.

Teamwork, communication, and conflict management constituted another major domain of the qualitative findings. The continuation of an entrepreneurial idea was often affected not only by the quality of the idea itself but also by the functioning of the team developing it. The field experiences identified unstable teams, ambiguous roles, unequal participation, domination by more assertive members, withdrawal of less assertive members, disagreements regarding the direction of the idea, difficulty hearing criticism, and difficulty transforming disagreement into constructive decisions. These observations indicated that social competence in entrepreneurship extends beyond general sociability or confidence in speaking. Adolescents needed to explain their ideas clearly, listen to alternative perspectives, receive and use feedback, negotiate responsibilities, request assistance when needed, manage disagreements, and remain accountable for their assigned role. Psychological safety was particularly important because adolescents were less likely to experiment, disclose uncertainty, or present incomplete ideas when interpersonal evaluation felt threatening. Accordingly, the package needed to provide direct opportunities to establish explicit roles, undertake shared tasks, request assistance, manage disagreement, and reflect on each member's contribution to collective outcomes.

The findings further demonstrated the importance of **future orientation, mentoring style, and resilience in shaping entrepreneurial persistence**. For some adolescents, the future was predominantly represented through socially familiar and relatively secure pathways such as academic achievement, university admission, professional qualifications, and organizational employment. Entrepreneurship could therefore be admired while still being perceived as less realistic, more ambiguous, or less compatible with expected definitions of success. Family and educational expectations contributed to this orientation. At the same time, mentoring could either strengthen or weaken adolescent agency. Mentors were experienced as valuable sources of motivation, realism, feedback, and support, yet excessive dependence on mentor approval could reduce independent decision making. Empowerment mentoring therefore required the mentor to ask questions, facilitate reflection, and support adolescents in making their own decisions rather than supplying complete solutions. The

same principle applied to responses to setbacks. Some adolescents interpreted an unsuccessful presentation, ineffective prototype, disagreement, or critical feedback as information that could guide revision, whereas others interpreted small failures as evidence that the entire idea—or their entrepreneurial suitability—was invalid. Entrepreneurial resilience consequently emerged as the capacity to recover, extract information from failure, modify the course of action, and return to purposeful activity.

The final integrative finding was the **need for profile-based personalization and reflective use of artificial intelligence**. The qualitative analysis indicated that adolescents could display superficially similar disengagement while the mechanisms underlying it were substantially different. One adolescent might discontinue an idea because of fear of failure, another because of weak planning, another because of low self-efficacy, another because of dysfunctional teamwork, and another because the idea had never acquired sufficient personal meaning. A uniform educational intervention would therefore fail to address the principal barrier for every adolescent. The

resulting conceptual model organized entrepreneurial readiness into thirteen interconnected dimensions: entrepreneurial intention and identity; entrepreneurial self-efficacy and perceived control; opportunity recognition, problem identification, and sensitivity to value creation; executive functions and conversion of ideas into action; tolerance of ambiguity and decision making under uncertainty; applied creativity; fear of failure, perfectionism, and growth mindset; intrinsic motivation, ownership, and meaning; social skills, teamwork, and psychological safety; proactivity, agency, and initiative; resilience and learning from failure; future orientation; and digital readiness for using artificial intelligence as a developmental tool. Artificial intelligence was consequently conceptualized as a supportive mechanism for questioning, reflection, option generation, feedback, and cognitive scaffolding rather than as an authority that determines the adolescent's decisions. This synthesis formed the conceptual basis for the final AI-based cognitive empowerment package presented in Table 1.

Table 1

Final Structure of the Artificial Intelligence–Based Cognitive Empowerment Package for Entrepreneurial Skills

Session	Session Focus	Core Content and Activities	Role of Artificial Intelligence
Session 1	Understanding the Profile and Setting Goals	Reviewing the adolescent's entrepreneurial profile in simple and developmentally appropriate language; identifying one personal strength and two developmental goals; clarifying the role and limitations of ChatGPT; determining one small and immediately achievable first action	Supporting reflection on strengths and developmental needs, asking clarifying questions, and helping the adolescent formulate a small next step without making decisions on the adolescent's behalf
Session 2	Problem Identification and Value Creation	Selecting a problem closely connected to the adolescent's own experience; distinguishing the problem from its possible solutions; identifying the people affected by or involved in the problem; examining the potential value that could be created through addressing it	Generating short supplementary questions that help the adolescent clarify the problem, examine it from different perspectives, and identify missing information
Session 3	Converting an Idea into an Action Plan	Selecting one proposed solution; dividing the overall objective into three to five manageable steps; identifying the person responsible for each action, the required time, and possible obstacles; completing a simplified three-stage action form	Assisting with goal decomposition, identifying possible implementation barriers, and prompting the adolescent to refine the sequence of actions while preserving personal responsibility for the final plan
Session 4	Presenting an Initial Version and Using Feedback	Presenting a simple and deliberately incomplete version of the idea; obtaining specific feedback; distinguishing criticism of the idea from judgment of the individual; selecting and implementing one concrete modification	Acting as a guided feedback or critical-questioning partner, helping the adolescent examine weaknesses or alternative interpretations without generating a complete replacement solution
Session 5	Teamwork and Agency	Establishing clear roles for team members; completing a shared activity; practicing help-seeking and constructive conflict management; examining the contribution and responsibility of each member in relation to the team outcome	Providing prompts for role clarification, perspective taking, communication, and examination of possible approaches to disagreement while leaving interpersonal decisions to the participants
Session 6	Final Presentation and Continuation Plan	Presenting the revised version of the idea; reviewing changes made throughout the process; identifying the immediate next step; developing a four-week continuation plan for maintaining activity beyond the structured sessions	Facilitating reflection on progress, asking questions about the feasibility of subsequent steps, and helping organize the continuation plan without replacing the adolescent's judgment or decision making

The final structure was organized as a six-session developmental sequence that moved from self-understanding toward increasingly independent entrepreneurial action. The first session established a profile-based starting point by helping each adolescent identify existing strengths and a limited number of developmental priorities. This individualized starting point directly reflected the qualitative finding that apparently similar entrepreneurial difficulties could arise from different underlying mechanisms. Rather than exposing every participant to an identical remedial emphasis, the package allowed common session objectives to be interpreted through the adolescent's specific psychological and cognitive profile. The session also introduced the principle that artificial intelligence should function as a support for thinking rather than a substitute for thinking, thereby establishing personal agency from the beginning of the intervention.

The second and third sessions addressed the cognitive transition from recognizing meaningful problems to organizing executable action. Problem identification was deliberately anchored in adolescents' own experiences to increase psychological ownership and intrinsic relevance. Separating the problem from the solution discouraged premature commitment to the first idea and encouraged deeper exploration of users, stakeholders, and value. The subsequent action-planning session targeted the gap identified between creative ideation and implementation by requiring participants to reduce a broad entrepreneurial objective to three to five concrete steps and specify responsibility, timing, and anticipated obstacles. In this phase, AI support was designed to provide questions, alternatives, and cognitive scaffolding while requiring the adolescent to select and justify the final course of action.

The fourth and fifth sessions directly addressed two of the most consequential qualitative barriers: sensitivity to failure and difficulties in collaborative action. Presenting a deliberately simple and incomplete version of an idea created an opportunity to experience imperfection as a normal stage of development rather than as evidence of personal inadequacy. Feedback was converted into a specific revision task so that criticism could lead to action rather than withdrawal. Teamwork activities then shifted attention toward explicit role definition, shared responsibility, help-seeking, and constructive management of disagreement. These elements responded to the observed problems of ambiguous responsibilities, unequal participation, dependency, and avoidance of interpersonal conflict and

were intended to strengthen both social competence and personal agency within collaborative entrepreneurial activity.

The sixth session integrated the preceding processes through a revised presentation, reflection on changes, identification of the next action, and development of a four-week continuation plan. This continuation component was particularly important because the qualitative findings demonstrated that entrepreneurial engagement often weakened after external workshop structures disappeared. The final session therefore sought to transfer responsibility progressively from the structured program to the adolescent by making the next stage explicit and manageable. Across all sessions, the revised structure allocated the largest portion of session time to experiential activity rather than theoretical explanation. Each session consisted of approximately 10 minutes for reviewing previous work, 10 minutes for introducing the focal skill, 35 minutes for practical activity, 10 minutes for guided use of ChatGPT, and 10 minutes for feedback and specification of the subsequent action.

Across the package, ChatGPT was positioned as a cognitive support and reflective dialogue tool rather than an autonomous instructor or decision maker. Its function was to ask concise clarifying questions, help break broad goals into manageable actions, expose weaknesses in an idea, generate or compare alternatives, simulate a potential audience or critic, and support reflection on experience. The system was not intended to provide a complete entrepreneurial plan or make definitive judgments regarding the adolescent's personality, capabilities, or future. The underlying design principle was that adolescents should first articulate their own interpretation or proposed solution, after which AI could extend their reasoning through limited questioning and feedback. In this way, the final package integrated artificial intelligence with human mentoring while preserving the adolescent's autonomy, critical evaluation, decision-making responsibility, and entrepreneurial agency.

4. Discussion and Conclusion

The present qualitative from creativity and initial entrepreneurial interest to sustained entrepreneurial action is shaped by a multidimensional configuration of cognitive, motivational, emotional, interpersonal, and contextual factors. The qualitative analysis identified difficulties related to entrepreneurial intention and identity, entrepreneurial self-efficacy, opportunity and problem recognition,

executive functioning and translation of ideas into action, tolerance of ambiguity, applied creativity, fear of failure and perfectionism, intrinsic motivation and psychological ownership, teamwork and psychological safety, proactive agency, resilience and learning from failure, future occupational orientation, and readiness to use artificial intelligence reflectively. These dimensions were not independent barriers but interacted with one another. For example, low self-efficacy could intensify avoidance under uncertainty, perfectionistic tendencies could increase fear of presenting incomplete ideas, weak executive functioning could prevent a motivated adolescent from implementing a promising idea, and dependence on external guidance could undermine entrepreneurial agency. The qualitative synthesis therefore supported the development of a profile-oriented rather than uniform intervention and ultimately informed a six-session package progressing from profile awareness and goal setting to problem identification, action planning, feedback utilization, teamwork and agency, and preparation for independent continuation.

One of the most important findings was that initial enthusiasm for entrepreneurship did not necessarily represent internalized entrepreneurial intention or identity. Adolescents could enjoy innovation workshops, interact positively with mentors, participate in ideation activities, and produce creative suggestions without regarding entrepreneurship as a realistic component of their own future. This distinction is particularly important during adolescence because occupational aspirations and personal identity are still being constructed and are increasingly influenced by educational, social, technological, and cultural environments. Sirin et al. emphasized the need to understand adolescent identity within the changing conditions of the digital age, where young people negotiate possible selves across both traditional and emerging environments (Sirin et al., 2024). The current findings extend this perspective to entrepreneurial development by suggesting that entrepreneurship education must create opportunities for adolescents to see themselves as active problem solvers and value creators rather than merely participants in temporary entrepreneurship activities. The prior qualitative investigation forming the conceptual foundation of the present package similarly identified weak entrepreneurial intention, lack of psychological ownership, and the dominance of secure employment-oriented future images as factors contributing to discontinuation after entrepreneurship workshops (Javidnia, 2026). Thus, strengthening entrepreneurial identity appears to require

connecting entrepreneurial action with adolescents' own values, interests, lived problems, and perceptions of future possibility.

The finding concerning low entrepreneurial self-efficacy despite high cognitive or creative potential was also central. Gifted adolescents frequently demonstrated competence in discussion and ideation but became more hesitant when entrepreneurial tasks required actual exposure to evaluation, independent decision making, implementation, or revision following criticism. This suggests that having the capacity to think creatively differs from believing that one can successfully act on creative ideas. The relevance of self-efficacy is also evident in research on human–AI creative collaboration. McGuire et al. demonstrated that self-efficacy and co-creation are important elements in effective creative collaboration with artificial intelligence, indicating that individuals benefit more when they perceive themselves as meaningful contributors to the creative process rather than passive recipients of AI-generated output (McGuire et al., 2024). This finding supports the decision in the present package to require adolescents to generate their own initial interpretations and solutions before consulting AI. Human–AI interaction should therefore reinforce the adolescent's sense of agency and competence instead of transferring cognitive responsibility to the system. The wider literature on human–AI collaboration also indicates that combining human and artificial intelligence does not automatically improve outcomes; effectiveness depends on the way their roles and complementary capabilities are structured (Vaccaro et al., 2024). Consequently, the intervention was designed to position AI as a scaffold for adolescent reasoning rather than a substitute for it.

Another major result concerned intolerance of ambiguity, fear of failure, and perfectionistic concerns. Some gifted and creative adolescents were comfortable when problems had clear requirements and recognizable success criteria but experienced considerably greater difficulty in open-ended situations characterized by uncertainty and multiple possible solutions. Entrepreneurship, however, inherently involves experimentation, incomplete information, and the possibility that an initial idea will not work. This challenge became more pronounced when adolescents were reluctant to reveal imperfect ideas because of concerns about evaluation or failure. The systematic review by Jiménez Morales and Checa Fernández showed that perfectionism in gifted students is complex and cannot simply be treated as a defining characteristic of giftedness; its forms and consequences vary considerably (Jiménez Morales & Checa

Fernández, 2024). In the present study, the practically important dimension was not high standards themselves, but the possibility that concern about errors could inhibit experimentation. This interpretation is also compatible with evidence regarding youth growth-mindset interventions, which highlights the developmental importance of beliefs about change, learning, and improvement (Jiang et al., 2024). Consequently, the package incorporated deliberate exposure to incomplete work and feedback, especially through the session requiring adolescents to present an initial imperfect version of their idea. The intended cognitive shift was from interpreting failure as a threat to competence toward interpreting feedback and unsuccessful attempts as information that can guide revision.

The qualitative findings further demonstrated a gap between creative ideation and executive implementation. Several adolescents appeared capable of generating original possibilities yet had difficulty converting broad ideas into sequential, manageable actions. Problems were evident in identifying the first step, distributing responsibilities, establishing time frames, anticipating obstacles, monitoring progress, and determining how feedback should change the plan. This distinction is crucial because entrepreneurship requires more than divergent thinking. Indeed, emerging research on generative AI illustrates why creativity alone should not be treated as equivalent to effective entrepreneurial cognition. Doshi and Hauser found that generative AI can increase individual creativity while simultaneously reducing the diversity of novel content across users (Doshi & Hauser, 2024). Lee and Chung likewise documented an impact of ChatGPT on creativity (Lee & Chung, 2024), whereas Meincke et al. reported reduced diversity during AI-assisted brainstorming (Meincke et al., 2025). Together, these studies demonstrate that AI can facilitate idea production but may also create convergence or cognitive dependence if learners accept generated content too readily. For the present package, AI was therefore integrated not primarily as an idea generator but as a tool for asking questions, comparing possibilities, identifying weaknesses, and breaking selected goals into feasible steps. This design preserves the adolescent's original contribution while supporting the executive processes required to turn creativity into entrepreneurial action.

The identified dependence on external structures and mentor direction provided further justification for emphasizing agency within the intervention. The qualitative findings showed that adolescents could perform adequately while schedules, mentor instructions, team meetings, and

presentation deadlines remained in place but had difficulty continuing independently when these supports were withdrawn. This phenomenon is especially relevant to the use of artificial intelligence because an inadequately designed AI assistant could reproduce the same dependency in digital form. Rather than waiting for a mentor to provide an answer, an adolescent might begin waiting for ChatGPT to provide one. Research on human-in-the-loop approaches in artificial intelligence in education emphasizes the importance of retaining meaningful human participation and oversight within AI-supported systems (Memarian & Doleck, 2024). Similarly, research on human-AI co-learning demonstrates that interaction with AI involves an evolving process in which both task performance and human learning depend on how collaboration is structured (Lu et al., 2025). Therefore, the package deliberately assigned AI a questioning and supportive role. The adolescent remained responsible for the decision, while the mentor remained responsible for contextual guidance and developmental oversight. This structure was intended to strengthen initiative rather than replace it with technologically mediated compliance.

A further qualitative theme was difficulty with teamwork, communication, role clarity, help-seeking, and conflict management. Entrepreneurial action typically takes place through interaction with others, and a creative idea may fail to progress when interpersonal processes are dysfunctional. The present findings indicated that team instability, ambiguous roles, unequal participation, domination by more assertive members, withdrawal of quieter members, and difficulty using disagreement constructively could interrupt the entrepreneurial process independently of the quality of the underlying idea. This observation supports the inclusion of an explicit teamwork and agency session rather than assuming that gifted adolescents will naturally acquire collaborative competence through group participation alone. Evidence from social-emotional learning research indicates that carefully structured programs can strengthen relevant social, emotional, and behavioral competencies, particularly when effective components are intentionally incorporated into intervention design (Shi & Cheung, 2024). Innovative approaches to the direct assessment of social and emotional skills also emphasize the value of evaluating competencies through behavior and performance rather than relying solely on generalized self-report (Linzarini & Catarino da Silva, 2024). Accordingly, the proposed package incorporated observable team activities involving explicit role

assignment, shared tasks, help-seeking, conflict resolution, and reflection on each individual's contribution.

The finding that different adolescents require different developmental emphases provides perhaps the strongest rationale for the profile-based structure of the intervention. The qualitative data indicated that the same behavioral outcome—for example, failure to continue an idea—could emerge from substantially different mechanisms. One adolescent could withdraw because of perfectionism, another because of weak planning, another because of inadequate teamwork, and another because entrepreneurship had little personal meaning. Personalized intervention literature strongly supports distinguishing between shared program architecture and individualized intervention emphasis. Li et al. demonstrated growing evidence concerning personalized psychological interventions for adolescents and highlighted the potential value of tailoring intervention processes to individual characteristics (Li et al., 2024). Similarly, just-in-time adaptive intervention research illustrates how support can be responsive to changing states, contexts, and individual needs (Hsu et al., 2024). Guan et al. further emphasized participatory and co-designed approaches to adaptive recommendations among adolescents and young adults, reinforcing the importance of involving young people in decisions concerning personalized support (Guan et al., 2026). These findings support the structure developed in the present study, in which all participants can move through common developmental stages while specific goals, prompts, examples, and exercises are adjusted according to their entrepreneurial profile.

Artificial intelligence provides considerable potential for operationalizing such personalization. Systematic reviews of AI-based personalized learning demonstrate that educational systems can adapt content, activities, feedback, and progression according to learner characteristics and performance (Farhood et al., 2025). Adaptive education research similarly suggests that AI technologies can support individualized educational pathways and differentiated learning experiences (Hariyanto et al., 2025). Voulgari et al. further highlighted the potential relationship between AI-supported personalized learning, adaptive assessment, and cognitive processes (Voulgari et al., 2024). These developments are directly relevant to the present intervention because entrepreneurial barriers may not only differ between adolescents but may also change within the same adolescent across the intervention. A learner who initially needs support in problem definition may later

require help with feedback tolerance or team conflict. The use of AI can potentially facilitate this responsiveness by modifying questions, presenting alternative perspectives, adjusting task complexity, and supporting reflection on progress. However, personalization in this study was conceptualized as developmental scaffolding rather than automated prescription.

This cautious approach is justified by the broader literature on AI with children and adolescents. Mutluer et al. identified expanding applications of artificial intelligence across interventions ranging from psychotherapy to developmental support but also emphasized the need for appropriate implementation with younger populations (Mutluer et al., 2026). Sharma et al. similarly documented growing use of AI in adolescent mental health care alongside important concerns regarding evidence, implementation, ethics, and future development (Sharma et al., 2025). Guo et al.'s review of large language models in mental health contexts likewise illustrates both the substantial capabilities of these systems and the need for careful evaluation of reliability and role boundaries (Guo et al., 2024). Although the intervention developed in the present study is educational and developmental rather than clinical, these considerations remain applicable because adolescents represent a population for whom privacy, interpretive caution, autonomy, and adult oversight are particularly important. Accordingly, AI within the package was not designed to diagnose entrepreneurial potential, determine personality, label adolescents, or prescribe occupational futures.

The findings also highlight the importance of valid assessment as the foundation of personalization. Moving toward profile-based intervention requires credible information about adolescents' strengths and needs rather than relying on a general impression that a learner is creative, motivated, or gifted. Technology-mediated approaches may provide valuable supplementary information, but technological sophistication does not itself establish validity. Fogel et al. discussed both possibilities and conceptual challenges involved in transforming functional cognitive assessments for children and adolescents into digital platforms (Fogel et al., 2025). Oddleifson et al. similarly emphasized the importance of validity evidence for technology-mediated youth assessments (Oddleifson et al., 2025), while Kaldaras et al. highlighted the changing assessment challenges created by generative AI and the need to preserve valid interpretation in AI-rich educational environments (Kaldaras et al., 2024). Large language models may eventually contribute additional

forms of targeted psychological assessment (Kjell et al., 2024), and recent evidence documents the growing use of AI-powered approaches in adolescent psychological assessment (Liu et al., 2026). Nevertheless, these developments support rather than contradict the present study's decision to use AI-supported profile interpretation only under human review. A developmental profile should guide conversation and intervention priorities rather than function as a deterministic classification.

The final six-session structure reflected the integration of these qualitative findings. The first session focused on understanding the adolescent's profile and setting individualized developmental goals, thereby translating personalization into an explicit starting point. The second session focused on identifying meaningful problems and value creation, strengthening the transition from externally supplied exercises toward personally meaningful entrepreneurial problems. The third addressed the executive gap between idea and implementation by converting a selected solution into manageable steps. The fourth deliberately normalized incomplete work and feedback, targeting perfectionism, fear of evaluation, and learning from error. The fifth focused on teamwork, communication, agency, and responsibility. The final session required adolescents to integrate revisions, identify the next independent action, and establish a continuation plan so that entrepreneurial activity would not terminate simply because formal sessions had ended. This structure is consistent with emerging reviews of AI in entrepreneurship education, which identify opportunities for generative AI to support creativity, entrepreneurial learning, feedback, problem exploration, and knowledge construction (Park et al., 2025; Yu et al., 2025). Conversational agents and prompt engineering have similarly been proposed as mechanisms for supporting the transition from entrepreneurial ideas toward more developed venture-related knowledge and reasoning (Thanasi-Boçe & Hoxha, 2024).

At the same time, the present findings reinforce the need to avoid equating frequent AI use with deeper entrepreneurial learning. Generative AI has substantial potential to support education, but its learning effects depend on instructional context and on whether learners remain cognitively engaged (Yan et al., 2024). The wider empirical literature on generative AI in education likewise indicates rapidly expanding applications while revealing the need for more carefully designed educational integration (Zhang et al., 2024). The central contribution of the present package is therefore its attempt to embed AI within a psychological and

developmental model rather than simply adding ChatGPT to an entrepreneurship curriculum. AI is used to extend questioning, reveal alternatives, support planning, simulate constructive critique, and facilitate reflection, but each activity is structured so that the adolescent's own cognition precedes and governs the interaction. Such a model is compatible with the emerging understanding that the greatest value of AI may lie not in replacing human thought but in creating appropriately structured conditions for human-AI collaboration, personalization, and co-learning (Lu et al., 2025; Vaccaro et al., 2024). Overall, the findings suggest that entrepreneurial empowerment among gifted and creative adolescents requires an integrated approach in which creativity is connected to execution, self-efficacy to action, ambiguity to experimentation, failure to learning, teamwork to psychological safety, personalization to developmental profiling, and artificial intelligence to supported rather than displaced human agency.

Several limitations should be considered when interpreting the present findings. First, the study was qualitative and developmental in nature; therefore, its purpose was to identify relevant dimensions and construct an intervention framework rather than establish causal effects or determine the magnitude of change attributable to the package. The qualitative findings were also shaped by the experiences represented in the examined educational, cultural, organizational, and mentoring environments from which the data were derived. In addition, entrepreneurial readiness is a dynamic phenomenon, and the proposed profile may not capture every cognitive, emotional, interpersonal, family, or contextual factor that influences entrepreneurial development. The rapid evolution of generative AI is another limitation, because specific technological affordances, risks, and user practices may change considerably over relatively short periods. Finally, the package necessarily simplifies a complex developmental process into a structured sequence of sessions, and individual adolescents may require different amounts of time or additional support for particular competencies.

Future studies should examine the qualitative structure identified in this research with more diverse groups of gifted and creative adolescents across different educational, socioeconomic, cultural, and geographic contexts. Further qualitative research could explore how adolescents themselves experience each component of the package, which AI-supported activities they perceive as most useful, and when AI assistance begins to feel overly directive or dependency-producing. Research should also investigate

whether different entrepreneurial profiles can be meaningfully distinguished and whether particular profile configurations require different sequences, intensities, or combinations of intervention components. Longitudinal studies would be particularly valuable for determining how entrepreneurial identity, agency, self-efficacy, teamwork, resilience, and independent continuation develop after formal intervention ends. Future package development should additionally examine alternative AI tools, different prompting architectures, age-appropriate safeguards, methods for documenting human–AI interaction, and culturally sensitive approaches to personalization. Subsequent research may also refine the intervention through repeated cycles of implementation, qualitative feedback, expert review, and revision before wider application.

In practice, schools, gifted education centers, innovation laboratories, and adolescent entrepreneurship programs should avoid assuming that creativity or high cognitive ability automatically indicates readiness for entrepreneurial action. Before intervention, educators and mentors should attempt to understand each adolescent's pattern of strengths and developmental needs, including self-efficacy, planning, ambiguity tolerance, response to failure, motivation, teamwork, initiative, and future orientation. Entrepreneurship activities should be organized around meaningful real-world problems and should require adolescents to take progressively greater responsibility for decisions and actions. Mentors should use questions and guided reflection instead of immediately solving difficulties for participants. AI should be introduced with explicit rules emphasizing that adolescents must think first, critically evaluate generated responses, and retain responsibility for all important decisions. Exercises should remain sufficiently short and actionable to coexist with academic demands, while team tasks should clearly specify responsibilities and expected outcomes. Programs should also include deliberate experiences of incomplete performance, constructive feedback, revision, and small failure so that adolescents learn to regard entrepreneurial progress as an iterative process rather than a requirement to produce a perfect solution at the first attempt.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

References

- Doshi, A. R., & Hauser, O. P. (2024). Generative Artificial Intelligence Enhances Creativity but Reduces the Diversity of Novel Content. *Science advances*, 10(28), eadn5290. <https://doi.org/10.1126/sciadv.adn5290>
- Farhood, H., Nyden, M., Beheshti, A., & Muller, S. (2025). Artificial Intelligence-Based Personalised Learning in Education: A Systematic Literature Review. *Discover Artificial Intelligence*, 5, 331. <https://doi.org/10.1007/s44163-025-00598-x>
- Fogel, Y., Josman, N., Cohen Elimelech, O., & Zlotnik, S. (2025). Can Functional Cognitive Assessments for Children/Adolescents Be Transformed into Digital Platforms? A Conceptual Review. *Children*, 12(10), 1384. <https://doi.org/10.3390/children12101384>
- Guan, K. W., Amara, M., Cortiana, V., Khan, I., Gürbüz, S., Iorio, C., Ali, R., Adlung, C., Smit, C. R., Vreeker, A., Thalassinou, E., van Roekel, E., Keijsers, L., de Reuver, M., & Figueroa, C. A. (2026). Toward Participatory Precision Health with Co-Designed Recommendations: Systematic Review of Just-in-Time Adaptive Interventions in Adolescents and Young Adults. *Journal of medical Internet research*, 28, e84422. <https://doi.org/10.2196/84422>
- Guo, Z., Lai, A., Thygesen, J. H., Farrington, J., Keen, T., & Li, K. (2024). Large Language Models for Mental Health Applications: Systematic Review. *Jmir Mental Health*, 11, e57400. <https://doi.org/10.2196/57400>

- Hariyanto, Kristianingsih, F. X. D., & Maharani, R. (2025). Artificial Intelligence in Adaptive Education: A Systematic Review of Techniques for Personalized Learning. *Discover Education*, 4, 458. <https://doi.org/10.1007/s44217-025-00908-6>
- Hsu, T. C. C., Whelan, P., Gandrup, J., Armitage, C. J., Cordingley, L., & McBeth, J. (2024). Personalized Interventions for Behaviour Change: A Scoping Review of Just-in-Time Adaptive Interventions. *British Journal of Health Psychology*, 30(1), e12766. <https://doi.org/10.1111/bjhp.12766>
- Javidnia, S. (2026). *Psychological Pathology of Student Entrepreneurship Workshops and Development of an Initial Model of the Psychological Profile of Entrepreneurship*.
- Jiang, X., Mueller, C. E., & Paley, N. (2024). A Systematic Review of Growth Mindset Interventions Targeting Youth Social-Emotional Outcomes. *School Psychology Review*, 53(3), 251-272. <https://doi.org/10.1080/2372966X.2022.2151321>
- Jiménez Morales, M. I., & Checa Fernández, P. (2024). Is Perfectionism an Exclusive Characteristic of Gifted Students? A Systematic Review. *Liberabit*, 30(1), e806. <https://doi.org/10.24265/liberabit.2024.v30n1.806>
- Kaldaras, L., Akaeze, H. O., & Reckase, M. D. (2024). Developing Valid Assessments in the Era of Generative Artificial Intelligence. *Frontiers in Education*, 9, 1399377. <https://doi.org/10.3389/educ.2024.1399377>
- Kjell, O. N. E., Kjell, K., & Schwartz, H. A. (2024). Beyond Rating Scales: With Targeted Evaluation, Large Language Models Are Poised for Psychological Assessment. *Psychiatry research*, 333, 115667. <https://doi.org/10.1016/j.psychres.2023.115667>
- Lee, B. C., & Chung, J. J. (2024). An Empirical Investigation of the Impact of ChatGPT on Creativity. *Nature Human Behaviour*, 8, 1906-1914. <https://doi.org/10.1038/s41562-024-01953-1>
- Li, W., Gleeson, J., Fraser, M. I., Ciarrochi, J., Hofmann, S. G., Hayes, S. C., & Sahdra, B. (2024). The Efficacy of Personalized Psychological Interventions in Adolescents: A Scoping Review and Meta-Analysis. *Frontiers in psychology*, 15, 1470817. <https://doi.org/10.3389/fpsyg.2024.1470817>
- Linzarini, A., & Catarino da Silva, D. (2024). *Innovative Tools for the Direct Assessment of Social and Emotional Skills*. <https://doi.org/10.1787/ced9bb04-en>
- Liu, J., Ding, X., & Gan, Y. (2026). AI-Powered Methods for Psychological Assessment in Adolescence Psychological Disorders: A Systematic Review and Meta-Analysis. *Clinical psychology review*, 126, 102728. <https://doi.org/10.1016/j.cpr.2026.102728>
- Lu, J., Yan, Y., Huang, K., Yin, M., & Zhang, F. (2025). Do We Learn from Each Other: Understanding the Human-AI Co-Learning Process Embedded in Human-AI Collaboration. *Group Decision and Negotiation*, 34, 235-271. <https://doi.org/10.1007/s10726-024-09912-x>
- McGuire, J., De Cremer, D., & Van de Cruys, T. (2024). Establishing the Importance of Co-Creation and Self-Efficacy in Creative Collaboration with Artificial Intelligence. *Scientific reports*, 14, 18525. <https://doi.org/10.1038/s41598-024-69423-2>
- Meincke, L., Nave, G., & Terwiesch, C. (2025). ChatGPT Decreases Idea Diversity in Brainstorming. *Nature Human Behaviour*, 9, 1107-1109. <https://doi.org/10.1038/s41562-025-02173-x>
- Memarian, B., & Doleck, T. (2024). Human-in-the-Loop in Artificial Intelligence in Education: A Review and Entity-Relationship Analysis. *Computers in Human Behavior: Artificial Humans*, 2, 100053. <https://doi.org/10.1016/j.chbah.2024.100053>
- Mutluer, T., Gurel Ficicioglu, I. E., & Uysal, M. (2026). A Systematic Review of Artificial Intelligence in Child and Adolescent Interventions: From Psychotherapy to Developmental Support. *European Child & Adolescent Psychiatry*, 35, 669-689. <https://doi.org/10.1007/s00787-025-02867-7>
- Oddleifson, C., Vengurlekar, I. N., Hendrix, C., Levis, T., Anderson, E., Eklund, K., & Kilgus, S. (2025). A Scoping Review of Validity Evidence for Technology-Mediated Assessments of Youth Mental Health. *School Mental Health*, 17, 316-335. <https://doi.org/10.1007/s12310-025-09760-3>
- Park, J. H., Kim, S. J., & Lee, S. T. (2025). AI and Creativity in Entrepreneurship Education: A Systematic Review of LLM Applications. *Ai*, 6(5), 100. <https://doi.org/10.3390/ai6050100>
- Sharma, G., Yaffe, M. J., Ghadiri, P., Gandhi, R., Pinkham, L., Gore, G., & Abbasgholizadeh-Rahimi, S. (2025). Use of Artificial Intelligence in Adolescents' Mental Health Care: Systematic Scoping Review of Current Applications and Future Directions. *Jmir Mental Health*, 12, e70438. <https://doi.org/10.2196/70438>
- Shi, J., & Cheung, A. C. K. (2024). Effective Components of Social Emotional Learning Programs: A Meta-Analysis. *Journal of youth and adolescence*, 53(4), 755-771. <https://doi.org/10.1007/s10964-024-01942-7>
- Sirin, S. R., Brauer, S. Z., & Tugberk, R. C. (2024). Reframing Adolescent Identity: A Global Perspective for the Digital Age. *Annual Review of Developmental Psychology*, 6, 301-322. <https://doi.org/10.1146/annurev-devpsych-010923-101059>
- Thanasi-Boçe, M., & Hoxha, J. (2024). From Ideas to Ventures: Building Entrepreneurship Knowledge with LLM, Prompt Engineering, and Conversational Agents. *Education and Information Technologies*, 29, 24309-24365. <https://doi.org/10.1007/s10639-024-12775-z>
- Vaccaro, M., Almaatouq, A., & Malone, T. W. (2024). When Combinations of Humans and AI Are Useful: A Systematic Review and Meta-Analysis. *Nature Human Behaviour*, 8, 2293-2303. <https://doi.org/10.1038/s41562-024-02024-1>
- Voulgari, I., Komis, V., & Sampson, D. G. (2024). Leveraging AI in E-Learning: Personalized Learning and Adaptive Assessment Through Cognitive Neuropsychology—A Systematic Analysis. *Electronics*, 13(18), 3762.
- Yan, L., Greiff, S., Teuber, Z., & Gašević, D. (2024). Promises and Challenges of Generative Artificial Intelligence for Human Learning. *Nature Human Behaviour*, 8, 1839-1850. <https://doi.org/10.1038/s41562-024-02004-5>
- Yu, G., Ramayah, T., & Lin, Z. (2025). Toward Understanding the Role of Generative AI in Entrepreneurship Education: A Systematic Review. *Computers and Education: Artificial Intelligence*, 9, 100470. <https://doi.org/10.1016/j.caeai.2025.100470>
- Zhang, X., Zhang, P., & Shen, Y. (2024). A Systematic Literature Review of Empirical Research on Applying Generative Artificial Intelligence in Education. *Frontiers of Digital Education*, 1, 223-245. <https://doi.org/10.1007/s44366-024-0028-5>