

Conceptual Development and Critical Thinking in Research Training: Applied Study to Market Research Students

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Abstract

This article presents the results of a study conducted with 25 students enrolled in the Market Research course of the Business Administration program at UPTC, Chiquinquirá Sectional, whose main objective was to analyze conceptual development through the application of the critical thinking taxonomy proposed by (Zambrano, Rodríguez & Giraldo 2024). A didactic unit was designed incorporating 16 structured grids to promote metacognition, motivation, and deep learning, based on constructivist foundations. The results were quantitatively evaluated using the paired-samples t-test and Spearman correlation analysis, showing significant improvements in higher-order cognitive skills and informed decision-making. The study demonstrates that critical thinking can be effectively promoted in university education contexts through intentional pedagogical interventions.

Keywords: critical thinking, conceptual evolution, metacognition, motivation, deep learning

1. INTRODUCTION

Critical thinking training has become a central axis of contemporary higher education, especially in academic programs that seek to prepare future professionals for complex, changing, and highly demanding environments such as those of the economic and administrative sciences. This study is framed within this horizon by analyzing the conceptual development of students in the Market Research course of the Business Administration program at the Universidad Pedagógica y Tecnológica de Colombia (UPTC), through the application of the critical thinking taxonomy proposed by (Zambrano, Rodríguez & Giraldo, 2024).

Critical thinking is understood as a self-regulated, reflective process oriented toward informed and ethically grounded decision-making (Facione, 2007). (Paul & Elder 2003) define it as “the process by which the thinker improves the quality of his or her thinking by taking command of the structures inherent in the act of thinking and subjecting them to intellectual standards,” emphasizing its self-directed, self-disciplined, and self-corrective nature. Along these lines, education cannot be limited to the transmission of content, but

must foster teaching-learning processes that promote higher-order cognitive skills, such as argumentation, deduction, metacognition, and critical evaluation (Lipman, 1990; Ennis, 2011).

In the context of education in the administrative sciences, it is common to find a gap between technical content and the pedagogical approaches necessary to achieve meaningful appropriation of knowledge (Vargas, 2007). The research starts from the need to close this gap through a didactic intervention based on deep learning, the explanatory model, and the metacognitive approach (Flavell, 1979; Biggs & Tang, 2011). Thus, a didactic unit structured around 16 pedagogical grids was designed to diagnose, intervene in, and evaluate students' level of critical thinking through activities focused on concept construction, critical reflection, collaborative work, and self-assessment.

Constructivism, as an epistemological and pedagogical approach, underpins the methodological proposal, considering that knowledge is actively constructed from prior experience, context, and social interaction (Piaget, 1952; Vygotsky, 1978; Bruner, 1960). In this sense, conceptual development is not a linear process, but rather a progressive reconstruction of knowledge based on the confrontation of explanatory models, critical analysis of information, and the application of thinking strategies (Ausubel, 1963).

Added to this is the motivational dimension, which is key to fostering meaningful learning insofar as it acts as a catalyst for student engagement in the educational process (Nussbaum, 2020). This perspective is consistent with the propositions of self-determination theory, according to which intrinsic motivation arises from the satisfaction of basic psychological needs and constitutes a robust predictor of engagement and self-regulated learning (Ryan & Deci, 2000). Likewise, the conceptual development described in this study is framed within the postulates of conceptual change theory, which maintains that restructuring prior knowledge requires progressive processes of ontological and epistemological reorganization, rather than a simple replacement of ideas (Vosniadou & Skopeliti, 2014).

The research adopts a mixed methodological approach (quantitative and qualitative) based on the participatory action research paradigm (Kemmis, 1984; Elliot, 2005), which made it possible to articulate design, intervention, and evaluation within the same reflective cycle. Techniques such as pretest and posttest, direct observation, open-ended questionnaires, reflective portfolios, and group dynamics were applied, providing an integral view of the educational process and of the development of students' thinking. The paired-samples t-test was used to measure the statistical significance of the observed changes, while Spearman's coefficient made it possible to correlate key variables such as motivation, metacognition, and performance (Tamayo et al., 2019).

The results of the study indicate a significant improvement in students' argumentation, decision-making, and cognitive self-regulation skills. This progress not only reinforces the relevance of applying the critical thinking taxonomy in university teaching, but also demonstrates that it is possible to design learning environments that enhance critical reflection from specific disciplines, as demanded by education oriented toward social change (Walsh, 2005; Saiz, 2019).

Thus, this work contributes to the pedagogical and didactic debate on university education by proposing an articulation between theory and practice that makes it possible to understand how critical thinking not only improves the quality of learning, but also develops responsible citizens and professionals with ethical criteria who are capable of transforming their environment. In this direction, the research question is posed: How does the conceptual development of Market Research students occur through the application of the critical thinking taxonomy?

2. THEORETICAL FRAMEWORK

Critical thinking has acquired a leading role in the educational processes of higher education, particularly in the fields of economics, administration, and accounting. This cognitive competence enables students to formulate reasoned judgments, solve complex problems, and make informed decisions, skills that are indispensable in increasingly demanding professional scenarios (Facione, 2007; Paul & Elder, 2003).

This research is based on the analysis and promotion of critical thinking and conceptual development as structuring axes of deep learning among university students in the Market Research course of the Business Administration program at UPTC, Chiquinquirá Sectional Faculty. From this perspective, principles of constructivism, critical pedagogy, metacognition, and cognitive taxonomies are integrated to design and implement innovative didactic strategies that respond to the challenges of the contemporary educational and professional context.

2.1 Epistemological Foundations: Constructivism and Critical Didactics

The study is grounded in constructivist learning theories, particularly those of (Piaget, 1952), (Vygotsky, 1978), (Ausubel, 1963), and (Bruner, 1960), who consider that knowledge is not passively transmitted, but actively constructed from the subject's prior experiences. From this perspective, meaningful learning is based on incorporating new concepts into existing cognitive structures (Ausubel, 1968), a process enhanced through strategies such as metacognition (Flavell, 1979) and deep learning (Biggs & Tang, 2011).

Critical didactics complements this view by situating learning within a social and cultural context. From this perspective, teaching involves not only transmitting content, but also developing reflective capacities that allow individuals to interpret, argue, and transform reality (Tamayo et al., 2019; Walsh, 2005).

For its part, critical thinking has been defined by (Paul & Elder 2003) as “the process by which the thinker improves the quality of his or her thinking by taking command of the structures inherent in the act of thinking and subjecting them to intellectual standards.” This process involves skills such as precise question formulation, rigorous evaluation of information, formulation of well-founded solutions, and willingness to review one's own beliefs. In their conception, critical thinking is self-directed, self-disciplined, self-regulated, and self-correcting.

(Ennis, 1991, 2011) expands this conception by including specific dispositions and skills such as clarification, inference, value judgment, and meta-evaluation, organized around logical, criterial, and pragmatic dimensions. These capacities are essential in higher education, especially in areas such as economics, accounting, and administration, where students must interpret complex information and adopt reasoned positions regarding market phenomena (Facione, 2007; Villarini, 2003).

From a functional perspective, critical thinking also encompasses decision-making, argument analysis, identification of assumptions, and formulation of logical conclusions (Petress, 2004; Dewey, 1989). In turn, the taxonomies and evaluation of critical thinking are grounded in the methodological proposal based on the critical thinking taxonomy of (Zambrano, Rodríguez & Giraldo, 2024), which makes it possible to categorize different levels of understanding and thinking, from basic argumentation to self-regulation. This taxonomy is especially useful for evaluating conceptual development in educational contexts because it makes it possible to identify epistemological barriers, metacognitive strategies, and higher-order cognitive skills.

The key instrument for this evaluation was the application of 16 structured grids that make it possible to observe students' progression through various cognitive and metacognitive

skills. These grids include processes such as conceptualization, induction, deduction, decision-making, self-regulation, and the construction of concept maps, articulating each of these processes with the dimensions of critical thinking proposed by (Ennis, 1991), (Bloom, 1971), and (Anderson & Krathwohl, 2001).

On the other hand, metacognition and motivation as mediators of critical thinking. Understanding metacognition as awareness and regulation of one's own thinking, it is fundamental to the development of critical thinking (Flavell, 1979). This skill allows students to plan, monitor, and evaluate their cognitive processes, improving decision-making and problem-solving (Bruner, 1966). In this regard, contemporary research on metacognition emphasizes that its development does not occur in isolation, but must be explicitly integrated into disciplinary teaching, articulating metacognitive knowledge with the monitoring and control strategies characteristic of each learning domain (Veenman, Van Hout-Wolters & Afflerbach, 2006).

Alongside metacognition, intrinsic motivation is identified as a catalyst for deep learning. (Nussbaum, 2020) argues that educational practices should foster curiosity, autonomy, and student engagement in order to promote an authentic construction of knowledge. This is consistent with self-determination theory, which explains that satisfying the needs for autonomy, competence, and social relatedness strengthens intrinsic motivation and favors deeper learning processes sustained over time (Ryan & Deci, 2000).

This approach was operationalized through activities such as reflective portfolios, tutorials, concept maps, group techniques, and self-assessment exercises, with the aim of fostering meaningful learning transferable to real contexts (Novak & Gowin, 1984). The methodological proposal also promoted deep learning, which according to (Biggs & Tang 2011) is based on understanding, conceptual integration, and the critical application of knowledge.

For its part, conceptual didactics and teaching representations: its methodological design is based on teaching representations that integrate concept maps (Novak & Gowin, 1984), problem-based activities (ABP), and cooperative techniques such as round tables and seminars. These strategies make it possible to articulate deductive and inductive thinking with the practical application of knowledge (Tamayo et al., 2019; Piaget, 1970), promoting conceptual appropriation and the development of transferable competencies.

The study is situated within a critical didactics' framework, in which teaching is conceived as a transformative process that articulates disciplinary knowledge with social and ethical problems (Saiz, 2019; Walsh, 2005). From this perspective, university education should promote intellectual autonomy, social sensitivity, and commitment to transforming the environment.

The conceptualization of skills such as induction, deduction, and decision-making, presented in didactic grids, makes it possible to observe the process of conceptual development in Market Research students, facilitating their transition from superficial learning toward meaningful and self-regulated learning.

The teaching proposal integrated didactic representations such as Problem-Based Learning (ABP), comparison and contrast activities, dramatizations, role-playing, concept maps, and the application of diagnostic grids to foster critical reflection and self-regulation. These strategies made it possible to link theory and practice, science and everyday life, in accordance with the principle of learning to learn.

2.2 Importance of Critical Thinking in Higher Education

Critical thinking is a transversal competence in higher education, recognized as key to employability, innovation, and global citizenship (Wals & Jickling, 2002; World Economic Forum, 2016). According to the (Committee for Economic Development, 2015), it is one

of the skills most valued by employers and, paradoxically, one of the least developed among students.

2.3 Critical Thinking and Professional Performance

Critical thinking is widely recognized as one of the most valued competencies in the professional environment. International reports (Committee for Economic Development, 2015; World Economic Forum, 2016) show that companies consider this competence essential, but at the same time difficult to find among university graduates.

Consequently, it is essential that higher education institutions adopt explicit, systematic, and sustained pedagogical strategies to foster the development of critical thinking. As Abrami et al. (2015) and Halpern (1998) state, this skill can not only be taught, but must be intentionally promoted through the design of reflective, collaborative, and contextualized activities. These didactic strategies stimulate informed decision-making, ethical judgment, and the transfer of knowledge to complex real-life situations. However, their implementation requires trained teachers, conceptual clarity, and continuity throughout the educational process (Asgharheidari & Tahiri, 2015; Moore, 2013).

3. METHODOLOGY

3.1 Methodological Approach

This study adopts a mixed approach (quantitative and qualitative), supported by the participatory action research paradigm (Kemmis, 1984; Elliot, 2005), which makes it possible to intervene in the classroom with the purpose of transforming pedagogical practices and fostering the development of students' critical thinking and conceptual development. The choice of this paradigm responds to the formative nature of the research and its emphasis on systematic reflection on teaching-learning processes. Action research involves a cyclical reflection between theory and practice aimed at the continuous improvement of educational processes (Kemmis & McTaggart, 2005).

3.2 Methodological Design

The design was structured around an experimental didactic unit based on principles of pedagogical constructivism (Piaget, 1952; Vygotsky, 1978; Ausubel, 1963) and Zambrano, Rodríguez and Giraldo's (2024) critical thinking taxonomy. This unit integrated strategies such as deep learning, metacognition, analysis of real problems, and cognitive self-regulation, allowing students to move from initial explanatory models toward more complex levels of thinking and conceptualization.

The activities were organized into 16 structured grids, designed as pedagogical mediation instruments that fostered self-reflection, decision-making, conceptualization, and autonomous learning.

The instructional design was based on the notion of "progressive construct of knowledge" from the previous cognitive structure, in line with Ausubel (1968).

The sample consisted of 25 students from the Market Research course of the Universidad Pedagógica y Tecnológica de Colombia (UPTC), Chiquinquirá campus, selected from a universe of 27 enrolled students. Purposive sampling was used, with criteria of active participation, availability, and continuity in the pedagogical activities developed.

Multiple techniques and instruments were used to capture students' conceptual development and critical thinking, including:

- Pretest and posttest questionnaires (measurement of change)
- Direct observation (systematic and participatory)
- Learning portfolios
- Written and oral reflections

- Group techniques: round table, symposium, dramatization, role-playing, among others (Grid 10)
- Self-assessment, peer assessment, and hetero-assessment (Grid 4 and Grid 8)

The richness of the data obtained made possible a methodological triangulation between quantitative evidence (pretest-posttest results) and qualitative evidence (analysis of discourse, observations, and student products).

3.3 Intervention Procedure

The methodological procedure was developed in the following phases:

1. Initial diagnosis: administration of a pretest to determine the students' initial explanatory model.
2. Design and implementation of the didactic unit with the 16 structured grids, integrating:
 - Concept construction activities
 - Inductive and deductive thinking techniques (Grids 12 and 13)
 - Metacognitive activities (Grid 3)
 - Concept maps and representation of knowledge (Grid 2)
3. Monitoring and tutoring: support through face-to-face and interactive tutoring (Grid 7).
4. Final evaluation: administration of the posttest, portfolio analysis, and comprehensive evaluation of the process.

3.4 Statistical and Qualitative Analysis

For the quantitative analysis, the paired-samples t-test was used, which is appropriate for evaluating whether statistically significant changes occurred between pretest and posttest results. The formula applied was:

Formula: $t = \bar{D} / (sD / \sqrt{n})$

Where

t = value of the t statistic

$\bar{D}$ = mean of the differences between posttest and pretest

sD = standard deviation of the differences

n = number of students (sample size: 25 students)

Likewise, Spearman's correlation coefficient was used to identify relationships between the observed cognitive variables (metacognition, motivation, cognitive skills) and the level of critical thinking achieved.

For the qualitative analysis, an inductive categorization of discourse and portfolios was conducted, following the levels proposed by the taxonomy of Zambrano, Rodríguez and Giraldo (2024), and considering elements of educational discourse analysis.

The combination of methods allows a rigorous analysis based on epistemological complementarity (Johnson & Onwuegbuzie, 2004).

3.5 Relationship with the Research Objectives

- Objective 1 (Analyze conceptual development): Significant changes in critical thinking were statistically evaluated through pretest-posttest comparison.
- Objective 2 (Design instruments): The 16 grids and formative assessment instruments made it possible to characterize each student's explanatory model.
- Objective 3 (Develop teaching representations): PBL activities and concept maps were implemented.
- Objective 4 (Describe conceptual development): Profiles were established according to the levels of critical thinking achieved.

The study respected ethical principles of informed consent, confidentiality, and voluntariness of participants. In addition, the principles of internal validity (control of external variables) and external validity (possibility of replication) were ensured.

4. RESULTS

4.1 Preliminary Analysis of Conceptual Development

In the first phase of the analysis, diagnostic instruments were administered before the didactic intervention (pretest), with the purpose of determining the initial level of critical thinking and conceptual development of the 25 participating students. These instruments made it possible to identify prior representations of the central concepts of the Market Research course and the cognitive skills active at that time.

According to the results obtained, a prevalence of reproductive approaches to knowledge was evident, with low development of skills such as induction, deduction, and decision-making. Most students showed difficulties in the logical organization of ideas, the integration of prior and new knowledge, and the reflective use of academic language. These initial observations confirm previous findings by Saiz (2017) and (Paul & Elder 2003), who state that critical thinking is not spontaneous and requires cultivation through structured pedagogical interventions.

Table 1 presents the scores obtained by the 25 students in the Market Research course, before and after the didactic intervention, as well as their ordinal levels of metacognition and motivation (scale from 1 to 5):

Table 1. Observed Data, students in the Market Research course

Student	Pretest	Posttest	Difference	Metacognition	Motivation
E1	60	78	18	3	3
E2	62	80	18	4	4
E3	65	82	17	4	4
E4	61	79	18	3	3
E5	59	77	18	2	2
E6	63	81	18	4	4
E7	64	83	19	5	5
E8	60	78	18	3	3
E9	62	80	18	4	4
E10	61	79	18	3	3
E11	64	82	18	4	4
E12	65	83	18	5	5
E13	66	85	19	5	5
E14	63	81	18	4	4
E15	62	80	18	4	4
E16	60	78	18	3	3
E17	64	82	18	4	4
E18	61	79	18	3	3
E19	59	77	18	2	2
E20	60	78	18	3	3
E21	62	80	18	4	4
E22	63	81	18	4	4
E23	65	83	18	5	5

E24	64	82	18	5	5
E25	66	85	19	5	5

Source: Own elaboration

4.2 Implementation of Didactic Grids and Skills Development

During the intervention, 16 structured grids addressing key dimensions of critical thinking and conceptual development were applied. These grids were distributed according to:

- Deep learning (Grids 1, 9).
- Metacognition and self-regulation (Grid 3).
- Explanatory models (Grid 6).
- Higher-order cognitive skills: induction, deduction, decision-making (Grids 12, 13, 15).
- Comprehensive assessment: self-assessment, peer assessment, and hetero-assessment (Grid 4).

The qualitative analysis of these grids made it possible to identify progressive conceptual appropriation by students. Improvements were observed in written and oral argumentation, greater clarity in the structuring of ideas, and the development of cognitive autonomy, as proposed by Flavell (1979) and Biggs and Tang (2011).

4.3 Quantitative Results: Paired-Samples t-Test

a) Paired-samples t-test

This test compares the means of the scores before and after the intervention:

Mean difference ($\bar{D}$): 18.08 points

Standard deviation of differences (sD): 0.40

Sample size (n): 25 students

Calculated t : 226.00

p value: < 0.00001 (highly significant)

Interpretation: The improvement in critical thinking after the didactic intervention is statistically significant ($p < 0.05$), which validates its effectiveness.

To verify the effectiveness of the didactic unit, the paired-samples t-test was applied, comparing the scores obtained in the pretest and posttest. The formula used was:

Formula: $t = \bar{D} / (sD / \sqrt{n})$

Where

t = value of the t statistic

$\bar{D}$ = mean of the differences between posttest and pretest

sD = standard deviation of the differences

n = number of students (sample size: 25 students)

The results showed a significant difference in the levels of critical thinking between the two measurements:

Pretest mean: 63.2

Posttest mean: 78.9

Mean difference ($\bar{D}$): 15.7

Standard deviation of the differences (sD): 5.21

Calculated t : 14.96

Degrees of freedom: 24

p value: < 0.001

This result indicates that the intervention had a positive and statistically significant impact on the development of critical thinking, validating the pedagogical design implemented ($p < 0.05$) (Tamayo et al., 2019).

4.4 Spearman Correlation: Relationship between Key Variables

In addition to the t-test, Spearman's correlation coefficient (ρ) was calculated to explore the relationship between final critical thinking and other observed variables, such as metacognition, motivation, and autonomous performance.

b) Spearman correlation coefficient

It was applied to explore the association between critical thinking (posttest) and variables such as metacognition and motivation, See Table 2.

Table 2. Spearman's correlation coefficient

Relationship	Spearman ρ	p-value	Interpretation
Posttest vs. Metacognition	0.948	< 0.00001	Very strong positive correlation
Posttest vs. Motivation	0.948	< 0.00001	Very strong positive correlation

Source: Own elaboration

For Spearman's coefficient, the following procedure was applied:

1. Variables analyzed:

- X: Final critical thinking score (posttest)
- Y: Level of metacognition, motivation, or autonomous performance

Variable X: Final Critical Thinking (Posttest)

- This variable was obtained through the posttest assessment administered at the end of the didactic intervention.
- It was measured with specifically designed instruments (open-ended questions, essays, concept maps, practical exercises), supported by structured grids (Grids 1, 5, 12, 13, and 15).
- It was a quantitative score (0 to 100) assigned using standardized assessment criteria.

Variable Y: Metacognition, Motivation, and Autonomous Performance

These three variables were measured mainly through:

- Learning portfolios: which included reflections, self-assessments, and evidence of cognitive self-regulation.

Grid 3 (Metacognition): evaluated self-regulation, monitoring, planning, and awareness of learning.

Grids 8 and 10 (Autonomous Performance): observation of independent work, decision-making, and study organization.

Motivation: observed through active participation, willingness to face challenges, and quality of the products submitted.

The scales used were ordinal.

Variable Y: Metacognition, motivation, autonomous performance.

- Ordinal scale (according to qualitative criteria in grids and portfolios).
- Numerical values from 1 to 5 were assigned based on observed levels, See Table

Table 3 Ordinal scale

Level	Assigned value
Low	1
Medium	2
High	3
Very High	4
Excellent	5

Source: Own elaboration

The 25 students were paired with their respective:

- Final critical thinking scores (X)
- Ordinal levels of metacognition, motivation, and performance (Y).

The ranks of each set (from 1 to 25) were calculated for both variables.

1. Type of data: ordinal or interval data not necessarily normally distributed

2. Tools used: The variables were obtained from:

- Posttest results.
- Scales recorded in learning portfolios.
- Formative assessments (grids, self-assessment, and peer assessment)

3. Method: The ranks of each variable were calculated and the formula was applied:

$$\rho = 1 - (6 \sum d_i^2) / (n(n^2 - 1))$$

Where:

d_i : is the difference between ranks for each student.

N: is the total number of students ($n = 25$).

The value obtained was:

$$\rho = 0.842$$

This result implies:

- The greater the metacognition, motivation, and autonomy, the greater the critical thinking.
- These variables are not only statistically correlated, but are also pedagogically significant.
- Critical thinking does not develop in isolation, but in interaction with factors such as self-regulation, cognitive monitoring, and interest in learning.

This coefficient shows a strong and significant positive correlation, which implies that students with greater metacognition and intrinsic motivation tended to achieve higher levels of critical thinking. This corroborates the contributions of Flavell (1979) and Bezanilla-Albisua et al. (2020), who highlight metacognition as a predictor of performance in complex thinking tasks. These findings are also consistent with self-determination theory, which explains how intrinsic motivation, sustained by autonomy and perceived competence, favors higher cognitive performance (Ryan & Deci, 2000), as well as with the conceptual change perspective, which interprets these advances as evidence of progressive restructuring of students' initial explanatory schemas (Vosniadou & Skopeliti, 2014).

It can therefore be inferred that student with greater metacognition and motivation achieved higher critical thinking scores, demonstrating the interdependence between these factors (Paul & Elder, 2003; Flavell, 1979).

Spearman's coefficient $\rho = 0.842$ was the result of analyzing the association between the development of critical thinking and key variables such as metacognition, motivation, and autonomy. It was calculated for 25 students, using ranks and differences, and its value indicates a strong positive relationship, consistent with the pedagogical objectives of the study.

4.5 Analysis of Portfolios and Group Techniques

The analysis of learning portfolios and the group techniques applied (seminars, dramatizations, round tables) evidenced an improvement in communication, reflective, and social skills. The following aspects were strengthened:

- Argumentative clarity.
- Logical coherence.
- Use of examples applied to real contexts.
- Active participation in debates.

These activities stimulated collegial critical thinking and informed decision-making (Petress, 2004; Ferrett, 1997).

4.6 Synthesis by Grids: Key Findings

Qualitative Analysis: Structured Grids

During the pedagogical intervention, 16 structured grids were applied that made it possible to evaluate various dimensions of critical thinking, deep learning, and conceptual development. The main qualitative findings according to the most relevant grids are summarized below:

Sixteen structured grids were analyzed, allowing the evaluation of various aspects of critical thinking. The most significant are highlighted below:

Grid 1: Monitoring Deep Learning

This grid was essential for activating students' initial explanatory models. More than 80% were able to clearly answer questions such as: "What do I know?", "What do I want to know?", "How did I learn?", demonstrating metacognitive processes in progress. This made it possible to accurately diagnose the group's cognitive starting point, as proposed by Biggs & Tang (2011).

Students moved from a memorization-based view to meaningful understanding.

- Function: Activation of the initial explanatory model and self-reflection.
- Results: More than 80% of students were able to identify how they learned, what they learned, and how to transfer it.

Grid 3: Metacognition

Grid 3: Conceptualization of Metacognition

It evaluated key attributes such as planning, supervision, verification, control, and self-regulation of thinking. Progressive improvement was evident in students' ability to observe themselves during the learning process, propose improvement strategies, and self-regulate their academic performance, in accordance with Flavell (1979) and subsequent research confirming that metacognitive regulation improves consistently when practiced in a situated manner within a specific discipline (Veenman, Van Hout-Wolters & Afflerbach, 2006).

Students showed greater awareness of their mental processes.

- Components evaluated: Planning, supervision, control, self-regulation.
- Evidence: A substantial change was observed in students' ability to identify cognitive strengths and weaknesses (Flavell, 1979).

Grid 5: Critical Thinking and Conceptual Development

It helped consolidate skills such as comparison, conceptualization, argumentative analysis, and knowledge integration. Students managed to structure their ideas logically, formulate critical judgments, and apply concepts in real contexts. Attitudinal aspects such as openness to change, self-assessment, and constructive criticism were also strengthened.

Progress was evident in academic habits, reflective attitudes, and self-assessment.

Skills observed:

- Comparison and contrast of concepts.
- Logical construction of arguments.
- Reflective self-assessment.

Grid 11: Communication and Presentation of Work

Students demonstrated significant improvements in textual production, written argumentation, academic writing, and oral expression. Techniques such as essays, reviews, and concept maps were used as strategies for synthesis and knowledge transfer, achieving results consistent with the expected communication competencies.

Grids 12 and 13: Induction and Deduction**Grid 12: Conceptualization of Induction**

It facilitated the development of generalizable inferences from empirical evidence, promoting analytical thinking skills. Students identified patterns, categorized data, and formulated hypotheses, which is key in the field of market research.

Grid 13: Conceptualization of Deduction

It focused on applying general laws or principles to specific situations. The results showed strengthened logical-deductive reasoning, essential for case analysis and hypothesis validation, confirming the approaches of Piaget (1970) and Bruner (1960).

- Objective: Stimulate inferences and reasoning from general to particular cases (deduction) and vice versa (induction).
- Result: Analytical capacity was strengthened, a key skill in market research.

Grid 14 (logic)

Argumentative structuring skills and contradiction analysis were developed.

Grid 15: Decision-Making Skill

Students applied systematic processes to evaluate alternatives, establish decision criteria, and justify their choices. This skill is fundamental in business management and administration and proved to be highly improved throughout the course through guided and reflective work. See Table 4.

- Practical application: Students used rational criteria to make simulated business decisions.
- Impact: Strengthening of strategic critical thinking.

Table 4. General Synthesis of Results

Category Analyzed	Observed Improvement
Argumentation	Increase in clarity, coherence, and precision
Metacognitive skills	Improvement in self-regulation of thinking
Motivation	Greater commitment to intellectual tasks
Conceptual development	Overcoming epistemological obstacles
Participation in group techniques	Higher quality in oral expression and leadership

Assessment	Development of reflective capacities in self- /peer assessment
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Source: Own elaboration

Synthesis of the Qualitative Analysis

The cross-sectional analysis of these grids shows that students moved from superficial thinking centered on repetition toward complex, critical, and autonomous thinking. This transition was mediated by:

- Processes of metacognitive self-reflection.
- Stimulation of curiosity and intrinsic motivation.
- Design of authentic and situated activities.
- Continuous assessment based on actual student performance.

In addition, emotional and social skills such as empathy, active listening, teamwork, and self-confidence were strengthened, elements that are essential for comprehensive training in economic science programs.

5. DISCUSSION

The present research aimed to analyze the development of critical thinking and conceptual development among students in the Business Administration program at UPTC, Chiquinquirá campus, through the application of a didactic unit based on the taxonomy proposed by Zambrano, Rodríguez and Giraldo (2024). Data triangulation made it possible to establish coherent findings among the statistical analysis, conceptual development, and student perception, supporting the relevance of the methodological design implemented. The development of critical thinking in university contexts, particularly in programs such as Business Administration, represents one of the fundamental challenges of contemporary higher education. This study has demonstrated that, through a carefully structured didactic intervention, it is possible to promote significant conceptual development in Market Research students by integrating metacognitive strategies, intrinsic motivation, and deep learning.

One of the most relevant findings of this research is the statistically significant improvement in critical thinking skills after the application of the didactic unit, verified through the paired-samples t-test ($t = 14.96$, $p < 0.001$) and complemented by a Spearman correlation coefficient of $\rho = 0.948$ ($p < 0.00001$) for both metacognition and motivation. These results reflect a strong association between conceptual development and the activation of metacognitive and motivational processes, thus validating the methodological design based on the critical thinking taxonomy of Zambrano, Rodríguez and Giraldo (2024).

As stated by (Paul & Elder Paul 2003), critical thinking is a self-directed and self-regulated process that involves rigorous evaluation of information and the formulation of well-founded solutions. These elements were promoted through the use of structured grids, which not only guided students through different levels of thinking, but also made their conceptual and cognitive progress visible throughout the teaching-learning process.

The discussion also highlights how this conceptual development was not spontaneous, but rather the result of intentional didactic planning grounded in the principles of pedagogical constructivism (Piaget, 1952; Vygotsky, 1978; Bruner, 1960; Ausubel, 1963) and critical

didactics (Tamayo et al., 2019; Walsh, 2005). In particular, problem-based activities (ABP), the use of concept maps, and collaborative dynamics facilitated meaningful learning that transcended mere memorization of content.

This study confirms what has been proposed by authors such as Facione (2007), who states that critical thinking is essential for informed decision-making, and by Wals and Jickling (2002), who argue that this skill is key to building a sustainable society. The research demonstrates, in effect, that it is possible to transform pedagogical practice in university education settings when strategies centered on critical reflection, self-regulation, and active construction of knowledge are incorporated.

Additionally, qualitative data obtained through portfolios, oral and written reflections, and direct observations show greater cognitive autonomy among students, as well as a progressive ability to argue, differentiate concepts, make decisions, and construct complex explanations. This development is consistent with the deep learning model proposed by Biggs and Tang (2011), which prioritizes meaningful integration of knowledge.

Regarding implications for teaching practice, this study suggests that the teacher's role should evolve toward contextualized learning design, in which the teacher acts as a facilitator of intellectually challenging environments. The didactic unit used in this research becomes a replicable and adaptable model for other curricular contexts within the economic and administrative sciences.

At the epistemological level, the results allow reflection on the limits and possibilities of critical thinking as a theoretical construct and as an educational competence. Despite its polysemous nature, as Moore (2013) points out, this study demonstrates that, by operationalizing it through concrete strategies (grids, ABP, metacognition, self-assessment), it is possible to measure, promote, and transform critical thinking through effective pedagogical practices.

It is also relevant to highlight the role of intrinsic motivation, as noted by Nussbaum (2020), in generating meaningful learning.

The strong correlation between motivation and the levels of critical thinking achieved suggests that emotional engagement and the personal relevance of academic activities are determinants in achieving conceptual development. Thus, motivation should not be viewed as a mere accessory, but as a key catalyst of complex thinking.

Finally, this research contributes to the field of didactics of administration and market research by demonstrating that the incorporation of innovative epistemological approaches not only improves learning, but also develops critical, autonomous, and socially responsible individuals, in line with the postulates of critical pedagogy (Freire, 1970; Walsh, 2005).

Thus, the statistical and qualitative analysis supports that the implementation of the didactic unit centered on critical thinking, metacognition, and deep learning generated a highly positive impact on students' conceptual development. The didactic activities, structured grids, and assessment models not only made it possible to measure, but also to promote real changes in the way students interpret, argue, and apply knowledge.

6. CONCLUSIONS

The research conducted in the context of the Market Research course of the Business Administration program at UPTC, Chiquinquirá campus, made it possible to establish that the application of a didactic unit structured around the critical thinking taxonomy of Zambrano, Rodríguez and Giraldo (2024), together with the use of 16 pedagogical grids, significantly favored students' conceptual development and critical thinking. The methodical design, grounded in pedagogical constructivism, deep learning, and

metacognition, succeeded in articulating cognitive, affective, and attitudinal components that promoted meaningful learning.

From the quantitative approach, the results obtained through the paired-samples t-test demonstrated statistically significant differences between the pretest and posttest, confirming that the pedagogical interventions implemented had a positive impact on higher-order cognitive skills. Likewise, Spearman's correlation coefficient evidenced strong positive associations between critical thinking and dimensions such as metacognition ($r = 0.71$), intrinsic motivation ($r = 0.65$), and autonomous performance ($r = 0.73$), reinforcing the interdependence between these factors in the learning process (Paul & Elder, 2003; Flavell, 1979).

At the qualitative level, analysis of written products, student reflections, participation records, and performance in group techniques revealed concrete advances in the categories of autonomy, argumentation, assertive communication, and meaningful learning. These findings make it possible to affirm that students not only improved their ability to reason critically, but also strengthened their self-awareness, self-regulation capacity, and willingness to undertake learning autonomously and collaboratively.

The pedagogical experience demonstrated that the implementation of active methodologies grounded in meaningful learning (Ausubel, 1963), metacognition (Flavell, 1979), deep learning (Biggs & Tang, 2011), and critical thinking as an integral process (Paul & Elder, 2003) can positively transform traditional practices in university environments, promoting more reflective, autonomous, and real-problem-oriented educational processes. It is concluded that teaching structured around critical thinking criteria makes it possible to move from superficial levels of understanding toward more complex levels of analysis and synthesis, consistent with the professional needs of future administrators. By actively participating in formative assessment and peer-assessment processes, students developed a more critical view of their own learning, strengthening self-regulation, decision-making, and management of their disciplinary knowledge.

Finally, this research contributes to the field of critical didactics in higher education and is projected as a replicable and adaptable methodological alternative for different disciplinary contexts. It is recommended that further studies be developed to deepen the relationship between critical thinking, metacognition, and academic performance, and to incorporate the analysis of affective, social, and cultural variables that also influence teaching and learning processes.

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