EDUCAÇÃO EMPREENDEDORA ATIVA, COGNIÇÃO E INTENÇÃO EMPREENDEDORA: EVIDÊNCIAS ESTRUTURAIS E PRÉ-PÓS COM ESTUDANTES UNIVERSITÁRIOS BRASILEIROS

ACTIVE ENTREPRENESHIP EDUCATION, COGNITION, AND ENTREPRENEURIAL INTENTION: STRUCTURAL AND PRE-POST EVIDENCE FROM BRAZILIAN UNIVERSITY STUDENTS

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Objetivo do estudo
Integrar a metacognição à Teoria do Comportamento Planejado para explicar a intenção empreendedora e avaliar se essa intenção se altera após uma disciplina obrigatória de empreendedorismo baseada em metodologias ativas.

Relevância/originalidade
O estudo aproxima educação empreendedora, metacognição e intenção em um mesmo quadro explicativo, examinando mecanismos cognitivos associados ao controle comportamental percebido e combinando evidências estruturais com mudanças observadas ao longo de uma experiência educacional.

Metodologia/abordagem
Adotou-se um desenho complementar em duas etapas: modelagem de equações estruturais baseada em 336 estudantes de graduação e análise pré-pós com 50 participantes pareados. A mudança na intenção empreendedora foi examinada por teste t pareado e Cohen’s d.

Principais resultados
O conhecimento metacognitivo associou-se ao controle comportamental percebido, que apresentou a relação mais forte com a intenção empreendedora. O modelo explicou 46,2% de sua variância. Após a disciplina, a intenção aumentou de 3,1 para 3,5, com efeito médio.

Contribuições teóricas/metodológicas
A pesquisa posiciona o conhecimento metacognitivo como antecedente cognitivo do julgamento de viabilidade dentro da Teoria do Comportamento Planejado e demonstra a utilidade de combinar modelagem estrutural e avaliação pré-pós sem confundir associação estrutural com evidência causal longitudinal.

Contribuições sociais/para a gestão
Os resultados indicam que disciplinas obrigatórias podem ampliar o acesso a experiências empreendedoras e sugerem que projetos, validação de mercado, simulações, reflexão e contato com empreendedores sejam organizados para desenvolver julgamento, capacidade de adaptação e percepção de controle.

Palavras-chave: Educação empreendedora, Metacognição, Intenção empreendedora, Metodologias ativas, Teoria do Comportamento Planejado

ACTIVE ENTREPRENESHIP EDUCATION, COGNITION, AND ENTREPRENEURIAL INTENTION: STRUCTURAL AND PRE-POST EVIDENCE FROM BRAZILIAN UNIVERSITY STUDENTS

Study purpose
To integrate metacognition into the Theory of Planned Behavior to explain entrepreneurial intention and assess whether intention changes after a compulsory entrepreneurship course based on active learning methodologies.

Relevance / originality
The study connects entrepreneurship education, metacognition, and intention within a common explanatory framework, examining cognitive mechanisms associated with perceived behavioral control while combining structural evidence with changes observed during an educational experience.

Methodology / approach
A complementary two-stage design combined structural equation modeling using data from 336 undergraduate students with a pre-post analysis of 50 matched participants. Changes in entrepreneurial intention were examined using a paired-samples t test and Cohen's d.

Main results
Metacognitive knowledge was associated with perceived behavioral control, which showed the strongest relationship with entrepreneurial intention. The model explained 46.2% of its variance. Following the course, intention increased from 3.1 to 3.5, representing a medium within-person effect.

Theoretical / methodological contributions
The study positions metacognitive knowledge as a cognitive antecedent of feasibility judgments within the Theory of Planned Behavior and shows the value of combining structural modeling with pre-post assessment without treating structural associations as longitudinal causal evidence.

Social / management contributions
The findings indicate that compulsory courses can broaden access to entrepreneurial experiences and suggest organizing venture projects, market validation, simulations, reflection, and interaction with entrepreneurs to develop judgment, adaptive capacity, and perceived behavioral control.

Keywords: Entrepreneurship education, Metacognition, Intenção empreendedora, Active methodologies, Theory of Planned Behavior

ACTIVE ENTREPRENEURSHIP EDUCATION, COGNITION, AND ENTREPRENEURIAL INTENTION: STRUCTURAL AND PRE-POST EVIDENCE FROM BRAZILIAN UNIVERSITY STUDENTS

1 Introduction

Entrepreneurship education has gained relevance because it can prepare students to recognize opportunities, mobilize resources, and respond to uncertain work environments rather than merely transmit procedures for opening a business. In Brazil, this agenda also reaches basic education. The Base Nacional Comum Curricular provides competency-based space for entrepreneurial practices, work-related learning, autonomy, and life-project development, although it does not establish a uniform national entrepreneurship course (Brasil, 2018). Higher education therefore receives students with uneven prior exposure and must provide more systematic opportunities to learn through action.

This shift is not unique to Brazil. International literature similarly frames entrepreneurship education as a vehicle for developing cognitive and attitudinal competencies, strategic thinking, calculated risk-taking, and opportunity recognition in opposition to mere technical instruction (Rae, 2006; Hattab, 2014). Curricular design choices, in turn, shape which of these competencies a program can realistically develop (McVay, Murphy, & Yoon, 2008; Sobh, Younis, & Keshta, 2025).

Entrepreneurial action is usually preceded by intention, which makes the Theory of Planned Behavior (TPB) a useful framework to study educational outcomes. The theory proposes that attitude toward behavior, subjective norms, and perceived behavioral control shape behavioral intention (Ajzen, 1991, 2002). In entrepreneurship research, these dimensions capture whether starting a venture is considered desirable, socially supported, and feasible (Liñán & Chen, 2009). Education may affect these judgments by changing what students know, how capable they feel, and how they interpret entrepreneurship as a career option.

Research evaluating entrepreneurship education has consequently moved beyond venture counts and satisfaction surveys. Fayolle et al. (2006) proposed using TPB as an assessment framework and comparing the same participants before and after an educational intervention. This approach recognizes that a course may raise intention, strengthen perceived control, or produce a more realistic appraisal of entrepreneurial demands. Changes need not follow the same direction across all constructs, which is why program evaluation should distinguish cognitive mechanisms from the final intention score.

Metacognition offers a cognitive explanation for these educational effects. It concerns awareness and regulation of one's thinking, including what a person knows about tasks and strategies, how previous experiences are interpreted, and how feedback is used to revise a course of action (Haynie & Shepherd, 2009; Haynie et al., 2010). Because metacognition is a learned and adaptable process, venture projects, customer validation, simulations, and structured reflection may help students replace passive knowledge with more deliberate entrepreneurial judgment.

Existing studies often identify associations between entrepreneurship education, cognitive characteristics, and entrepreneurial intention, but cross-sectional evidence cannot show whether intention changes during a course (Bae et al., 2014; Ratten & Usmanij, 2021). This study addresses that limitation through two complementary analyses. First, a structural model based on 336 undergraduates examines metacognitive knowledge, perceived behavioral control, and entrepreneurial intention. Second, a paired pre-post assessment tests whether intention changed among 50 students who completed a compulsory course based on active entrepreneurship education.

The research question is: To what extent does a compulsory course based on active methodologies modify students' metacognition, and how is this change converted into changes in personal attraction, perceived behavioral control, and entrepreneurial intention? The available evidence answers this question in two complementary, but not fully longitudinal, steps. The structural sample tests the proposed cognitive and motivational relationships, whereas the matched course sample establishes whether entrepreneurial intention changed during the instructional period. Because metacognition, personal attraction, and perceived control were not measured at both course occasions, their longitudinal mediation remains a proposition for future direct testing.

Accordingly, the study aims to integrate metacognition with the TPB to explain entrepreneurial intention and to assess whether intention changes after a compulsory active-learning course. It contributes by connecting program evaluation to specific cognitive mechanisms, by distinguishing standardized path coefficients from explained variance, and by reporting the reliability and indicator limitations that define the evidential boundary of the model.

2 Theoretical framework

Entrepreneurship education can influence entrepreneurial intention, but its effects depend on what students do during the learning process and on the cognitive resources they bring to it. Meta-analytic evidence indicates a positive, although heterogeneous, relationship between entrepreneurship education and intention (Bae et al., 2014). This variation directs attention to course design. Programs organized around authentic problems, iterative projects, social interaction, and feedback provide conditions in which students can evaluate entrepreneurship using evidence generated by their own actions.

More recent syntheses confirm the same pattern of heterogeneity: pedagogical design, disciplinary context, and cultural setting all moderate the effect, so that no single course format guarantees a gain in intention (Ameri et al., 2026). This heterogeneity directs attention to course design as the central explanatory variable and motivates a framework in which specific cognitive mechanisms, rather than program exposure alone, connect teaching to intention. Evaluation research has repeatedly found mixed results, including a widely discussed finding that formal coursework can produce no measurable gain, or even a temporary decline, in self-assessed entrepreneurial attitudes (Oosterbeek, van Praag, & IJsselstein, 2010). One interpretation is that realistic exposure to entrepreneurial tasks corrects overly optimistic prior beliefs, lowering self-reported attitudes even as usable competence increases; another is that some courses simply do not engage the mechanisms that intention formation requires. Both readings point to the same conclusion: evaluating entrepreneurship education by intention scores alone, without a theory of what changed and why, cannot distinguish a course that failed to work from one that recalibrated unrealistic expectations. It is this evidential quality of active methodologies, more than curricular content per se, that the present framework treats as the operative mechanism.

2.1 Active methodologies in entrepreneurship education

Active methodologies place students in situations that resemble entrepreneurial work. Developing a venture proposal, testing assumptions with potential customers, managing a sales funnel, and making decisions in a simulation require students to connect concepts with uncertain information. Live projects can develop entrepreneurial skills because learners must revise plans after contact with external stakeholders rather than wait for a predetermined answer (Bandera et al., 2018; Chang & Rieple, 2013). Reflection turns these activities into learning by making the reasons for adaptation explicit.

Systematic reviews of experiential entrepreneurship education converge on this same requirement for reflection. Motta and Galina (2023) synthesized the experiential-learning literature and concluded that learning-by-doing activities generate positive effects on entrepreneurial intention and skill development mainly when they are structured around a full experiential cycle rather than offered as isolated exercises. A parallel review by Carpenter and Wilson (2022) reported that practice-oriented pedagogy produced consistently stronger learning outcomes than content-transmission pedagogy across the highest-validity studies they examined, while also cautioning that many published evaluations lack the methodological rigor needed to isolate the pedagogy's specific contribution from selection and maturation effects. This caution matters directly for the present study, since it anticipates the limitations that the pre-post component below must also confront.

The educational setting also supplies social information by teamwork, peer evaluation, mentoring, and contact with entrepreneurs expose students to different strategies and make entrepreneurial careers more concrete. Role models can reduce psychological distance from entrepreneurship, while feedback from classmates and customers forces learners to compare their initial assumptions with observed responses (Abbasianchavari & Moritz, 2021; Bellò et al., 2018). Consistent with social learning theory, exposure to entrepreneurial role models has been shown to operate partly through perceived behavioral control: observing a model navigate uncertainty appears to strengthen students' sense that entrepreneurial tasks are within their own capability, which then carries forward into stronger entrepreneurial intention or calling (Jin et al., 2023). This mediating pathway is conceptually close to the one this study proposes for metacognitive knowledge, suggesting that social and cognitive routes to perceived control may reinforce one another inside a well-designed course rather than operate as separate, competing explanations. These processes are especially relevant in compulsory courses, where participation is not restricted to students who already intend to become entrepreneurs.

2.2 Metacognitive knowledge and perceived behavioral control

Metacognitive knowledge concerns conscious understanding of people, tasks, and strategies. In an entrepreneurial context, it includes knowing which information is required to assess a market, recognizing one's strengths and limitations, and selecting an appropriate strategy when initial assumptions fail (Haynie & Shepherd, 2009; Haynie et al., 2010). Active coursework can make this knowledge more usable because students repeatedly plan, act, receive feedback, and reconsider how they approached the task.

A recent systematic review of the entrepreneurial-metacognition literature situates this knowledge dimension within a broader mental architecture that entrepreneurs use to sense, act, and mobilize cognitive resources under uncertainty (Bastian et al., 2025). Their synthesis notes that metacognitive research in entrepreneurship, although expanding rapidly, remains fragmented across independent and dependent variables and has produced few studies that connect metacognition explicitly to established motivational frameworks such as TPB. The present study responds directly to that gap by treating metacognitive knowledge as an antecedent within, rather than an alternative to, the TPB sequence. This positioning also distinguishes the construct from the more commonly studied entrepreneurial self-efficacy: whereas self-efficacy captures a general belief in one's capability, metacognitive knowledge captures the more specific, task-level understanding of what a venture problem requires and which strategy fits it, which is a plausible input to, rather than a synonym for, a feasibility judgment.

Perceived behavioral control refers to the perceived ease or difficulty of performing a behavior and is closely related to judgments of capability and feasibility (Ajzen, 1991, 2002). Students who understand entrepreneurial tasks and can identify alternative strategies have a stronger basis for judging that they could start and manage a venture. The relationship is not

automatic, since realistic exposure may also reveal constraints, but better organized metacognitive knowledge should support a more informed sense of control. *H1: Metacognitive knowledge is positively associated with perceived behavioral control.*

2.3 Metacognitive experience, subjective norms, and personal attraction

Metacognitive experience concerns feelings, judgments, and situational interpretations that accompany a cognitive task. In entrepreneurship education, an experience of successfully reframing a customer problem or recovering from a failed assumption can change how attractive entrepreneurial action appears. Personal attraction captures the favorable evaluation of an entrepreneurial career. Active tasks make that evaluation more concrete because students experience both the autonomy and the demands of venture creation instead of evaluating an abstract occupation.

The social environment also informs attraction and by doing do subjective norms represent perceived approval or disapproval from important others (Ajzen, 1991; Liñán & Chen, 2009). Peers, teachers, family members, mentors, and entrepreneurs can legitimize or discourage venture creation, while role models make a possible entrepreneurial identity more visible (Abbasianchavari & Moritz, 2021; Bellò et al., 2018). Mentorship pedagogy research reinforces this point empirically: direct engagement with mentors and entrepreneurs has been linked to increased entrepreneurial confidence through an observational, Bandura-style modeling process in which students assimilate attitudes and behaviors they see demonstrated rather than merely described (Yuliawan et al., 2025). Because the compulsory course examined in this study explicitly incorporated contact with practicing entrepreneurs through community outreach, this literature provides a specific behavioral channel through which subjective norms could plausibly be strengthened, in addition to their conceptual role within TPB. *H2: Metacognitive experience is positively associated with personal attraction. H3: Subjective norms are positively associated with personal attraction.*

2.4 Personal attraction, perceived behavioral control, and entrepreneurial intention

Entrepreneurial intention represents a deliberate willingness to pursue venture creation rather than a general interest in business. Personal attraction represents desirability, whereas perceived behavioral control represents feasibility. Within TPB, both should contribute to intention, and perceived control may be especially relevant when the behavior requires complex knowledge, resources, and sustained action. Evidence from university students has repeatedly linked these evaluations to entrepreneurial intention, including studies conducted in Brazil and other emerging economies (Liñán & Chen, 2009; Sousa et al., 2022; Yurtkoru et al., 2014). This pattern, in which perceived behavioral control tends to outweigh personal attraction as a correlate of intention when both are estimated jointly, recurs across independent TPB applications in entrepreneurship research and is not idiosyncratic to the Brazilian context examined here. *H4a: Personal attraction is positively associated with entrepreneurial intention. H4b: Perceived behavioral control is positively associated with entrepreneurial intention.*

2.5 Educational intervention and pre-post change

The structural relationships explain why an active course may influence intention, but program evaluation also requires evidence that participants changed during the educational period. A paired design compares each student with his or her own baseline and therefore removes stable between-person differences from the mean comparison. It does not eliminate maturation, external events, or response-shift effects, yet it provides stronger temporal evidence than a single post-course survey when a comparison group is unavailable (Fayolle et al., 2006).

This evaluative tradition remains active and contested. Recent contributions continue to interrogate not only whether entrepreneurship education changes intention, but for whom it is

designed and which forms of entrepreneurial agency it legitimizes (Fayolle et al., 2026). Applied program evaluations using pre-post designs in other institutional settings report a similar pattern to the one hypothesized here, with entrepreneurial self-efficacy and perceived behavioral control functioning as proximal, trainable outcomes that a single-cohort pre-post design can detect even without a control group (Karlsson & Moberg, 2013). This literature supports a paired design as an appropriate, if bounded, evaluation strategy, while also cautioning against overinterpreting a mean increase as evidence that the course serves all students, or all versions of entrepreneurship, equally well.

The proposed model treats metacognitive knowledge as a cognitive resource that informs perceived feasibility, while the pre-post component evaluates whether entrepreneurial intention changed across a compulsory course. These parts address different questions and should not be merged into an unsupported mediation claim. The structural model examines the relationship among constructs, whereas the paired test evaluates within-student change in a directly reported intention score. *H5: Entrepreneurial intention is higher after the compulsory entrepreneurship course than before it.*

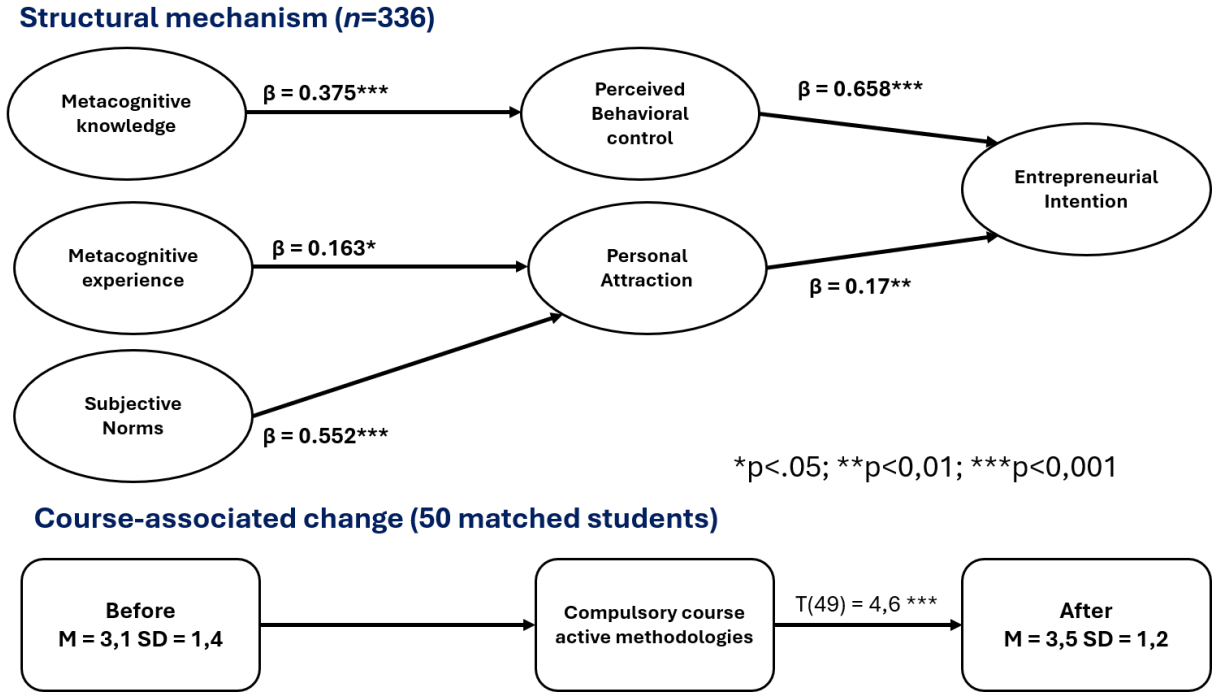


Figure 1. Conceptual model and complementary empirical design

Note. The upper panel presents the focal paths from the structural model. The lower panel presents the paired pre-post assessment of entrepreneurial intention. Source: prepared by the authors.

3 Methodology

The research used a complementary two-stage design. The first stage was a cross-sectional survey developed to test the cognitive mechanism linking metacognitive knowledge, perceived behavioral control, and entrepreneurial intention. The second stage was a one-group pre-post assessment conducted in a compulsory entrepreneurship course. Keeping the stages separate is methodologically important because the structural survey measured several latent constructs, whereas the course assessment used a single direct item to capture change in entrepreneurial intention.

3.1 Study context

Data were collected in an undergraduate business administration program at a Brazilian public university. The curriculum requires final-year students to complete entrepreneurship-related coursework, which reduces the self-selection common in elective programs. The course examined in the pre-post stage used venture development, opportunity recognition, customer validation, sales-funnel activities, and technology-supported simulations. Students had to make decisions with incomplete information, receive market feedback, and adjust their proposals during the semester.

The course also connected classroom activities with the Entrepreneurial Network, a community outreach initiative through which entrepreneurs discuss concrete decisions, mistakes, and adaptations with students. These encounters supplied vicarious experience and broadened access to role models. Taken together, the course components represented an active entrepreneurship education intervention because conceptual content was repeatedly applied to decisions, external feedback, and revision of action strategies rather than assessed only through content recall.

3.2 Participants and procedures

The structural stage used 336 complete anonymous responses from undergraduate students. Of these participants, 219 were younger than 24 years and 117 were 24 years or older. The pre-post stage comprised 50 students with matched responses at both measurement occasions, as indicated by the 49 degrees of freedom in the paired test. The baseline question was administered before the course activities, and the same item was reapplied after completion of the instructional period.

3.3 Measures

For the structural stage, metacognition was assessed with an adapted version of the 36-item Measure of Adaptive Cognition developed by Haynie and Shepherd (2009). Responses were recorded on a seven-point agreement scale. The focal analysis used metacognitive knowledge and metacognitive experience. TPB constructs—personal attraction, subjective norms, perceived behavioral control, and entrepreneurial intention—were measured with adapted items from Liñán (2008) and Liñán and Chen (2009), also using seven-point response scales. The parsimonious final measurement specification retained only two indicators for some dimensions. Although an identified two-indicator factor can be estimated under constraints, it is less stable and less capable of representing content breadth than a factor with at least three adequate indicators.

The pre-post assessment deliberately used a simpler instrument. Students answered one question about their intention to start a business, rated from 1 to 5, before and after the compulsory course. Because this was a single observed item, it was not modeled as a latent construct and no internal-consistency coefficient was calculated. The measure provides a direct and low-burden indicator of perceived intention, but it does not capture the full content domain represented by multi-item entrepreneurial-intention scales.

3.4 Data analysis

Covariance-based structural equation modeling was estimated with the lavaan package in R to evaluate the measurement model and the structural relationships simultaneously (Rosseel, 2012). Model fit was examined with chi-square, the chi-square to degrees-of-freedom ratio, CFI, GFI, NFI, RMSEA, and standardized RMR. Convergent and discriminant evidence was examined using average variance extracted, composite reliability, and the Fornell-Larcker criterion. The pre-post scores were analyzed with a paired-samples t test, and Cohen's dz was calculated as t divided by the square root of the number of matched pairs.

Table 1. Complementary research stages

Stage	Purpose and design	Sample and measure	Analysis
Structural	Test the focal cognitive mechanism using a cross-sectional survey	N = 336; metacognition and TPB measures on seven-point scales	CB-SEM in lavaan
Pre-post	Assess within-student change across a compulsory active-learning course	n = 50 matched pairs; one EI item on a five-point scale	Paired t test and Cohen's dz

Note. CB-SEM = covariance-based structural equation modeling; TPB = Theory of Planned Behavior; EI = entrepreneurial intention. Source: prepared by the authors.

4 Results Analysis and Discussion

4.1 Measurement evidence

The measurement model presented acceptable fit: $\chi^2 = 92.7$ with 57 degrees of freedom, $\chi^2/df = 1.63$, CFI = .98, GFI = .99, NFI = .96, RMSEA = .04, and standardized RMR = .04. Average variance extracted ranged from .510 to .849, and the square root of each construct's AVE exceeded its correlations with the other constructs. These results support convergent and discriminant interpretation of the measures, while the reliability evidence requires one qualification.

Composite reliability ranged from .722 to .918 for entrepreneurial intention, personal attraction, perceived behavioral control, subjective norms, and metacognitive experience. Metacognitive knowledge produced CR = .665 and AVE = .510. Its reliability therefore did not reach the usual .70 guideline, and prior validation of the broader scale does not, by itself, remove this limitation. The construct was retained because of its theoretical role, but its coefficients are interpreted cautiously. Together with the use of only two indicators for some dimensions in the final parsimonious model, this result requires replication with at least three well-performing indicators for every latent variable.

4.2 Structural relationships

All proposed structural relationships were positive and statistically significant. Metacognitive knowledge was associated with perceived behavioral control ($\beta = .375$, $z = 3.59$, $p < .001$), supporting H1. Metacognitive experience was associated with personal attraction ($\beta = .163$, $p = .017$), supporting H2, and subjective norms were associated with personal attraction ($\beta = .552$, $p < .001$), supporting H3. Personal attraction was associated with entrepreneurial intention ($\beta = .170$, $p = .003$), supporting H4a, and perceived behavioral control was associated with entrepreneurial intention ($\beta = .658$, $z = 5.83$, $p < .001$), supporting H4b. These values are standardized path coefficients, not percentages of explained variance.

The complete structural model explained 46.2% of the variance in entrepreneurial intention ($R^2 = .462$). This R^2 value, rather than the individual coefficients of .375, .552, or .658, expresses the proportion of variance explained by the set of predictors. The result provides

additional evidence that the integrated cognitive and TPB framework accounts for a substantive portion of differences in intention, although the cross-sectional design does not establish the temporal order of the relationships.

4.3 Course-associated change

Entrepreneurial intention also increased across the course. Before the intervention, the mean was 3.1 (SD = 1.4); after the course, it was 3.5 (SD = 1.2). The paired comparison was statistically significant, $t(49) = 4.6$, $p < .001$, with an average increase of .4 scale points. The standardized within-person change was Cohen's $dz = .65$, which represents a medium effect. This finding supports H5 and indicates that the students reported stronger entrepreneurial intention after the compulsory course than at baseline.

Table 2. Focal structural relationships and pre-post entrepreneurial intention

Evidence	Relationship or occasion	Estimate	Test	p / effect
Structural	MK -> PBC	$\beta = .375$	$z = 3.59$	$p < .001$
Structural	PBC -> EI	$\beta = .658$	$z = 5.83$	$p < .001$
Structural	Explained variance in EI	$R^2 = .462$	Full model	46.2%
Pre-post	Before	$M = 3.1$	$SD = 1.4$	$n = 50$
Pre-post	After	$M = 3.5$	$SD = 1.2$	$n = 50$
Pre-post	Paired change	$\Delta M = .4$	$t(49) = 4.6$	$p < .001$; $dz = .65$

Note. The table highlights the focal structural paths used to connect the cognitive mechanism with the educational argument. Structural estimates derive from N = 336; pre-post results derive from 50 matched students. Source: prepared by the authors.

Taken together, the analyses provide complementary evidence. The structural stage identifies a plausible cognitive route from metacognitive knowledge to intention through perceived behavioral control. The paired stage shows that intention was higher after the course. Since metacognition and perceived control were not measured at both pre-post occasions, the data do not demonstrate that they mediated the observed increase. The mechanism remains theoretically and empirically supported by the structural sample, but it requires direct longitudinal testing.

4.4 Integrated discussion

The results connect entrepreneurship education with a specific cognitive mechanism rather than treating course attendance as a sufficient explanation for entrepreneurial intention. In the structural sample, students who reported stronger metacognitive knowledge also reported greater perceived control, and perceived control was the strongest focal correlate of intention. In the course sample, the mean intention score increased after participation. This combination suggests that educational activities may matter when they help students understand entrepreneurial tasks and judge that action is within their capabilities.

Active methodologies are relevant to this process because they expose students to the parts of entrepreneurship that cannot be learned only from lectures. Venture development and customer interviews require choices about what information matters; sales-funnel exercises make the consequences of assumptions observable; simulations allow decisions to be tested without the full cost of market failure. Each activity can generate a cycle of planning, feedback, reflection, and revision, which corresponds to the metacognitive processes described by Haynie et al. (2010). Consistent with the systematic account of entrepreneurial metacognition proposed by Bastian et al. (2025), the present findings position metacognitive knowledge as a mobilizable cognitive resource rather than a fixed trait, which is the interpretation that justifies treating it as

a legitimate target of course design rather than merely a selection characteristic of certain students.

The coefficient from perceived behavioral control to entrepreneurial intention (β = .658) indicates a strong standardized association, but it should not be described as 65.8% explanatory power. Its educational meaning lies in the relative importance of feasibility judgments. A student may value entrepreneurship yet avoid it if venture creation appears beyond his or her capacity. Courses can address this gap by dividing complex tasks into manageable decisions, allowing repeated practice, and making progress visible through external feedback. This relative weighting is not unique to the present sample: perceived behavioral control has emerged as a comparatively strong TPB predictor of entrepreneurial intention across independent studies and cultural settings, which suggests that feasibility judgments carry disproportionate weight in entrepreneurial decision-making more broadly, not only in this Brazilian sample.

4.4.1 Theoretical implications

Three theoretical contributions follow from these results. First, the study answers a call, made explicitly in recent systematizations of the entrepreneurial-metacognition literature, to connect metacognitive constructs more directly to established motivational theories rather than studying them as a parallel, loosely integrated stream (Bastian et al., 2025). By nesting metacognitive knowledge inside a TPB sequence and estimating it alongside personal attraction, subjective norms, and perceived behavioral control, the model specifies one concrete cognitive antecedent of feasibility judgments instead of leaving perceived behavioral control unexplained, as it remains in most TPB applications in entrepreneurship research.

Second, the pattern of results helps distinguish metacognitive knowledge from adjacent constructs with which it is sometimes conflated, particularly entrepreneurial self-efficacy. Self-efficacy captures a generalized belief in one's capability, whereas metacognitive knowledge, as operationalized here, captures a more specific understanding of what a task requires and which strategy fits it. The composite reliability observed for metacognitive knowledge, below the conventional threshold (CR = .665), is consistent with this construct being harder to capture with few items precisely because it concerns implicit, situated knowledge rather than a generalized self-belief; other reviews of entrepreneurship-education outcomes note a similar pattern, in which learning-through-experience competencies are frequently the weakest measured dimension because they are individual and difficult for students to verbalize on a standardized scale (Liszt-Rohlf et al., 2025). This is a measurement observation, not a justification for the low reliability, and the limitations section returns to it accordingly.

Third, the coexistence of a robust structural pathway with a modest but significant pre-post change offers a methodological argument for complementary designs in program evaluation research. Neither piece of evidence alone would support the same interpretation: the structural model, estimated on a single cross-sectional occasion, cannot show that intention changed; the paired comparison, based on a single item, cannot show why it changed. Together, they narrow the plausible explanations more than either would in isolation, which is the same logic Fayolle et al. (2006) proposed when they first argued for combining a theoretical framework with a before-after assessment of entrepreneurship programs.

4.4.2 Practical and pedagogical implications

For course design, the results favor deliberate alignment between activities and cognitive outcomes. A business project should not be included only because it is practical; it should require students to state assumptions, select a strategy, compare expected and observed responses, and explain what they changed. These reflective requirements convert activity into metacognitive learning. This requirement is not automatically satisfied by any hands-on format,

however: evidence from a project-based learning and mentorship program found that instructor-organized projects alone did not significantly improve entrepreneurial self-efficacy, while direct mentorship from industry professionals did (Wang & Xun, 2026). Applied to the course examined here, this distinction suggests that the Entrepreneurial Network component, through which students had direct contact with practicing entrepreneurs, may have been doing more explanatory work than the venture-development exercises considered in isolation, although the present design cannot separate the specific contribution of each course component from their combined effect.

Social interaction remains part of the educational explanation even when the focal results table is restricted to metacognitive knowledge and perceived control. Peers, mentors, and visiting entrepreneurs supply examples of how decisions are made under uncertainty. They can also challenge narrow images of who can become an entrepreneur. The coefficient from subjective norms to personal attraction in the extended model ($\beta = .552$) indicates an association with favorable evaluation, not that social norms alone explain 55.2% of personal attraction. This magnitude is consistent with research on entrepreneurial role models, which has found that perceived behavioral control can partially mediate the relationship between exposure to role models and entrepreneurial calling, suggesting that social exposure and cognitive-feasibility judgments are not independent educational levers but may reinforce each other when a course combines both (Jin et al., 2023). For instructors with limited class time, these findings suggest a prioritization heuristic: activities that inform students about entrepreneurship without requiring them to act, receive feedback, and revise a plan are less likely to move the strongest predictor of intention identified here.

4.4.3 Implications for educational policy

The Brazilian educational context gives the findings a broader curricular meaning. The BNCC associates learning with autonomy, work, responsible choice, and life projects, and its implementation materials present entrepreneurial practices across educational stages (Brasil, 2018). Yet the national framework does not prescribe a single, standardized program of entrepreneurship education. Students can therefore enter university with markedly different experiences. A compulsory course can provide a common practical foundation while avoiding the selection bias produced when only already-interested students enroll.

This curricular space is not free of debate. Critical analyses of the BNCC's entrepreneurship provisions have argued that framing entrepreneurial competencies primarily around individual autonomy and responsibility risks presenting economic outcomes as a matter of personal initiative alone, potentially understating the structural conditions that shape who can act on entrepreneurial intention (Bucioli et al., 2022). This critique does not contradict the present findings, but it qualifies their policy implication: demonstrating that a compulsory course can raise perceived control and intention is evidence that structured active learning is pedagogically effective, not evidence that expanding entrepreneurial intention is a self-sufficient response to youth unemployment or regional inequality. A policy reading should therefore separate two claims that are easy to conflate: that active entrepreneurship education can strengthen the cognitive and motivational precursors of venture creation among the students who receive it, which this study supports, and that increasing entrepreneurial intention at scale is an adequate substitute for other labor-market and educational policies, which this study does not test. With that qualification, universities need to recognize unequal prior exposure to entrepreneurial content from basic education and design compulsory experiences that combine conceptual instruction with action and reflection, which is consistent with a broader reading of entrepreneurial competencies as transferable to employment and civic contexts beyond venture founding, a point increasingly emphasized in recent entrepreneurship-education scholarship

that treats the field as preparing adaptive decision-makers rather than exclusively future founders (Fayolle et al., 2026).

The paired result is consistent with an educational contribution, but the design sets clear limits on interpretation. The study did not include a comparison group, and the pre-post measure consisted of one intention item. Change may partly reflect maturation, events outside the course, or a different interpretation of the question after students learned more about entrepreneurship. The finding should therefore be described as a medium increase associated with the course, not as a definitive causal effect of any single active methodology.

5 Conclusions and Final Considerations

This study examined entrepreneurial intention through two complementary forms of evidence. The structural analysis showed that metacognitive knowledge was positively associated with perceived behavioral control and that perceived control was, in turn, positively associated with entrepreneurial intention. The pre-post analysis showed that intention increased from M = 3.1 to M = 3.5 among 50 students completing a compulsory entrepreneurship course, with a statistically significant medium within-person effect.

The main educational contribution is to explain why active entrepreneurship education may be related to intention. Activities such as venture creation, market validation, simulations, mentoring, and contact with entrepreneurs can improve students' understanding of tasks and strategies while giving them evidence about their ability to act. This interpretation links course design to metacognition and perceived behavioral control instead of assuming that exposure to business content automatically produces entrepreneurial intention. It also responds to a specific gap identified in recent reviews of entrepreneurial metacognition, which have called for research connecting metacognitive constructs more explicitly to established intention frameworks rather than treating them as a separate line of inquiry (Bastian et al., 2025).

The theoretical value of the study lies less in any single path coefficient than in the structure of the explanation it offers. By distinguishing standardized coefficients from the variance explained in entrepreneurial intention, and by keeping the cross-sectional mechanism separate from the paired change evidence, the study offers a model of what an active course plausibly does, cognitively, without claiming more temporal or causal certainty than the design supports. This distinction is not a rhetorical caveat; it directly shapes what future research needs to test, and it is the reason the study's contribution is framed as a plausible, evidence-consistent mechanism rather than a demonstrated causal chain.

The findings also support a curricular discussion that begins before higher education. Entrepreneurial practices are compatible with the competencies and life-project orientation of the BNCC, but Brazilian basic education does not operate under one uniform entrepreneurship program. Universities therefore need to recognize unequal prior exposure and design compulsory experiences that combine conceptual instruction with action and reflection. Such courses may create a shared learning base without requiring every student to adopt entrepreneurship as a career. At the same time, this curricular argument should not be read as endorsing entrepreneurial intention as an unqualified educational objective; critical analyses of entrepreneurship's place in Brazilian curricular policy caution against treating entrepreneurial self-reliance as a substitute for addressing the structural conditions that shape opportunity, a distinction that reframes the present results as evidence about pedagogical effectiveness rather than evidence for any particular policy scale-up (Bucioli et al., 2022).

The evidence remains bounded by the cross-sectional structural model, the reliability of metacognitive knowledge below the preferred guideline, the absence of a comparison group, and the single-item pre-post measure. Each of these limitations defines a specific direction for future research rather than a generic call for "more data." First, future studies should apply multi-item measures with at least three indicators per latent variable at both pre-post occasions,

allowing metacognitive knowledge, personal attraction, and perceived behavioral control to be modeled as latent constructs across time rather than assessed only once. Second, researchers should test longitudinal measurement invariance before interpreting any mean change in these constructs, since an apparent increase in a latent mean is uninterpretable if the measurement structure itself shifted between administrations. Third, studies with the institutional capacity to do so should include a comparison group, whether a waitlist cohort, an alternative elective course, or a matched non-compulsory sample, allowing the course-associated change reported here to be distinguished from maturation or from generic semester effects. Fourth, a delayed follow-up would indicate whether the observed gain in intention persists, decays, or continues to develop, a question the present two-occasion design cannot address. Together, these steps would allow direct testing of whether changes in metacognition and perceived control precede changes in entrepreneurial intention, which is the mediational claim this study can motivate theoretically but not yet confirm empirically.

A further avenue concerns the disaggregation of course components. Because the compulsory course combined venture development, customer validation, simulations, and contact with entrepreneurs, the present design cannot determine which components contributed most, nor whether their combination produced effects beyond what any single component would alone (cf. Wang & Xun, 2026). Component-level measurement, whether through repeated assessments across the semester or through experimental variation in which activities students receive, would give course designers more actionable guidance than an evaluation of the compulsory course as a single, undifferentiated treatment.

Finally, because the structural sample and the pre-post sample were drawn from related but not identical groups of students, future work would benefit from a fully longitudinal design in which the same cohort provides both the structural and the pre-post intention data, closing the gap between the two forms of evidence the present study had to treat as complementary rather than integrated. Until then, the mechanism proposed here should be read as a theoretically grounded and empirically supported proposition awaiting longitudinal confirmation, not as an established causal pathway.

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