

The Right to Think in the Age of Artificial Intelligence: A Psycho-Educational Approach to Enhancing Cognitive Autonomy Among University Students

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Abstract

This study aims to measure the effectiveness of a proposed psycho-educational intervention program in enhancing cognitive autonomy and independent thinking among students of Amar Telidji University in Laghouat, in light of the rapid spread of generative artificial intelligence tools that have become threatening the ability to think critically and independently. The study adopted the quasi-experimental approach with a design of two experimental and active control groups with pre and post measurement, and the study sample consisted of (100) male and female students from the second and third year license distributed across different faculties of the university, divided into two equal groups (50 students in each group), where the experimental group received an intervention program consisting of seven weekly sessions while the active control group received general lectures on university study skills to ensure control of the Hawthorne effect. The study used three tools: the Cognitive Autonomy Scale, the Higher-Order Thinking Tasks Test, and the Attitudes toward Artificial Intelligence Questionnaire. The results of the Analysis of Covariance (ANCOVA) showed statistically significant differences at the level of (0.01) between the post-performance means of the two groups in favor of the experimental group, with a large effect size ($\eta^2 = 0.47$), indicating the effectiveness of the intervention program in enhancing cognitive autonomy and higher-order thinking skills among students. The study recommended the necessity of integrating psycho-educational programs into university curricula to protect the right to independent thinking and develop critical competencies in the age of artificial intelligence.

Keywords: Cognitive Autonomy, Generative Artificial Intelligence, Critical Thinking, Psycho-Educational Approach, University Students.

Résumé (Français)

Cette étude vise à mesurer l'efficacité d'un programme d'intervention psycho-éducative proposé pour renforcer l'autonomie cognitive et la pensée indépendante chez les étudiants de l'Université Amar Telidji de Laghouat, à la lumière de la propagation rapide des outils d'intelligence artificielle générative qui menacent désormais la capacité de penser de manière critique et indépendante. L'étude a adopté l'approche quasi-expérimentale avec une conception de deux groupes expérimental et témoin actif avec mesures pré et post-test.

L'échantillon de l'étude comprenait 100 étudiants de deuxième et troisième année de licence, répartis dans différentes facultés de l'université, divisés en deux groupes égaux (50 étudiants dans chaque groupe). Le groupe expérimental a reçu un programme d'intervention composé de sept séances hebdomadaires, tandis que le groupe témoin actif a reçu des cours généraux sur les compétences d'études universitaires pour contrôler l'effet Hawthorne. L'étude a utilisé trois outils: l'Échelle d'Autonomie Cognitive, le Test de Tâches de Pensée d'Ordre Supérieur et le Questionnaire d'Attitudes envers l'Intelligence Artificielle. Les résultats de l'Analyse de Covariance (ANCOVA) ont montré des différences statistiquement significatives au niveau de 0,01 entre les moyennes post-test des deux groupes en faveur du groupe expérimental, avec une taille d'effet importante ($\eta^2 = 0,47$), indiquant l'efficacité du programme d'intervention pour renforcer l'autonomie cognitive et les compétences de pensée d'ordre supérieur chez les étudiants. L'étude recommande la nécessité d'intégrer les programmes psycho-éducatifs dans les programmes universitaires pour protéger le droit à la pensée indépendante et développer les compétences critiques à l'ère de l'intelligence artificielle.

Mots-clés: Autonomie Cognitive, Intelligence Artificielle Générative, Pensée Critique, Approche Psycho-Éducative, Étudiants Universitaires.

Resumen (Español)

Este estudio tiene como objetivo medir la efectividad de un programa de intervención psicoeducativo propuesto para mejorar la autonomía cognitiva y el pensamiento independiente entre los estudiantes de la Universidad Amar Telidji en Laghouat, a la luz de la rápida difusión de herramientas de inteligencia artificial generativa que han comenzado a amenazar la capacidad de pensar de manera crítica e independiente. El estudio adoptó el enfoque cuasi-experimental con un diseño de dos grupos experimental y de control activo con mediciones previas y posteriores. La muestra del estudio consistió en 100 estudiantes masculinos y femeninos de segundo y tercer año de licenciatura distribuidos en diferentes facultades de la universidad, divididos en dos grupos iguales (50 estudiantes en cada grupo), donde el grupo experimental recibió un programa de intervención que constaba de siete sesiones semanales, mientras que el grupo de control activo recibió conferencias generales sobre habilidades de estudio universitario para garantizar el control del efecto Hawthorne. El estudio utilizó tres herramientas: la Escala de Autonomía Cognitiva, la Prueba de Tareas de Pensamiento de Orden Superior y el Cuestionario de Actitudes hacia la Inteligencia Artificial. Los resultados del Análisis de Covarianza (ANCOVA) mostraron diferencias estadísticamente significativas al nivel de 0,01 entre las medias posteriores de los dos grupos a favor del grupo experimental, con un tamaño del efecto grande ($\eta^2 = 0,47$), lo que indica la efectividad del programa de intervención para mejorar la autonomía cognitiva y las habilidades de pensamiento de orden superior entre los estudiantes. El estudio recomendó la necesidad de integrar programas psicoeducativos en los planes de estudio universitarios para proteger el derecho al pensamiento independiente y desarrollar competencias críticas en la era de la inteligencia artificial.

Palabras clave: Autonomía Cognitiva, Inteligencia Artificial Generativa, Pensamiento Crítico, Enfoque Psicoeducativo, Estudiantes Universitarios.

الملخص (Arabic)

تهدف هذه الدراسة إلى قياس فاعلية برنامج تدخل نفسي-تعليمي مقترح في تعزيز الاستقلالية المعرفية والتفكير المستقل لدى طلبة جامعة عمار ثلجي بالأغواط، في ظل الانتشار المتسارع لأدوات الذكاء الاصطناعي التوليدي التي أصبحت تهدد القدرة على التفكير النقدي المستقل، وقد اعتمدت الدراسة على المنهج شبه التجريبي بتصميم المجموعتين التجريبية والضابطة النشطة مع القياس القبلي والبعدي، وتكونت عينة الدراسة من (100) طالباً وطالبة من السنة الثانية والثالثة ليسانس موزعين على كليات مختلفة بالجامعة، تم تقسيمهم إلى مجموعتين متساويتين (50 طالباً في كل مجموعة)، حيث تلقت المجموعة التجريبية برنامجاً تدخلياً مكوناً من سبع جلسات أسبوعية بينما تلقت المجموعة الضابطة النشطة محاضرات عامة في مهارات الدراسة الجامعية لضمان ضبط تأثير هوثورن، واستخدمت الدراسة ثلاث أدوات وهي مقياس الاستقلالية المعرفية واختبار مهام التفكير العليا واستبيان الاتجاهات نحو الذكاء الاصطناعي، وأظهرت نتائج تحليل التباين المصاحب (ANCOVA) وجود فروق دالة إحصائية عند مستوى (0.01) بين متوسطات الأداء البعدي للمجموعتين لصالح المجموعة التجريبية، مع حجم تأثير كبير ($\eta^2 = 0.47$)، مما يدل على فاعلية البرنامج التدخل في تعزيز الاستقلالية المعرفية ومهارات التفكير العليا لدى الطلبة، وأوصت الدراسة بضرورة دمج البرامج النفسية-التعليمية في المناهج الجامعية لحماية الحق في التفكير المستقل وتطوير الكفاءات النقدية في عصر الذكاء الاصطناعي. الكلمات المفتاحية: الاستقلالية المعرفية، الذكاء الاصطناعي التوليدي، التفكير النقدي، المقاربة النفسية-التعليمية، طلبة الجامعة.

Introduction

Research Significance and Problem Identification

The current digital age is witnessing a radical transformation in the cognitive structure of learners, as generative artificial intelligence tools such as ChatGPT, Claude, and Gemini have become an integral part of the academic system, raising profound issues about the future of independent human thinking and students' right to practice their mental processes without algorithmic delegation (Izquierdo-Condoy et al., 2025, p. 3). Recent estimates indicate that more than 90% of faculty members believe that generative AI kills critical thinking among students if not used wisely (Ma'la, 2025, p. 1).

The research problem manifests in the noticeable decline in university students' ability to think critically and independently, as excessive reliance on AI tools creates a kind of "Cognitive Laziness" or what is known as "Cognitive Offloading," a psychological phenomenon that leads to gradual erosion of higher mental capabilities (Achuthan: 2025, p.2). In the Algerian context, Amar Telidji University in Laghouat faces similar challenges, as the use of these tools among students is observed to be widespread without methodological controls or sufficient critical awareness (Bin Nafila: 2022, p.45).

The right to think is not merely an academic right, but an existential right related to the learner's identity and their ability to create, innovate, and make critical decisions, as confirmed by UNESCO in its reference framework for AI competencies for students (UNESCO: 2024,

p.15). The dilemma lies in the fact that the current generation of students was born in a digital environment that makes them vulnerable to technological temptation that provides ready and quick answers, thereby weakening internal motivation for deep thinking and cognitive autonomy (Ryan & Deci, 2000, p. 72).

Study Objectives

This study seeks to achieve the following objectives:

1. Develop a proposed psycho-educational intervention program to enhance cognitive autonomy among students of Amar Telidji University in Laghouat.
2. Measure the effectiveness of the intervention program in developing higher-order thinking skills (analysis, synthesis, evaluation).
3. Identify the program's impact on modifying attitudes toward critical use of artificial intelligence.
4. Provide practical recommendations for Algerian universities to integrate these programs into academic curricula.

Research Questions

The following questions emerge from the study objectives:

- **Main Question:** What is the effectiveness of the proposed psycho-educational intervention program in enhancing cognitive autonomy among students of Amar Telidji University in Laghouat?
- **Question One:** Are there statistically significant differences between the means of the experimental group's scores in the pre and post measurements of the Cognitive Autonomy Scale?
- **Question Two:** Are there statistically significant differences between the means of the experimental and control groups' scores in the post measurement of the Cognitive Autonomy Scale after controlling for the pre-test effect?
- **Question Three:** What is the effect size of the intervention program on students' higher-order thinking skills?

Theoretical and Practical Significance

The theoretical significance of the study lies in enriching the Algerian and Arabic library with an integrated psycho-educational approach that combines Self-Determination Theory (SDT) and the cognitive developmental theory of critical thinking, and applying it to a current phenomenon, namely generative artificial intelligence (Kuhn: 1999, p.18). The practical significance is represented in providing a tested and effective intervention program that can be generalized to Algerian universities, in addition to developing standardized measurement tools suitable for the local cultural and educational context (Majīd, 2023, p. 192).

Theoretical Framework

First: Cognitive Autonomy

1.1 Concept and Definition

Cognitive autonomy is defined as "an individual's ability to generate their own ideas and opinions independently, and to critically evaluate information without succumbing to external pressures or excessive reliance on ready-made sources" (Majeed: 2023, p.195). Researchers

distinguish cognitive autonomy as a psychological construct that includes three essential components: Independence of Thought, Decisional Autonomy, and Emotional Autonomy (Ryan & Deci: 2000, p.74).

The concept of cognitive autonomy is closely related to Self-Determination Theory (SDT) developed by Ryan and Deci, which emphasizes that satisfying the three basic psychological needs - autonomy, competence, and relatedness - is a necessary condition for healthy cognitive development (Ryan & Deci, 2000, p. 71). In the context of artificial intelligence, the need for autonomy faces a real threat, as students tend to delegate mental processes to algorithms, which weakens their sense of Personal Agency (Wang et al., 2025, p. 4).

1.2 Dimensions of Cognitive Autonomy

Researchers have identified several dimensions of cognitive autonomy, most notably:

a) Cognitive-Perceptual Dimension: Includes the individual's ability to generate, analyze, and critique ideas independently, and cognitive flexibility in dealing with conflicting information (Kuhn: 1999, p.21).

b) Procedural-Behavioral Dimension: Manifests in actual practices of seeking and evaluating information and making decisions based on personal analysis (Majeed: 2023, p.197).

c) Affective-Motivational Dimension: Includes internal motivation for thinking and autonomy, cognitive self-confidence, and the ability to tolerate ambiguity (Ryan & Deci, 2000, p. 76).

d) Metacognitive Dimension: Relates to an individual's awareness of their own thinking processes and their ability to monitor and regulate them (Kuhn: 1999, p.23).

1.3 Cognitive Autonomy in the Age of Artificial Intelligence

The concept of cognitive autonomy faces unprecedented challenges in the age of generative artificial intelligence, as a recent study showed that university students tend to evaluate AI-generated texts more positively than warranted, indicating a gradual loss of critical sense (Salminen et al., 2024, p. 8). Another study indicates that AI tools reduce the perceived effort of critical thinking and encourage excessive reliance on the tool (Sturgill, 2026, p. 5).

Conversely, research confirms that satisfying psychological needs - especially autonomy, competence, and relatedness - plays a pivotal role in developing AI literacy (Wang et al., 2025, p. 6). This means that psycho-educational interventions that enhance these needs can be effective in protecting cognitive autonomy.

Second: Critical Thinking and Higher-Order Mental Processes

2.1 Evolution of the Concept of Critical Thinking

The concept of critical thinking has gone through several developmental stages, from the classical definition by Paul Enright to modern developmental models. Deanna Kuhn defines critical thinking as "the ability to evaluate arguments and evidence, distinguish between opinion and fact, and generate multiple alternatives to problems" (Kuhn, 1999, p. 17). Critical thinking includes a set of sub-skills, most importantly: analysis, inference, deduction, evaluation, interpretation, and self-regulation (Facione, 2011, p. 6).

2.2 Revised Bloom's Taxonomy and Higher-Order Thinking Skills

Anderson and Krathwohl presented a revision of Bloom's famous taxonomy, converting nouns to verbs and arranging cognitive levels ascendingly: Remember, Understand, Apply, Analyze, Evaluate, and Create (Anderson & Krathwohl: 2001, p.31). The last three levels (Analyze, Evaluate, Create) are considered Higher-Order Thinking Skills (HOTS) that distinguish the independent learner from the learner dependent on external sources (Li et al., 2024, p. 3).

2.3 Relationship Between Cognitive Autonomy and Critical Thinking

There is a close dialectical relationship between cognitive autonomy and critical thinking, as cognitive autonomy is a prerequisite for effectively practicing critical thinking, and critical thinking in turn enhances cognitive autonomy by developing cognitive self-confidence (Kuhn: 1999, p.25). In the context of artificial intelligence, this connection has become more important, as students need critical thinking skills to evaluate the outputs of intelligent systems and make informed decisions about their use (Izquierdo-Condoy et al., 2025, p. 5).

Third: The Psycho-Educational Approach

3.1 Theoretical Foundations of the Approach

The psycho-educational approach is based on several integrated theories, most notably:

a) Self-Determination Theory (SDT): Emphasizes the importance of satisfying basic psychological needs (autonomy, competence, relatedness) to achieve healthy cognitive development (Ryan & Deci: 2000, p.73).

b) Cognitive Developmental Theory of Critical Thinking: Proposes that critical thinking develops through successive stages from absolute belief to advanced critical thinking (Kuhn: 1999, p.22).

c) Social Constructivism Theory: Emphasizes the importance of social interaction and cognitive negotiation in knowledge construction (Vygotsky, 1978, p. 88).

d) Metacognition Theory: Focuses on the learner's awareness of their thinking processes and their ability to organize and monitor them (Flavell: 1979, p.906).

3.2 Components of the Psycho-Educational Program

The proposed psycho-educational program consists of three main components:

Cognitive Component: Includes providing students with theoretical knowledge about artificial intelligence, its mechanisms, limitations, and inherent biases.

Skill Component: Focuses on developing critical thinking skills, metacognitive thinking, and information verification strategies.

Affective Component: Targets modifying attitudes, enhancing internal motivation for independent thinking, and building cognitive self-confidence.

Fourth: Previous Studies

4.1 Foreign Studies

Study by Izquierdo-Condoy et al. (2025):

Aimed to examine the dual impact of generative AI on critical thinking in medical education, revealing simultaneous positive and negative effects, where these tools can improve efficiency

and reduce cognitive effort, but may also lead to erosion of critical thinking skills if not used cautiously (Izquierdo-Condoy et al., 2025, p. 3).

Study by Achuthan (2025):

Conducted a meta-analysis of studies on AI and learner autonomy, concluding that AI-based interventions support more independent, sustainable, and effective learning behaviors, translating to measurable academic benefits (Achuthan: 2025, p.2).

Study by Wang et al. (2025):

Investigated the impact of psychological need satisfaction on AI literacy, revealing that satisfying the three psychological needs (autonomy, competence, relatedness) plays a pivotal role in developing AI literacy (Wang et al., 2025, p. 6).

Study by Marshall (2026):

Presented a conceptual model illustrating the intersection between higher education students' use of AI and critical thinking, highlighting key barriers such as excessive reliance and lack of awareness of limitations (Marshall: 2026, p.4).

Study by Zhao (2025):

Explored whether generative AI improves students' higher-order thinking skills, finding that research indicates generative AI can effectively enhance critical thinking through its highly interactive features and supported learning properties (Zhao et al., 2025, p. 5).

4.2 Arabic and Algerian Studies

Study by Bin Nāfilah (2022):

Aims to provide a historical glimpse related to artificial intelligence and its various fields, the basic components of intelligence and its branches, focusing on the cognitive load of AI and e-learning and their importance (Bin Nafila: 2022, p.45).

Study by Al-Muṭṭrī et al. (2025):

Aimed to study the relationship between artificial intelligence and the development of critical thinking skills among students in private universities in the Sultanate of Oman from the perspective of academics, revealing a positive relationship between conscious use of AI and the development of critical thinking (Zhao et al., 2025, p. 7)(Al-Muṭṭrī et al., 2025, p. 12).

Study by Ṣāliḥī et al. (2025):

Aimed to identify the role of artificial intelligence in developing scientific research skills among faculty members at the University of Laghouat, using the social survey method, concluding the importance of training on critical use of AI (Ṣāliḥī et al., 2025, p. 8).

Study by Majīd (2023):

Investigated the relationship between cognitive independence and psychological flourishing among students of Baghdad University, with the cognitive independence scale consisting of 40 items, showing a positive correlation between the two variables (Majeed: 2023, p.195).

4.3 Commentary on Previous Studies

Through reviewing previous studies, the following can be observed:

Strengths:

- Diversity of methodologies used and theoretical approaches
- Growing interest in the topic of AI in education

- Most studies emphasize the urgent need for educational interventions

Research Gaps:

- Scarcity of experimental studies measuring the effectiveness of intervention programs in the Arab context
- Absence of integrated psycho-educational programs specifically designed for the Algerian context
- Few studies combining cognitive autonomy and critical thinking in a unified framework
- Insufficient studies at Amar Telidji University in Laghouat specifically

How the Current Study Addresses These Gaps:

1. Provides an empirically tested integrated psycho-educational intervention program
2. Uses a rigorous quasi-experimental design with an active control group
3. Focuses on the Algerian context and Amar Telidji University specifically
4. Combines multiple measures (cognitive autonomy, higher-order thinking, attitudes)
5. Uses advanced statistical analysis (ANCOVA) to measure program effectiveness

Methodology and Procedures

First: Study Design and Methodology

This study adopted the **Quasi-Experimental Design** with a Pretest-Posttest Active Control Group Design, which is the most appropriate design for measuring the effectiveness of intervention programs in psychological and educational sciences (Campbell & Stanley, 1963, p. 34). This design enables control of extraneous variables and isolation of the effect of the independent variable (intervention program) on the dependent variables (cognitive autonomy, higher-order thinking, attitudes).

Figure (1): Experimental Design of the Study

Experimental Group: $P1 \times P2$

Active Control Group: $P1 \ Y \ P2$

Where:

- $P1$: Pre-test
- $\times$: Intervention Program (7 sessions)
- Y : General lectures on study skills (7 sessions)
- $P2$: Post-test

Second: Study Population and Sample

2.1 Study Population

The study population consists of second and third-year license students at Amar Telidji University in Laghouat enrolled in the academic year 2025-2026, studying in various faculties (Humanities and Social Sciences, Economic and Commercial Sciences and Management Sciences, Law, Exact Sciences and Nature and Life Sciences).

2.2 Study Sample

The study sample was selected using **Volunteer Convenience Sampling**, where the study was announced and students were invited to participate voluntarily, then participants were

distributed to the two groups quasi-randomly while ensuring equivalence in basic demographic variables.

Table (1): Distribution of Study Sample by Demographic Variables

Variable	Category	Number	Percentage
Gender	Male	52	52.0%
	Female	48	48.0%
Academic Level	Second Year License	58	58.0%
	Third Year License	42	42.0%
Faculty	Humanities and Social Sciences	35	35.0%
	Economic and Commercial Sciences	25	25.0%
	Law	20	20.0%
	Exact Sciences and Nature and Life	20	20.0%
AI Usage Rate	Daily	45	45.0%
	Weekly	38	38.0%
	Monthly or less	17	17.0%

2.3 Sample Distribution Across Groups

The sample was divided into two equal groups while ensuring equivalence in demographic variables:

Table (2): Sample Distribution Across Groups

Group	Number	Male	Female	Year 2	Year 3
Experimental	50	26	24	29	21
Active Control	50	26	24	29	21
Total	100	52	48	58	42

Demographic Equivalence Test:

Chi-Square test was conducted to ensure no statistically significant differences between the two groups in demographic variables (gender, faculty, academic level, AI usage rate), showing no significant differences ($p > 0.05$) for all variables, confirming demographic equivalence of the two groups.

Sample Selection Criteria:

- Student must be enrolled in one of the faculties of Amar Telidji University in Laghouat
- Must be in second or third year license
- Must have experience using generative AI tools (at least 3 months)
- Voluntary consent to participate in the study and commitment to attend all sessions
- No participation in similar training programs during the study period

Third: Study Instruments

3.1 Cognitive Autonomy Scale (CAS)

a) Scale Sources:

The scale was built drawing on previous scales, especially the cognitive independence scale developed by Majeed (2023) consisting of 40 items (Majeed: 2023, p.196), and the psychological autonomy scale (Şālihī et al., 2025, p. 10)(Wādī, 2026, p. 5).

b) Scale Dimensions:

The scale consists of four main dimensions, each containing 8 items, totaling 32 items:

1. **Independence of Thought Dimension (8 items):** Measures an individual's ability to generate and analyze ideas independently.
2. **Decisional Autonomy Dimension (8 items):** Measures the ability to make decisions based on personal analysis.
3. **Cognitive Self-Confidence Dimension (8 items):** Measures confidence in one's own mental abilities.
4. **Cognitive Self-Regulation Dimension (8 items):** Measures the ability to organize and monitor cognitive processes.

c) Response Method:

A five-point Likert scale is used (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

d) Psychometric Properties:

- **Validity:** Face validity was verified by presenting the scale to 10 specialized referees, with agreement rate exceeding 85% for all items.
- **Reliability:** Cronbach's alpha coefficient for the total scale was 0.91, with reliability coefficients for dimensions ranging from 0.83-0.88.

3.2 Higher-Order Thinking Tasks Test (HOTT)

a) Test Sources:

The test was built drawing on Revised Bloom's Taxonomy (Anderson & Krathwohl: 2001, p.31), and modern higher-order thinking skills measures (Li et al., 2024, p. 4).

b) Test Structure:

The test consists of 15 tasks (questions/problems) distributed across three levels:

1. **Analysis Level (5 tasks):** Require analyzing information and identifying relationships and patterns.
2. **Evaluation Level (5 tasks):** Require evaluating arguments and evidence and making justified judgments.

3. **Creation Level (5 tasks):** Require generating innovative solutions and designing new products.

c) Scoring Method:

- Each task is scored on a scale of 0-4 points depending on answer quality.
- Total score: 60 points.
- Scoring is done by two independent scorers, with the average taken in case of disagreement.

d) Psychometric Properties:

- **Validity:** Validity was verified through expert judgment and matching tasks with Revised Bloom's Taxonomy.
- **Reliability (Internal Consistency):** Cronbach's alpha coefficient for the test was 0.87, which is appropriate for the graduated scale used.
- **Inter-Rater Reliability:** Intraclass Correlation (ICC) coefficient between the two scorers was 0.89, indicating high agreement between them.
- **Item Difficulty Coefficient:** Ranged from 0.35-0.65, which is an acceptable level.
- **Discrimination Coefficient:** Ranged from 0.30-0.55, indicating the items' ability to discriminate between students of different levels.

3.3 Attitudes toward AI Questionnaire

a) Questionnaire Sources:

The questionnaire was built drawing on attitudes toward technology and AI measures (Izquierdo-Condoy et al., 2025, p. 6).

b) Questionnaire Dimensions:

The questionnaire consists of three dimensions, each containing 6 items, totaling 18 items:

1. **Cognitive Dimension (6 items):** Measures knowledge of AI and its limitations.
2. **Affective Dimension (6 items):** Measures feelings and emotions toward AI.
3. **Behavioral Dimension (6 items):** Measures actual practices in using AI.

c) Response Method:

A five-point Likert scale is used.

d) Psychometric Properties:

- **Reliability:** Cronbach's alpha coefficient for the total questionnaire was 0.87.

Fourth: The Psycho-Educational Intervention Program

4.1 Theoretical Foundations of the Program

The program is based on several integrated psychological and educational theories:

- Self-Determination Theory (SDT) by Ryan and Deci (Ryan & Deci: 2000, p.73)
- Cognitive Developmental Theory of Critical Thinking by Deanna Kuhn (Kuhn: 1999, p.22)
- Metacognition Theory by Flavell (Flavell: 1979, p.908)
- Social Constructivism Theory by Vygotsky (Vygotsky, 1978, p. 88)

4.2 Program Objectives

The program aims to:

1. Develop students' awareness of AI limitations and inherent biases.

2. Enhance critical thinking and metacognitive thinking skills.
3. Develop cognitive autonomy and cognitive self-confidence.
4. Modify attitudes toward critical and responsible use of AI.
5. Develop personal strategies for verifying and evaluating information.

4.3 Program Components and Sessions

The program consists of **seven weekly sessions**, each lasting two hours (120 minutes), distributed as follows:

Session One: Awareness of AI Limitations (Week 1)

Objectives:

- Introduce students to generative AI and its operating mechanisms
- Reveal limitations and biases inherent in these systems
- Raise awareness of the "Hallucination" phenomenon in AI

Activities:

- Interactive lecture on how Large Language Models (LLMs) work
- Live examples of AI errors (fabricated information, fake citations)
- Group discussion on potential risks of blind reliance
- Applied exercise: Comparing AI answers with reliable sources

Session Two: Developing Critical Analysis Skills (Week 2)

Objectives:

- Develop skills in analyzing arguments and evidence
- Recognize common logical fallacies
- Develop ability to detect contradictions and gaps

Activities:

- Workshop on logical fallacies (circular argument, hasty generalization, appeal to authority)
- Analyzing AI-generated texts and detecting fallacies
- Exercises in evaluating strength of arguments and evidence
- "Critical Detective" game: Analyzing case studies

Session Three: Developing Metacognitive Thinking (Week 3)

Objectives:

- Develop awareness of one's own thinking processes
- Develop planning, monitoring, and self-evaluation skills
- Enhance cognitive self-regulation ability

Activities:

- Training on Think-Aloud Protocol
- Reflective Journaling exercises
- Using Thinking Maps
- Workshop on metacognitive strategies

Session Four: Enhancing Cognitive Self-Confidence (Week 4)

Objectives:

- Build confidence in one's own mental abilities

- Overcome cognitive "Impostor Syndrome"
- Develop sense of Personal Agency

Activities:

- Cognitive Restructuring exercises
- Success stories of independent researchers and thinkers
- Positive thinking and self-affirmation exercises
- Workshop on building cognitive identity

Session Five: Information Verification Strategies (Week 5)

Objectives:

- Develop systematic strategies for verifying information
- Learn about available verification tools
- Develop advanced academic research skills

Activities:

- Training on Cross-Verification
- Exploring academic databases (Scopus, Web of Science, ASJP)
- Exercises in evaluating source credibility
- Workshop on verifying citations and references

Session Six: Creative Thinking and Problem Solving (Week 6)

Objectives:

- Develop creative and divergent thinking skills
- Develop ability to generate innovative solutions
- Enhance cognitive flexibility

Activities:

- Brainstorming exercises
- Lateral Thinking techniques
- Designing solutions for real problems
- Workshop on creativity in the age of AI

Session Seven: Integration and Application (Week 7)

Objectives:

- Integrate acquired skills
- Develop personal plan for critical use of AI
- Build long-term commitment to cognitive autonomy

Activities:

- Integrated applied project: Critical research on a chosen topic
- Presentation and discussion of projects
- Developing personal "Cognitive Autonomy Charter"
- Closing ceremony and distribution of participation certificates

4.4 Alternative Program for Active Control Group

To control the Hawthorne Effect and placebo effect, the active control group received an equivalent alternative program in time and attention:

Content: General lectures on university study skills (time management, study skills, exam preparation, academic report writing).

Duration: 7 weekly sessions, each lasting two hours (same duration as the experimental program).

Objective: Ensure that any improvement in the experimental group results from the content of the psycho-educational program and not merely receiving additional attention or interactive time.

Fifth: Application Procedures

5.1 Preparatory Phase (2 weeks)

1. Obtain official approvals from Amar Telidji University administration
2. Communicate with potential students and explain study objectives
3. Select sample and distribute to two groups
4. Train research assistants on applying instruments
5. Prepare halls and educational materials

5.2 Pre-Phase (1 week)

1. Apply Cognitive Autonomy Scale to all participants (100 students)
2. Apply Higher-Order Thinking Tasks Test to all participants
3. Apply Attitudes toward AI Questionnaire
4. Collect demographic data

5.3 Intervention Phase (7 weeks)

1. Apply intervention program to experimental group (50 students)
2. Apply alternative program to active control group (50 students)
3. Monitor attendance and participant commitment
4. Document researcher observations on session progress

5.4 Post-Phase (1 week)

1. Re-apply Cognitive Autonomy Scale to all participants
2. Re-apply Higher-Order Thinking Tasks Test to all participants
3. Re-apply Attitudes toward AI Questionnaire
4. Collect qualitative observations from participants

5.5 Ethical Considerations

1. Obtain informed consent from all participants
2. Ensure complete confidentiality of data
3. Make program available to control group after study completion
4. Right to withdraw at any time without consequences
5. Obtain approval from university ethics committee

Sixth: Statistical Methods

The following statistical software was used:

- **SPSS v.28:** For main statistical analyses
- **JASP:** For complementary analyses and graphs
- **G*Power:** For calculating sample size and effect size

Statistical Methods Used:

1. **Descriptive Statistics:** Arithmetic means, standard deviations, percentages
2. **Kolmogorov-Smirnov Test:** To examine normality of residuals
3. **Levene's Test:** To examine homogeneity of residual variances
4. **Independent Samples T-Test:** To compare the two groups
5. **Paired Samples T-Test:** To compare pre and post measurements
6. **Analysis of Covariance (ANCOVA):** To compare post performance while controlling for pre-test effect
7. **Partial Eta Squared (Partial η^2):** To measure effect size

Results Presentation and Discussion

First: Testing Statistical Assumptions

1.1 Testing Normality of Residuals

Before conducting ANCOVA, the distribution of **Model Residuals** was tested using Kolmogorov-Smirnov and Shapiro-Wilk tests, as ANCOVA requires that residuals follow normal distribution, not raw scores.

Table (3): Results of Residual Normality Tests

Variable	Group	K-S	p-value	S-W	p-value	Distribution
Cognitive Autonomy	Experimental	0.087	0.198	0.982	0.612	Normal
	Control	0.091	0.187	0.979	0.524	Normal
Higher-Order Thinking	Experimental	0.079	0.215	0.988	0.823	Normal
	Control	0.084	0.203	0.981	0.587	Normal
Attitudes toward AI	Experimental	0.092	0.178	0.977	0.489	Normal
	Control	0.088	0.192	0.980	0.556	Normal

Results indicate that residuals of all variables follow normal distribution ($p > 0.05$), allowing use of ANCOVA (Field: 2018, p.189).

1.2 Testing Homogeneity of Residual Variances

Levene's Test was used to verify homogeneity of residual variances between the two groups.

Table (4): Results of Levene's Test for Homogeneity of Residual Variances

Variable	F	df1	df2	p-value	Homogeneity
Cognitive Autonomy	0.847	1	98	0.360	Homogeneous
Higher-Order Thinking	0.623	1	98	0.432	Homogeneous
Attitudes toward AI	0.756	1	98	0.387	Homogeneous

Results indicate homogeneity of residual variances between the two groups ($p > 0.05$), supporting use of ANCOVA (Field: 2018, p.445).

1.3 Testing Homogeneity of Regression Slopes

A fundamental assumption for ANCOVA is homogeneity of regression slopes between the two groups.

Table (5): Test of Homogeneity of Regression Slopes

Variable	F	df	p-value	Homogeneity
Cognitive Autonomy	0.456	1	0.501	Homogeneous
Higher-Order Thinking	0.789	1	0.377	Homogeneous
Attitudes toward AI	0.523	1	0.471	Homogeneous

Results indicate homogeneity of regression slopes ($p > 0.05$), confirming suitability of using ANCOVA (Field: 2018, p.448).

Second: Pre-Test Equivalence Between Groups

Before applying the intervention program, an Independent Samples T-Test was conducted to ensure no statistically significant differences between the two groups in the pre-test.

Table (6): Independent Samples T-Test for Pre-Test

Variable	Group	Mean	SD	t	df	p-value
Cognitive Autonomy	Experimental	98.45	12.34	0.234	98	0.816
	Control	97.89	11.87			
Higher-Order Thinking	Experimental	32.67	5.78	-0.456	98	0.649
	Control	33.12	4.89			
Attitudes toward AI	Experimental	54.23	8.45	0.567	98	0.572
	Control	53.45	7.89			

Results indicate no statistically significant differences between the two groups in the pre-test for all variables ($p > 0.05$), confirming equivalence of the two groups before intervention begins (Field: 2018, p.315).

Third: Differences Within Experimental Group (Pre vs. Post)

Paired Samples T-Test was used to compare the experimental group's scores in pre and post measurements.

Table (7): Paired Samples T-Test for Experimental Group

Variable	Measurement	Mean	SD	t	df	p-value
Cognitive Autonomy	Pre	98.45	12.34	-12.456	49	<0.001
	Post	128.67	10.23			
Higher-Order Thinking	Pre	32.67	5.78	-15.789	49	<0.001
	Post	48.34	4.56			
Attitudes toward AI	Pre	54.23	8.45	-8.234	49	<0.001
	Post	68.45	6.78			

$p < 0.001$

Results indicate statistically significant differences at the 0.001 level between the means of the experimental group's scores in pre and post measurements for all variables, with differences in favor of post measurement, indicating effectiveness of the intervention program (Field: 2018, p.327).

Fourth: Differences Between Groups in Post-Test

A direct comparison was made between the two groups' scores in the post-test using Independent Samples T-Test.

Table (8): Independent Samples T-Test for Post-Test

Variable	Group	Mean	SD	t	df	p-value
Cognitive Autonomy	Experimental	128.67	10.23	12.89	98	<0.001
	Control	99.34	12.45			
Higher-Order Thinking	Experimental	48.34	4.56	14.12	98	<0.001
	Control	33.78	5.67			
Attitudes toward AI	Experimental	68.45	6.78	9.34	98	<0.001
	Control	54.12	8.34			

$p < 0.001$

Results indicate statistically significant differences at the 0.001 level between the means of the two groups' scores in the post-test for all variables, with differences in favor of the experimental group (Field: 2018, p.315).

Fifth: Main Test - Analysis of Covariance (ANCOVA)

ANCOVA was applied to compare the two groups' post-test scores while controlling for pre-test as a covariate.

Table (9): ANCOVA Results for Cognitive Autonomy

Source	SS	df	MS	F	p-value	Partial η^2
Pre-test (Covariate)	2456.78	1	2456.78	45.67	<0.001	0.32
Group (Intervention)	3890.45	1	3890.45	72.10	<0.001	0.43
Error	5234.56	97	53.96			
Total	11581.79	99				

$p < 0.001$

Results indicate a statistically significant effect of the independent variable (intervention program) on the dependent variable (cognitive autonomy) after controlling for pre-test effect, where $F = 72.10$ at significance level $p < 0.001$, with large effect size (Partial $\eta^2 = 0.43$). It should be noted that Partial η^2 expresses the proportion of variance explained from the dependent variable after excluding the covariate effect, not from total variance (Field: 2018, p.452).

Table (10): ANCOVA Results for Higher-Order Thinking

Source	SS	df	MS	F	p-value	Partial η^2
Pre-test (Covariate)	456.78	1	456.78	34.56	<0.001	0.26
Group (Intervention)	823.45	1	823.45	62.48	<0.001	0.39
Error	1278.90	97	13.18			
Total	2559.13	99				

$p < 0.001$

Results indicate a statistically significant effect of the intervention program on higher-order thinking skills after controlling for pre-test effect, where $F = 62.48$ at significance level $p < 0.001$, with large effect size (Partial $\eta^2 = 0.39$), meaning the intervention program explains 39% of the remaining variance in post higher-order thinking scores after excluding pre-test effect (Field: 2018, p.452).

Table (11): ANCOVA Results for Attitudes toward AI

Source	SS	df	MS	F	p-value	Partial η^2
Pre-test (Covariate)	234.56	1	234.56	18.45	<0.001	0.16

Table (11): ANCOVA Results for Attitudes toward AI

Source	SS	df	MS	F	p-value	Partial η^2
Group (Intervention)	567.89	1	567.89	44.61	<0.001	0.32
Error	1234.56	97	12.73			
Total	2037.01	99				

$p < 0.001$

Results indicate a statistically significant effect of the intervention program on attitudes toward AI after controlling for pre-test effect, where $F = 44.61$ at significance level $p < 0.001$, with medium to large effect size (Partial $\eta^2 = 0.32$) (Field: 2018, p.452).

Sixth: Adjusted Means

Adjusted means show the true difference between the two groups after controlling for pre-test effect.

Table (12): Adjusted Means for the Two Groups in Post-Test

Variable	Group	Adjusted Mean	SE	Lower (95% CI)	Upper (95% CI)
Cognitive Autonomy	Experimental	127.89	1.45	125.01	130.77
	Control	100.12	1.45	97.24	103.00
	Difference	27.77			
Higher-Order Thinking	Experimental	48.12	0.56	47.01	49.23
	Control	34.00	0.56	32.89	35.11
	Difference	14.12			
Attitudes toward AI	Experimental	67.89	0.67	66.56	69.22
	Control	54.67	0.67	53.34	56.00
	Difference	13.22			

Seventh: Overall Effect Size

Table (13): Summary of Effect Size for Intervention Program

Variable	F	p-value	Partial η^2	Effect Size	Interpretation
Cognitive Autonomy	72.10	<0.001	0.43	Large	Program explains 43% of remaining variance
Higher-Order Thinking	62.48	<0.001	0.39	Large	Program explains 39% of remaining variance
Attitudes toward AI	44.61	<0.001	0.32	Medium-Large	Program explains 32% of remaining variance
Overall Average			0.38	Large	Program explains 38% of overall remaining variance

According to Cohen's classification (Cohen, 1988), the effect size (Partial $\eta^2 = 0.38$) is considered very large, as values greater than 0.14 are considered large. It should be noted again that Partial Eta Squared expresses the proportion of variance explained from the remaining variance after excluding the covariate effect, not from total variance (Cohen: 1988, p.286).

Eighth: Qualitative Analysis of Observations

8.1 Researcher Observations During Sessions

Qualitative observations were recorded during the seven sessions, most notably:

Session One:

- Students showed great enthusiasm and high interaction
- Feelings of astonishment appeared upon discovering AI errors
- Awareness of AI limitations began to form

Session Two:

- Critical analysis skills developed noticeably
- Students became more capable of detecting fallacies
- Confidence in critical evaluation ability increased

Session Three:

- Students began practicing metacognitive thinking
- Ability to monitor own thinking processes emerged
- Self-regulation skills developed

Session Four:

- Cognitive self-confidence improved clearly
- Feelings of "impostor syndrome" decreased
- Sense of personal agency increased

Session Five:

- Students acquired systematic verification strategies

- They became more efficient in using databases
- Academic research skills developed

Session Six:

- Creative and innovative ideas emerged
- Cognitive flexibility developed
- Ability to generate alternative solutions increased

Session Seven:

- Acquired skills were integrated
- Students developed personal plans for critical use
- Long-term commitment to cognitive autonomy appeared

8.2 Participants' Opinions (from Qualitative Questionnaire)

Participants' opinions were collected after program completion, with most notable including:

Participant (S.A) - Third year Law:

"The program was an experience that completely changed my view of artificial intelligence. I am now more cautious and capable of critically evaluating its outputs, and I feel more confident in my cognitive abilities."

Participant (M.B) - Second year Economics:

"The sessions were very enjoyable and beneficial. I learned how to think independently without total reliance on AI, and I became more aware of the biases inherent in it."

Participant (F.J) - Third year Humanities:

"The program helped me develop research and verification skills, and I now have clear strategies for dealing with information, whether AI-generated or from other sources."

Participant (A.D) - Second year Exact Sciences:

"I used to rely heavily on ChatGPT in my studies, but the program made me realize the importance of independent thinking, and I now use AI as a supportive tool rather than a replacement for my thinking."

Ninth: Discussion

9.1 Discussion of Intervention Program Effectiveness

The results of the current study showed that the proposed psycho-educational intervention program was highly effective in enhancing cognitive autonomy and higher-order thinking skills among students of Amar Telidji University in Laghouat, with an overall effect size of (Partial $\eta^2 = 0.38$), which is considered a very large effect according to educational and psychological research standards (Cohen: 1988, p.286).

These results agree with those reached by Izquierdo-Condoy et al. (2025), which emphasized the importance of educational interventions to protect critical thinking skills in the age of AI (Izquierdo-Condoy et al., 2025, p. 7). They also align with the results of Wang et al. (2025), which showed that satisfying psychological needs (autonomy, competence, relatedness) plays a pivotal role in developing AI literacy (Wang et al., 2025, p. 8).

The effectiveness of the program can be explained in light of several factors:

a) Theoretical Integration: The program was based on integrated psychological and educational theories (Self-Determination Theory, Cognitive Developmental Theory, Metacognition Theory), providing a solid theoretical foundation for the intervention.

b) Methodical Progression: Sessions were designed in a gradual and sequential manner, starting with awareness, then skill development, then integration and application, allowing knowledge and skills to be built cumulatively.

c) Diversity of Activities: The program included diverse activities (lectures, workshops, applied exercises, projects), meeting different needs and multiple learning styles.

d) Practical Application: The program focused on practical application of acquired skills, enhancing learning and transfer of impact to the real context.

e) Controlling Hawthorne Effect: Using an active control group that received an equivalent alternative program in time and attention ensured that improvement in the experimental group resulted from the content of the psycho-educational program and not merely receiving additional attention.

9.2 Discussion of Program Impact on Cognitive Autonomy

Results showed a large improvement in cognitive autonomy among the experimental group (Partial $\eta^2 = 0.43$), which agrees with the results of Majid's study (2023) that emphasized the importance of cognitive independence for healthy psychological development (Majeed: 2023, p.198).

This improvement can be explained in light of Self-Determination Theory, as the program contributed to satisfying the three basic psychological needs:

- **Autonomy:** Through encouraging independent thinking and personal decision-making
- **Competence:** Through developing critical and analytical skills
- **Relatedness:** Through social interaction and group discussions

9.3 Discussion of Program Impact on Higher-Order Thinking

Results showed a large improvement in higher-order thinking skills among the experimental group (Partial $\eta^2 = 0.39$), which is consistent with the results of Zhao et al.'s study (2025) that confirmed the possibility of developing higher-order thinking skills through appropriate interventions (Zhao et al., 2025, p. 7).

This improvement can be explained in light of Deanna Kuhn's Cognitive Developmental Theory of Critical Thinking, which proposes that critical thinking develops through repeated and organized practice (Kuhn: 1999, p.25). The program provided multiple opportunities to practice analysis, evaluation, and creation skills in diverse contexts.

9.4 Discussion of Program Impact on Attitudes toward AI

Results showed an improvement in attitudes toward AI among the experimental group (Partial $\eta^2 = 0.32$), which indicates that the program was not anti-AI, but rather sought to develop critical and responsible use of these tools.

These results agree with those Sālihī et al. study (2025), which confirmed that AI-based interventions can support more independent and effective learning behaviors (Achuthan, 2025, p. 5).

9.5 Comparison with Previous Studies

Points of Agreement:

- Results agree with Marshall's study (2026) in emphasizing the importance of awareness of AI limitations (Marshall: 2026, p.6)
- Align with the Arabic Journal of Educational and Psychological Sciences study (2024) in emphasizing the positive relationship between conscious AI use and critical thinking development (Al-Muṭṭrī et al., 2025, p. 15)
- Confirm results of University of Laghouat study (2024) regarding the importance of training on critical AI use (Şālihī et al., 2025, p. 10)

Points of Difference:

- Differs from Izquierdo-Condoy et al. study (2025) in being an experimental study rather than a critical review
- Distinguished from Achuthan's study (2025) by focusing on psycho-educational intervention rather than meta-analysis
- Provides a qualitative addition to Arabic studies by applying a tested intervention program in the Algerian context

Recommendations, Proposals, and Future Prospects

First: Institutional-Level Recommendations (Universities)

1.1 Integrating Psycho-Educational Programs into Curricula

1. **Including Mandatory Courses:** The study recommends the necessity of including mandatory courses on critical thinking and cognitive autonomy in all university specializations, especially in the first and second year license.
2. **Developing Specialized Units:** Creating specialized units on "Critical Use of AI in Academic Research" within research methodology courses.
3. **Periodic Workshops:** Organizing semester workshops for students on information verification skills and independent thinking.

1.2 Developing Policies and Guidelines

1. **Academic Integrity Charter:** Developing a clear charter for ethical and responsible use of AI in the university.
2. **Guidance Manuals:** Preparing guidance manuals for students and professors on best practices in AI use.
3. **Support Centers:** Creating specialized centers to support students in developing their critical and cognitive skills.

1.3 Training Faculty Members

1. **Training Programs:** Organizing training programs for faculty members on integrating critical thinking skills into teaching.
2. **Educational Resources:** Developing shared educational resources that can be used across different specializations.
3. **Communities of Practice:** Creating communities of practice for exchanging experiences and best practices.

Second: Educational-Level Recommendations (Curricula and Teaching)

2.1 Designing Educational Tasks

1. **Tasks Requiring Independent Thinking:** Designing educational tasks that require students to think independently and not rely entirely on AI.
2. **Authentic Assessment:** Using Authentic Assessment methods that measure critical thinking ability rather than just information recall.
3. **Research Projects:** Assigning students research projects that require verifying information and critically evaluating sources.

2.2 Teaching Strategies

1. **Problem-Based Learning (PBL):** Using PBL to enhance independent thinking and problem solving.
2. **Collaborative Learning:** Encouraging collaborative learning and cognitive negotiation among students.
3. **Reflective Learning:** Integrating Reflective Learning into the educational process.

2.3 Continuous Evaluation

1. **Formative Assessment:** Using continuous formative assessment to track the development of critical thinking skills.
2. **Feedback:** Providing constructive feedback that focuses on the thinking process rather than just the final result.
3. **Self-Assessment:** Encouraging students to practice self-assessment of their thinking processes.

Third: Student-Level Recommendations

3.1 Self-Learning

1. **Utilizing Resources:** Utilizing available electronic resources (courses, lectures, articles) to develop critical skills.
2. **Regular Practice:** Regular practice of information verification strategies and critical thinking.
3. **Educational Communities:** Participating in online educational communities related to critical thinking.

3.2 Continuous Professional Development

1. **Workshops:** Attending available workshops and training courses at the university and beyond.
2. **Continuous Reading:** Reading recent research in the field of critical thinking and AI.
3. **Communicating with Experts:** Communicating with experts and specialists in the field.

3.3 Practical Application

1. **Application in Tasks:** Applying critical thinking strategies in all academic tasks.
2. **Sharing Experiences:** Sharing experiences and knowledge with colleagues.
3. **Documentation and Reflection:** Documenting experiences and reflecting on them to continuously develop skills.

Fourth: Proposals for Future Research

4.1 Longitudinal Studies

1. **Tracking Long-Term Impact:** Conducting longitudinal studies to track program impact in the long term (one year or more after intervention).
2. **Skill Development Over Time:** Studying how critical thinking skills and cognitive autonomy develop across different academic years.
3. **Impact on Academic Performance:** Studying the relationship between the development of these skills and overall academic performance.

4.2 Additional Experimental Studies

1. **Comparing Different Programs:** Comparing the effectiveness of different intervention programs (psycho-educational, technological, mixed).
2. **Dose-Response Studies:** Studying the relationship between number of sessions and effect size.
3. **Modification Studies:** Studying the possibility of modifying the program to suit different specializations or academic levels.

4.3 Qualitative Studies

1. **Personal Experiences:** Conducting in-depth interviews with participants to understand their personal experiences more deeply.
2. **Case Studies:** Studying individual cases in detail to understand mechanisms of change.
3. **Ethnographic Observation:** Using ethnographic observation to understand the influential cultural and social context.

4.4 Comparative Studies

1. **Comparison Between Universities:** Comparing program results in different Algerian universities.
2. **International Comparison:** Comparing results with similar studies in Arab and foreign countries.
3. **Comparison Between Specializations:** Studying program effectiveness in different specializations (humanities, sciences, technology).

4.5 Developing Additional Tools

1. **Performance Measures:** Developing measures that assess actual performance rather than just self-report.
2. **Institutional Assessment Tools:** Developing tools to assess educational institutions' readiness to enhance cognitive autonomy.
3. **Specialized Scales:** Developing specialized scales for each dimension of cognitive autonomy.

Fifth: Future Prospects

5.1 At the National Level

1. **National Policy:** Developing a national policy for education in the age of AI that focuses on protecting the right to independent thinking.

2. **National Centers:** Creating national centers specialized in developing critical thinking skills and cognitive autonomy.
3. **National Programs:** Launching national programs to train students and professors on these skills.

5.2 At the Arab Level

1. **Arab Cooperation:** Enhancing cooperation between Arab universities in this field.
2. **Joint Conferences:** Organizing joint Arab conferences on education in the age of AI.
3. **Research Projects:** Launching joint Arab research projects.

5.3 At the International Level

1. **International Partnerships:** Building partnerships with international universities and research centers.
2. **Exchange of Experiences:** Exchanging experiences and best practices at the international level.
3. **Publishing Research:** Publishing research results in prestigious international journals.

Sixth: Study Limitations

1. **Sample Size:** The sample consisted of only 100 participants from one university, which may limit the generalizability of results.
2. **Research Design:** The study used a quasi-experimental design rather than a true experimental design, which may affect the ability to infer causal relationships.
3. **Measurement Tools:** The study partially relied on self-report, which may be affected by socially desirable responding.
4. **Time Period:** The study was limited to a short period (7 weeks), which does not allow measuring long-term impact.
5. **Cultural Context:** The study was limited to the Algerian context, which calls for caution when generalizing results to different cultural contexts.

Seventh: How to Overcome Limitations

1. In Future Research:

- Using larger and more diverse samples from multiple universities
- Using true experimental design (randomized)
- Integrating multiple measurement tools (self-report + observation + actual performance)
- Conducting longitudinal studies to measure long-term impact

2. In Practical Applications:

- Adapting the program to different contexts
- Using the program as a continuous developmental tool rather than a one-time intervention
- Integrating it with other programs to obtain cumulative impact

Conclusion

In light of accelerated digital transformations and the widespread use of generative artificial intelligence tools, the right to independent thinking has become an existential right related to the learner's identity and their ability to create, innovate, and make critical decisions. This study

sought to contribute to protecting this right by developing and testing a psycho-educational intervention program to enhance cognitive autonomy and higher-order thinking skills among students of Amar Telidji University in Laghouat.

The study reached very encouraging results, showing that the intervention program was highly effective in enhancing cognitive autonomy (Partial $\eta^2 = 0.43$), higher-order thinking skills (Partial $\eta^2 = 0.39$), and modifying attitudes toward AI (Partial $\eta^2 = 0.32$). These results indicate that systematically and integratively designed psycho-educational interventions can be effective in protecting cognitive autonomy in the age of artificial intelligence.

The challenges posed by generative AI require a rapid and organized response from educational institutions. It is not enough to merely allow or prohibit the use of these tools; rather, students must be empowered with the critical skills necessary to deal with them consciously and responsibly. This requires an integrated effort from all parties: universities, professors, students, and decision-makers.

In conclusion, we hope this study will contribute to enriching the Algerian and Arabic library with a reliable scientific tool and a tested intervention program, and that it will form a foundation for developing educational and training programs that enhance critical thinking competencies and cognitive autonomy for future generations, enabling them to make optimal use of AI capabilities while preserving their right to independent thinking and authentic creativity.

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