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Bridging bricolage and effectuation: The mediating role of innovative behavior in student entrepreneurial action under resource constraints

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Abstract

PURPOSE: *The purpose of this article is to examine how entrepreneurial bricolage enables student entrepreneurs to overcome resource constraints and uncertainty, fostering entrepreneurial action. Specifically, it investigates the mediating role of innovative behavior in translating entrepreneurial bricolage into discovery and exploitation activities.* ***METHODOLOGY:*** *A quantitative research design was employed, grounded in effectuation and bricolage theories. Data were gathered from 101 student entrepreneurs in the United Kingdom using a structured survey. We employed PLS-SEM to examine how student entrepreneurs use resourceful practices to promote innovative behavior. This approach supports our dual aim: explaining underlying mechanisms and assessing predictive relevance within a complex, hierarchical model.* ***FINDINGS****: The results reveal that entrepreneurial bricolage has a positive influence on both discovery and exploitation activities, which together constitute entrepreneurial action. Innovative behavior fully mediates these relationships, enabling student entrepreneurs to transform resource limitations into actionable entrepreneurial outcomes. Four dimensions of innovative behavior were identified to facilitate this process: questioning assumptions, observing resource-use patterns, experimenting with resource combinations, and networking for resource mobilization.* ***IMPLICATIONS:*** *This study reveals how effectuation and bricolage work together as complementary approaches. Effectuation provides a strategic framework for navigating uncertainty, while bricolage offers a tactical approach to resource mobilization. Innovative behavior bridges these theories, transforming available means into entrepreneurial action. By identifying innovative behavior as the link between resourcefulness and entrepreneurial action, this study deepens the understanding of cognitive-behavioral mechanisms in effectuation and resource transformation. The findings reinforce the role of innovative behavior in shaping opportunities rather than merely recognizing them. Practically, student entrepreneurs should refine their ability to question assumptions, observe resourceful practices, experiment, and network strategically. Universities should focus on fostering experimentation, peer learning, and mentorship to enhance innovative behavior. Given its mediating role, entrepreneurship programs should prioritize capability-building over direct resource allocation.* ***ORIGINALITY AND VALUE****: This study provides a novel integration of effectuation and bricolage theories, demonstrating their interaction as complementary rather than independent frameworks, unlike prior studies. This study contributes to opening the 'black box' of effectuation by explaining the cognitive and behavioral mechanisms through which resourceful and innovative actions lead to*

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entrepreneurial action, and by evaluating their ability to predict entrepreneurial outcomes. Additionally, it extends bricolage theory by highlighting its behavioral dimensions, shifting its focus from improvisation to a dynamic problem-solving process. These contributions provide a richer theoretical perspective on how student entrepreneurs navigate uncertainty and leverage limited resources to drive venture creation.
Keywords: *entrepreneurial bricolage, effectuation theory, innovative behavior, student entrepreneurship, resource constraints, entrepreneurial action, discovery and exploitation, cognitive-behavioral mechanisms, means-driven logic, resource mobilization.*

INTRODUCTION

In an entrepreneurial landscape in which intentions account for only 30 percent of venture creation behaviors (Shirokova et al., 2016; Van Gelderen et al., 2015), entrepreneurial action —i.e. the concrete activities by which individuals create new ventures through discovery and exploitation activities (Botha & Pietersen, 2022)— bridges aspirations and actionable strategies that generate market value (McMullen & Shepherd, 2006). Scholarship on entrepreneurship has emphasized the need to move beyond descriptive approaches and better understand the cognitive and behavioral fundamentals driving entrepreneurial action patterns (Arend et al., 2015). This focus is especially pertinent for student entrepreneurs who have to simultaneously cope with their academic studies and the development of their new ventures (Gupta & Gupta, 2017; Hägg & Kurczewska, 2019), as demonstrated in a recent systematic review of student entrepreneurship by Passavanti et al. (2023), which also highlights the role of students as entrepreneurs and the evolving recognition of their entrepreneurial potential. This dual context places them in a unique position to examine entrepreneurial action, as they navigate heightened uncertainty and significant resource constraints while at the same time pursuing their business ventures (Politis et al., 2012; Shirokova et al., 2016).

To date, research on student entrepreneurship has centered primarily on entrepreneurial intentions (Fernández-Pérez et al., 2019; Martins et al., 2023; Saeed et al., 2018; Wasilczuk & Licznerska, 2024). However, far less attention has been given to their concrete actions (Alshibani et al., 2024; Harima et al., 2021). This gap is particularly significant given that these nascent entrepreneurs play a pivotal role in addressing societal challenges and driving innovation by leveraging fresh perspectives, unencumbered by traditional industry norms, to generate novel and disruptive solutions (Ferrante et al., 2019; Kickul et al., 2018; Wright et al., 2017). However, traditional entrepreneurship literature, which sees resource mobilization as linear and expertise-driven, struggles to explain how students launch ventures with limited resources. Yet, many do—25.7% are starting businesses, and 11.1% already own one—suggesting resource mobilization emerges through resourceful behaviors and innovative capabilities (Sieger et al., 2024). This discrepancy poses a challenge to existing frameworks, suggesting that resource mobilization may emerge through a more nuanced relationship between resourceful behaviors and innovative capabilities.

To address this theoretical challenge, we draw on effectuation theory as a foundational lens for exploring entrepreneurial action in such conditions. Effectuation theory—defined as a non-predictive logic that emphasizes controlling an unpredictable future rather than predicting an uncertain one (Sarasvathy, 2001)— was originally developed to explain the behaviors of expert entrepreneurs, but its application has since expanded to include nascent entrepreneurs, such as students, who leverage available means and stakeholder commitments to overcome constraints and pursue opportunities (Chandler et al., 2011; Jiang & Tornikoski, 2019; Reymen et al., 2015). Effectual logic fosters resourceful behaviors through flexible goal adaptation and creative resource use, enabling entrepreneurs to seize emerging opportunities. Empirical evidence shows that student entrepreneurs frequently adopt effectual approaches, allowing them to innovate and act adaptively without rigid, plan-driven strategies (Passavanti et al., 2023). Despite its promise, scholars have argued that effectuation research must move beyond treating these processes as a "black box" and instead reveal how their various elements interact to drive entrepreneurial action (Jiang & Rüling, 2019).

Building on the foundation of effectuation, we examine entrepreneurial bricolage as a tactical approach that operationalizes effectual thinking (Fisher, 2012; Servantie & Rispal, 2018). Entrepreneurial bricolage—defined as the ability to "make do with whatever is at hand" (Baker & Nelson, 2005; Levi-Strauss, 1966), bricolage complements the strategic logic of effectuation by focusing on resource mobilization in uncertain conditions by enabling creative resource recombination, turning stakeholder commitments into resources, and allowing flexible goal adaptation (Scazziota et al., 2023; Vasconcelos-Scazziota et al., 2020; Welter et al., 2016). Empirical evidence highlights how student entrepreneurs who adopt entrepreneurial bricolage can effectively leverage their resourcefulness to overcome challenges (Politis et al., 2012). Nevertheless, research on bricolage in the context of student entrepreneurship remains scant, particularly its role in driving concrete entrepreneurial actions.

Effectual entrepreneurs favor flexibility, collaboration, and leveraging means over fixed plans. This approach encourages bricolage, as entrepreneurs resourcefully combine and repurpose resources to overcome constraints. Through stakeholder collaboration, they gain access to diverse inputs that further enhance their ability to experiment and innovate. As a result, innovative behavior—defined as the creation and implementation of new ideas (Tidd & Bessant, 2020)—naturally emerges, enabling them to adapt and generate value in uncertain environments. Whereas prior studies emphasized the role of innovative behavior in organizational contexts (Salam & Senin, 2022), current literature tends to focus on individual traits and contextual factors (e.g. Acar & Tuncdogan, 2019; Kim & Lee, 2018; Kistyanto et al., 2022), ignoring ways in which innovative behavior enables entrepreneurs to transform resource constraints into meaningful actions. This oversight is particularly significant given the emphasis in effectuation research on understanding the mechanisms that facilitate entrepreneurial action (Arend et al., 2015).

This study, grounded in effectuation and bricolage, addresses these gaps through the following research questions (RQ):

RQ: Does the application of entrepreneurial bricolage facilitate entrepreneurial action among student entrepreneurs?
To what extent does innovative behavior enable student entrepreneurs to transform entrepreneurial bricolage into entrepreneurial action?

This study makes a number of contributions to the literature on entrepreneurship. First, it examines the way in which entrepreneurial bricolage operates as an operational-level behavior within the effectuation framework, responding to recent calls for its integration (Scazziota et al., 2023; Vasconcelos-Scazziota et al., 2020; Welter et al., 2016). Second, it advances the debate on resourcefulness by clarifying how bricolage facilitates the translation of intentions into entrepreneurial action (Williams et al., 2021; Zahra, 2021). Third, it helps open the "black box" of effectuation (Grégoire & Cherchem, 2020; Jiang & Rüling, 2019) by identifying innovative behavior as a key mechanism driving entrepreneurial action. Fourth, it expands research on student entrepreneurship by exploring how effectual processes manifest in early-stage ventures (Choi, 2023; Frederiksen & Brem, 2017; Furlotti et al., 2020; Laskovaia et al., 2017). Finally, the study provides practical insights for student entrepreneurs, educators and policymakers, offering evidence-based strategies for nurturing resourcefulness and innovation capabilities.

The remainder of this article is structured as follows: First, we present the literature review and develop hypotheses regarding the relationships between entrepreneurial bricolage, innovative behavior, and entrepreneurial action. Next, we outline our methodology, including sample characteristics, measurement approaches, and analytical procedures. We then present our findings and discuss their theoretical and practical implications. The article concludes with a consideration of limitations and directions for future research.

LITERATURE REVIEW AND HYPOTHESES

Effectuation and entrepreneurial action

There has been a significant transformation in the conceptualization of entrepreneurial action, evolving from its traditional economic roots to a perspective that includes cognitive, behavioral, and social dimensions (Johnmark et al., 2016; Michaelis et al., 2021; Randerson et al., 2016; Simon & Shrader, 2012). Effectuation theory emphasizes entrepreneurial action as a dynamic process driven by the creative use of available means, iterative experimentation, and stakeholder collaboration, rather than the pursuit of predefined goals (Sarasvathy, 2001). Instead of relying on prediction, entrepreneurs shape outcomes by working with what they have and making decisions based on five key principles: bird-in-hand (starting with available means), affordable loss (focusing on what can be risked rather than expected returns), crazy quilt (co-creating opportunities through strategic partnerships), lemonade (leveraging contingencies), and pilot-in-the-plane (emphasizing control over uncertainty). This action-oriented perspective views entrepreneurship as a process of "doing" rather than merely planning (Gielnik et al., 2015), in which entrepreneurs actively combine and reconfigure personal traits and cognitive skills, experiences, expertise, and existing resources to create previously unanticipated opportunities (Kwasi Mensah et al., 2021; Weerakoon et al., 2019). This approach underscores the importance of individual agency and shifts entrepreneurial focus from prediction to the creative shaping of outcomes through existing means.

Effectuation theory posits that entrepreneurial action emerges through five key principles: bird-in-hand (starting with the means), affordable loss, crazy-quilt (strategic partnerships), lemonade (leveraging contingencies), and pilot-in-the-plane (focusing on controllable aspects) (Sarasvathy, 2001).

Entrepreneurial action stresses two forms of activity —discovery and exploitation— which entrepreneurs engage in iteratively (Botha & Pietersen, 2022). Discovery activities involve generating ideas and identifying market opportunities (Vogel, 2017). From an effectual perspective, opportunities are not pre-existing but rather emerge from creative recombination of means at hand, a process that is particularly valuable in uncertain or resource-scarce environments (Chinyoka, 2020; Welter et al., 2016). Exploitation activities focus on transforming these ideas into actionable ventures and in doing so encompass resource acquisition, organizational structuring and market entry (Choi & Shepherd, 2004). They follow an effectual perspective by leading continuous adaptation, leveraging stakeholder commitments, and assuming affordable loss (Chinyoka, 2020).

Empirical evidence shows that nascent entrepreneurs who employ effectual logic display superior opportunity identification than those using conventional search methods (Zhu et al., 2021). This relationship is particularly evident among student entrepreneurs, where numerous empirical studies have shown that prioritizing existing resources enhances entrepreneurial action (Choi, 2023; Furlotti et al., 2020; Laskovaia et al., 2017). This effectual approach leads to higher implementation effectiveness under uncertainty, fostering an iterative relationship between discovery and exploitation (Smolka et al., 2018).

Entrepreneurial bricolage and discovery activities

Student entrepreneurs frequently encounter significant resource constraints during their entrepreneurial journey, including limited financial capital, underdeveloped skills, and restricted access to professional networks (Longva, 2021). To navigate these challenges, entrepreneurial bricolage has emerged as a critical resourceful behavior, enabling individuals to leverage whatever they do have to overcome limitations. Entrepreneurial bricolage refers to "making do with resources at hand, recombining resources for new purposes, refusing to enact constraints, and predisposing to action" (Davidsson et al., 2017, p. 116). This behavior comprises a distinct cognitive approach to resource utilization and opportunity creation (Busch & Barkema, 2021; Kang et al., 2023). It operationalizes the "bird-in-hand" principle of effectuation, emphasizing practical actions that transform constraints into opportunities through the systematic repurposing and recombination of resources and facilitating the creation of new value despite inadequacies and constraints (Senyard et al., 2014).

The relationship between entrepreneurial bricolage and opportunity discovery operates through four interconnected paths: First, cognitive flexibility enables entrepreneurs who practice entrepreneurial bricolage to develop creative problem-solving skills, allowing them to recognize the potential of overlooked materials and opportunities (An et al., 2018; Busch & Barkema, 2021). This enhanced cognitive flexibility is aligned with an entrepreneurial mindset framework, strengthening their ability to evaluate and pursue novel opportunities (Chang & Fan, 2017).

Second, entrepreneurial bricolage cultivates heightened environmental scanning abilities through what we might call "resource-oriented alertness." While the classical concept of entrepreneurial alertness, as propounded by Kirzner (1979), focuses on opportunity recognition without deliberate searching, entrepreneurial bricolage enhances this by adding a resource-centered dimension. This process involves both active and passive scanning modes, i.e., systematic evaluation of immediate environments for usable resources (Fisher, 2012) and unconscious pattern recognition of resource-opportunity fits (Desa & Basu, 2013). By recombining resources and gaining experiential knowledge, student entrepreneurs can develop heightened pattern recognition abilities, improving their capacity to identify emerging trends and opportunities (Corbett, 2005).

Third, entrepreneurial bricolage enables entrepreneurs to apply available resources creatively to address gaps in the market. This behavior facilitates the identification of consumer needs that remain unfulfilled by leveraging existing resources in innovative ways (Kang et al., 2023). For example, Zorina (2021) observed that the flexibility inherent to entrepreneurial bricolage allows entrepreneurs to repurpose limited resources to meet demands that would otherwise remain unaddressed, thus creating value in overlooked niches.

Fourth, entrepreneurial bricolage supports systematic experimentation through "low-cost probing" (Andries et al., 2013) — a structured approach to testing opportunities with minimal resource commitment. This path involves rapid prototyping using readily available resources, iterative testing with potential customers, and continuous refinement based on feedback (Bezhovski et al., 2024; Kaffka et al., 2021). Drencheva et al. (2022) demonstrate how this approach enables student entrepreneurs to validate assumptions and refine their strategies before committing significant resources.

By facilitating early engagement with stakeholders, entrepreneurial bricolage enhances opportunity validation even in resource-constrained environments.

These paths work together to enhance opportunity recognition, as entrepreneurs' resourceful approaches to constraints lead to novel ways of identifying and validating potential opportunities. Based on this theoretical foundation and empirical evidence, we posit the following hypothesis:

H_1: The total effect of entrepreneurial bricolage positively impacts the development of discovery activities in student entrepreneurs.

Entrepreneurial bricolage and exploitation activities

The relationship between entrepreneurial bricolage and exploitation activities is a critical area of inquiry in entrepreneurship research, particularly in understanding how entrepreneurs transform identified opportunities into viable ventures under resource constraints (Mateus & Sarkar, 2024). Effectuation theory provides the overarching principles that explain entrepreneurial decision-making through concepts such as affordable loss (focusing on what entrepreneurs can afford to lose rather than their expected returns) and stakeholder commitments (building partnerships to reduce uncertainty) (Sarasvathy, 2001), while bricolage demonstrates how entrepreneurs operationalize these principles to create value under constraints (Baker & Nelson, 2005). This alignment is particularly salient for student entrepreneurs, since resourceful behaviors enable them to develop strategies that transform constraints into opportunities (Klyver & Schenkel, 2013; Politis et al., 2012).

The effectiveness of entrepreneurial bricolage in exploitation activities stems from its dual capacity to help entrepreneurs navigate uncertainty while simultaneously overcoming resource limitations. By integrating existing knowledge with insights gained from resource experimentation, entrepreneurs engage in a dynamic process that enhances their adaptability (Dothan & Lavie, 2016). This resourceful behavior, guided by effectuation principles, enables entrepreneurs to turn unexpected challenges swiftly into opportunities for growth (Chinyoka, 2020).

Empirical research has identified four distinct yet interrelated characteristics through which entrepreneurial bricolage facilitates exploitation activities. First, the creative recombination mechanism focuses on building unique resource portfolios from available means. For student entrepreneurs, this is manifested in resourceful integration of resources, personal networks, and facilities to launch and sustain ventures (Politis et al., 2012). This characteristic is compelling in the university context, where diverse resources can be repurposed in unexpected ways to support the development of ventures.

Second, the action-oriented approach promotes rapid market entry and iterative refinement of venture ideas. This is in line with effectuation's focus on affordable loss and enables entrepreneurs to develop and adjust their strategies without requiring significant resource commitments (Fisher et al., 2021). This characteristic is especially valuable for student entrepreneurs who have to balance venture development with academic commitments.

Third, the continuous resource reconfiguration characteristic represents a central aspect of entrepreneurial bricolage in exploitation. It entails dynamically adapting resource combinations based on market feedback and stakeholder interactions, supporting the emphasis placed by effectuation on leveraging contingencies (Yu & Wang, 2021). This attribute enables student entrepreneurs to maintain flexibility while building sustainable venture structures.

Fourth, strategic flexibility enables entrepreneurs to pivot their business models and strategies in response to dynamic market conditions. This adaptability is particularly crucial during the exploitation phase, where the speed of implementation is often a determinant of success, facilitating rapid responses to market feedback while maintaining academic progress (Epler & Leach, 2021).

These mechanisms function as an integrated system in which resource recombination leads to stronger action orientation and enhanced resource reconfiguration capabilities. This adaptive capacity enables student entrepreneurs to optimize exploitation activities and maximize value creation. Based on this theoretical foundation and empirical evidence, we posit the following hypothesis:

H_2: The total effect of entrepreneurial bricolage positively impacts the development of exploitation activities amongst student entrepreneurs.

The mediating role of innovative behavior in the relationship between entrepreneurial bricolage and entrepreneurial action

Innovative behavior, defined as the generation and implementation of novel ideas (Tidd & Bessant, 2020), is crucial to understanding how entrepreneurs transform resources into concrete actions. Research suggests that entrepreneurial bricolage, while effective for resource mobilization and recombination (Baker & Nelson, 2005), requires specific behavioral mechanisms to translate into entrepreneurial action due to the implicit limitations faced by students in generating high quality solutions (Kickul et al., 2018; Lanzara, 1999; Stinchfield et al., 2013).

The potential relationship between innovative behavior and entrepreneurial action is deeply embedded in effectuation theory. Rather than following predetermined paths, entrepreneurs act by creatively leveraging available means, managing risk through affordable loss, forming partnerships, embracing contingencies, and focusing on controllable aspects (Sarasvathy, 2001). Each of these effectual processes requires innovative behavior to transform uncertainty into actionable opportunities. For instance, starting with available means—who they are, what they know, and whom they know—necessitates innovative behavior to recombine resources in novel ways and create opportunities. Likewise, leveraging contingencies demands adaptability and creativity to turn unexpected challenges into entrepreneurial advantages (Sarasvathy, 2008).

Moreover, effectuation theory emphasizes that entrepreneurial action emerges through an iterative cycle of stakeholder interactions and commitment building (Weerakoon et al., 2019). This connection is particularly relevant for understanding how the resourceful behavior of bricolage operationalizes the means-driven approach of effectuation through resource combination (Fisher, 2012) and might relate to entrepreneurial action through innovative behavior. This relationship appears to be influenced by the way in which resource constraints shape cognitive processes and behavioral responses, leading entrepreneurs to develop enhanced capabilities for recognizing and implementing novel resource combinations (Baker & Nelson, 2005).

Innovative behavior is manifested through four distinct but interrelated behavioral dimensions: observing, questioning, experimenting, and networking (Dyer et al., 2008). These dimensions may help explain how entrepreneurial bricolage facilitates the transformation of available resources into value, ultimately leading to entrepreneurial action. From this perspective, innovative behavior is not only an output of cognitive processes but also a key enabler of opportunity enactment. This perspective is particularly relevant given the documented intention-behavior gap in student entrepreneurship (Harima et al., 2021).

The observing dimension facilitates pattern recognition in bricolage experiences, potentially enabling entrepreneurs to identify opportunities within existing resource constraints (Dyer et al., 2008). This capability is relevant for identifying opportunities within resource constraints (Osman, 2008). The questioning dimension enables entrepreneurs to challenge existing assumptions about resource limitations, fostering creative thinking about potential resource combinations (Raine & Pandya, 2019). This cognitive ability plays a critical role in effective opportunity recognition, enhancing entrepreneurs' capacity to identify novel applications for available resources (Peljko et al., 2016). Beyond recognizing opportunities, the experimenting dimension provides a practical mechanism for testing and refining ideas developed through bricolage (Kerr et al., 2014), enabling both discovery and exploitation activities. Supporting this view, Senyard et al. (2014) emphasize that actively experimenting with resource combinations can strengthen entrepreneurs' capabilities in opportunity implementation. In addition to experimentation, networking can be seen as a complementary dimension that facilitates knowledge exchange and resource mobilization through stakeholder engagement (Richez-Battesti & Petrella, 2020). Extending this argument, Klyver and Schenkel (2013) suggest that effective networking behavior might enhance entrepreneurs' ability to transform bricolaged resources into concrete venture outcomes.

In discovery activities, innovative behavior might contribute through questioning and observing behaviors, potentially helping student entrepreneurs to transform their capabilities into concrete discovery activities (Kim et al., 2018). For exploitation activities, experimenting and networking behaviors appear to be particularly relevant, facilitating real-world implementation (Harima et al., 2021; Lee et al., 2019).

Although the literature on entrepreneurship has not extensively examined innovative behavior as a mediating mechanism, empirical studies in employee-focused research lend support to its mediating role. For instance, Aryee et al. (2012) found that innovative behavior mediates the relationship between transformational leadership and task performance through work engagement. Likewise, Naranjo-Valencia et al. (2017) showed that innovative behavior mediates the relationship between organizational culture and radical product innovation in firms. Based on this theoretical foundation and empirical evidence, we posit the following hypotheses and the theoretical model (Figure 1).

H_3: Innovative behavior positively mediates the relationship between entrepreneurial bricolage and discovery activities among student entrepreneurs.

H_4: Innovative behavior positively mediates the relationship between entrepreneurial bricolage and exploitation activities among student entrepreneurs.

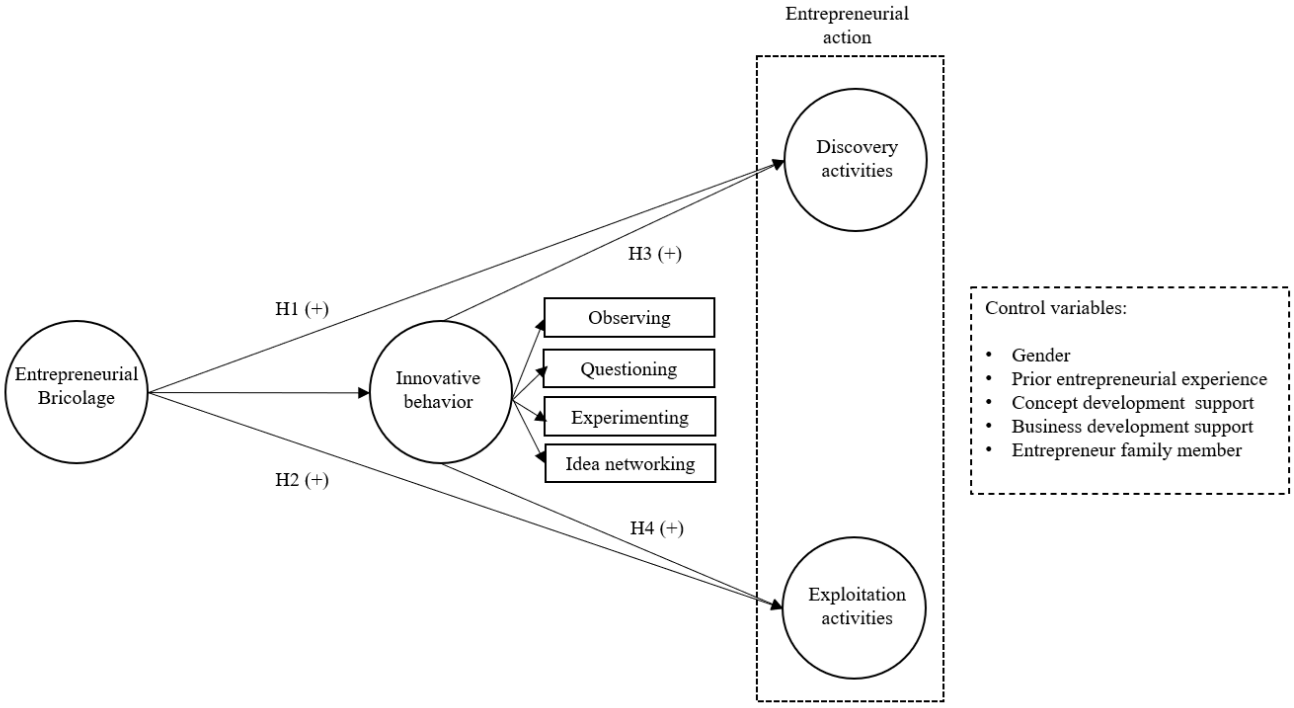

Figure 1. Theoretical model

METHODOLOGY

This study adopts an explanatory–predictive approach, using a cross-sectional design with a sample of student entrepreneurs from the United Kingdom. The explanatory component aims to explore how resourceful behaviors are associated with entrepreneurial action and to examine the mechanisms through which these relationships unfold, particularly through the mediating role of innovative behavior. Rather than testing a fully specified or previously validated theoretical model, we rely on effectuation theory to propose and assess new pathways of influence in this context. The predictive component evaluates the model's ability to forecast discovery and exploitation activities using out-of-sample prediction techniques. Our analysis involves assessing measurement and structural models, performing robustness checks, and applying procedures for mediation analysis and predictive validation.

Sampling strategy and participants

This study focuses on students actively engaged in venture creation while pursuing higher education. These student entrepreneurs operate at the intersection of academic and entrepreneurial contexts (Bergmann et al., 2016) and face greater resource constraints than established entrepreneurs (Nielsen & Gartner, 2017). Research on entrepreneurial processes such as effectuation and causation has widely relied on student entrepreneur samples due to their unique context and variability in resource usage (Laskovaia et al., 2017; Smolka et al., 2018). (Politis et al., 2012) further demonstrated that data from student entrepreneurs provide valuable theoretical insights, reinforcing their suitability for academic inquiry.

Given the specificity of our target population—students simultaneously balancing academic studies and entrepreneurial ventures—we employed a convenience sampling approach. This method was the most appropriate due to the accessibility and feasibility of recruiting student entrepreneurs actively engaged in business creation within our institutional setting.

Convenience sampling has been widely used in entrepreneurship research, particularly when studying niche populations with limited availability and clear inclusion criteria (Etikan, 2016).

The study was conducted within the UK higher education sector, specifically at the University of the West of England, Bristol (UWE Bristol). In the UK, student entrepreneurs play a crucial role in driving innovation and economic growth (Hannon, 2005; Wright & Mustar, 2019). The sample includes students from two undergraduate programs: the BA (Hons) in Business (Team Entrepreneurship) at Frenchay campus and the BA (Hons) in Sports, Business, and Entrepreneurship at Ashton Gate campus. The students were selected because of their high engagement levels in venture creation, ensuring the inclusion of individuals actively involved in running projects and developing ventures, rather than merely studying entrepreneurship theory. It is important to clarify that they are student entrepreneurs, not students of entrepreneurship. To enhance the representativeness of the sample, we incorporated students from three different years of study and various venture stages, gender and age, ensuring a diversity of perspectives.

Data collection procedures

Surveys were administered online and self-administered by the participants using the Qualtrics platform. Prior to the main data collection, we conducted a pilot test with 12 student entrepreneurs to validate the survey instrument's clarity, comprehensiveness, and technical functionality. Based on pilot feedback, we adjusted and clarified some of the instructions and terms.

To ensure that all participants were qualified student entrepreneurs, we applied a screening question: "During your studies at the university, have you individually or in a team undertaken at least one concrete action to create a start-up or an organization in its initial phase?" (Yes/No). If the answer was "Yes," they could continue with the survey; if the answer was "No," the survey ended. This screening approach ensured that our data specifically captured experiences from active student entrepreneurs rather than those merely interested in entrepreneurship. Of the total surveys received, 3 did not agree to participate in the study, 6 were incomplete, and 3 answered "No" to the filter question on whether they considered themselves to be student entrepreneurs. After data cleaning and validation, our final sample consisted of 101 valid responses. Characteristics of the final sample are shown in Table 1. Although the sample is not gender-balanced, its demographic profile is broadly aligned with the prevailing composition of the student population enrolled in these programs, which is approximately 85% male.

Table 1. Sample characteristics

	Sample	Gender			Age		
		Male	Female	Other	< 20	20 - 25	> 25
Frenchay Campus	77	59	17	1	16	60	1
Ashton Gate Campus	24	19	4	1	1	23	0
Total	**101**	**78**	**21**	**2**	**17**	**83**	**1**

The required sample size was determined through a priori power analysis using G*Power 3.1.9.7 software (Faul et al., 2009), as recommended for PLS-SEM studies (Hair et al., 2022). The analysis suggested a minimum sample size of 98 for 0.8 statistical power and a medium effect size of 0.15. Our final sample consisted of 101 valid responses, which meets and slightly exceeds this requirement.

Measurements

We used scales of measuring variables that have been validated in prior studies. The dependent variables were obtained from the conceptualization of entrepreneurial action, which encompasses two main types of activities: discovery and exploitation (Botha & Pietersen, 2022; Shane & Venkataraman, 2000). Discovery activities (referred to hereinafter as "discovery") involve generating initial venture ideas and identifying market opportunities at an early stage (Vogel, 2017), whereas exploitation activities (hereinafter "exploitation") focus on executing these concepts by acquiring resources, establishing an organizational structure, and entering the market (Mueller et al., 2012). The two dependent variables were assessed using the scales for discovery activities (six items) and exploitation activities (eleven items), respectively, as proposed by Botha and Pietersen (2022). The scale for the independent variable, entrepreneurial bricolage (EB) (eight items)

was adopted from Senyard et al. (2014) and further validated by Davidsson et al. (2017). The mediator variable, innovative behavior, was measured using a scale developed by Dyer et al. (008), which consists of four dimensions: questioning (six items), observing (four items), experimenting (five items), and idea networking (four items). These scales were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

On the recommendation of Memon et al. (2024) and Shiau et al. (2024), we included five relevant control variables to assess potential effects on the dependent variables: i) Gender: previous research has shown that gender influences access to and management of resources, entrepreneurial innovation, and entrepreneurial action (Saiz-Álvarez & Rodríguez-Aceves, 2019; Vamvaka et al., 2020). It is represented here as a dummy variable (1 = male, 0 = female); ii) Prior entrepreneurial experience (P_ENT_EXP): This binary variable (1 = yes; 0 = no) captures whether the student has prior experience in starting or running a business. Such experience influences the ability to identify and exploit opportunities and mobilize resources (Grežo, 2024); iii) Concept development support (CON_DEV_SUP): university assistance for early-stage business ideas (Kraaijenbrink et al., 2010), influencing opportunity discovery (Ho et al., 2014). Measured on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) (four items); iv) Business development support (BUS_DEV_SUP): university-provided activities for expanding ventures (Kraaijenbrink et al., 2010), impacting growth and opportunity exploitation (Guerrero et al., 2020). Measured on a 7-point Likert scale (three items) (Guerrero et al., 2020); v) Entrepreneur family member (ENT_FAM_MEM): family members who are entrepreneurs serve as role models, provide resources, and shape perceptions of entrepreneurship (Tarling et al., 2016)—measured as binary (1 = yes, 0 = no).

Data analysis method

We used structural equation modeling (SEM) to evaluate our hypotheses, allowing us to examine relationships between observed and latent variables simultaneously (Chin, 1998). SEM is particularly advantageous when dealing with multiple dependent and exogenous variables, which require concurrent estimation of several regression equations (Hair et al., 2022). Specifically, we applied PLS-SEM, as it supports both explanatory modeling and predictive analysis, making it appropriate for our aim of examining the mechanisms behind resourceful and innovative behaviors and assessing their ability to predict discovery and exploitation activities. Another key reason for choosing PLS-SEM is the complexity of our model and its use of composites, which align with the nature of our constructs. This approach is particularly suitable in contrast to covariance-based SEM techniques such as LISREL, which require larger samples, distributional assumptions, and are generally confirmatory in nature (Hair et al., 2022). Moreover, PLS-SEM is better suited for estimating variables that are not unidimensional, especially when dealing with high-order composites (Guenther et al., 2023), helping to prevent significant residual values and biased results resulting from factor estimation (Sarstedt et al., 2023).

Following the two-step procedure recommended by Hair et al. (2022), we first assessed the measurement model to evaluate the reliability (e.g., indicator loadings, internal consistency) and validity (e.g., convergent and discriminant validity) of each construct. In addition, to estimate the second-order construct of innovative behavior, we applied the disjoint two-stage approach as recommended by Becker et al. (2023) and Hair et al. (2024). This technique allows for robust assessment of higher-order constructs by estimating lower-order components in the first stage and using them as indicators in the second stage. Once the measurement model met the required criteria, we proceeded to analyze the structural model to test the hypothesized relationships and assess explanatory and predictive power.

Following Hair et al. (2022), all constructs were modeled as mode A composites. While AVE, composite reliability, and Cronbach's alpha were originally designed for reflective models, recent literature (Guenther et al., 2023) supports their interpretive use as informative quality diagnostics for mode A composites when indicators are conceptually similar and strongly correlated. Significance testing for parameter estimation (e.g., loadings and path coefficients) was conducted using a bootstrap procedure based on 10,000 subsamples to obtain p-values (p) and 95 percent bias-corrected confidence intervals (CI) (Chin, 1998). To perform our data analysis, we used SmartPLS 4.1.0.6 software (Ringle et al., 2024).

Common method bias

To address and mitigate common method bias (CMB), we followed the recommendations of Podsakoff et al. (2024). Our approach involved both ex ante (study design) and ex post (statistical) procedures. In designing our study, we implemented several procedural remedies: a) we created a perceived psychological separation between predictor and criterion variables by using different response formats; b) we assured respondents of the anonymity and confidentiality of their responses, in order to reduce social desirability bias and evaluation apprehension; c) we randomized the order of questions relating

to different constructs to control for priming effects and item-context-induced mood states. We also employed statistical remedies to assess the presence of CMB. First, we employed the full multicollinearity test (Kock, 2015). Second, we assessed the Variance Inflation Factor (VIF) values obtained from the full collinearity assessment, which ranged between 1.22 and 3.10, and found all values to be below the threshold of 3.30 (Table 2). Based on these measures and results, we consider this study not to be affected by CMB.

Table 2. Measurement model assessment

Composites/Dimension/Indicator	VIF	Mean	SD	Loadings	Weights	ρ_c	ρ_a	AVE
Discovery activities (Mode A)						0.832	0.763	0.501
DISCO2: I have identified market opportunities	1.223	5.767	0.783	0.622	0.296			
DISCO3: I have prepared a business plan	1.660	5.525	0.651	0.759	0.267			
DISCO4: I have developed models or procedures for a product/service	1.788	5.521	0.585	0.811	0.327			
DISCO5: I have selected a business name	1.372	4.904	0.749	0.663	0.246			
DISCO6: I am devoted full time to the business	1.326	5.102	0.742	0.671	0.276			
Exploitation activities (Mode A)						0.866	0.816	0.518
EXPLOT2: I have created a legal entity	2.386	4.767	0.745	0.668	0.244			
EXPLOT3: I have registered with the tax authorities	3.105	4.433	0.655	0.756	0.195			
EXPLOT 5: I have requested for and received financial assistance to start my business	1.950	4.821	0.664	0.748	0.210			
EXPLOT7: I have purchased or leased major items, like equipment, facilities, or property	1.698	4.913	0.682	0.731	0.267			
EXPLOT9: I have started marketing or promotional activities	1.709	5.858	0.719	0.695	0.247			
EXPLOT11: I have appointed employees	1.732	4.703	0.700	0.714	0.226			
Entrepreneurial bricolage (EB) (Mode A)						0.901	0.883	0.505
EB1: I am confident of my ability to find workable solutions to new challenges by using my existing resources	1.800	5.421	0.690	0.724	0.170			
EB2: I gladly take on a broader range of challenges than others with my resources would be able to	1.785	5.217	0.685	0.728	0.185			
EB3: I use any existing resource that seems useful to respond to a new problem or opportunity	2.593	5.175	0.664	0.747	0.151			
EB4: I deal with new challenges by applying a combination of my existing resources and other resources inexpensively available to me	1.984	5.254	0.785	0.619	0.142			
EB5: When dealing with new problems or opportunities, I take action by assuming that I will find a workable solution	1.932	5.333	0.671	0.741	0.138			
EB6: By combining our existing resources, I take on a surprising variety of new challenges	1.896	5.188	0.681	0.697	0.154			
EB7: When I face new challenges, I put together workable solutions from my existing resources	1.867	5.217	0.717	0.722	0.173			
EB8: I combine resources to accomplish new challenges that the resources were not originally intended to accomplish	1.691	4.938	0.692	0.675	0.110			
Innovative behavior (IB) (HOC Mode A)						0.844	0.787	0.579
Observing (Composite Mode A)	1.743			0.834***	0.374***	0.884	0.827	0.657
OBS1: New business ideas often come to me when directly observing how people interact with products and services	1.559	5.125	0.656	0.754	0.290			
OBS2: I have a continuous flow of new business ideas that comes through observing the world	3.055	5.021	0.500	0.866	0.314			
OBS3: I regularly observe customers' use of our company's products and services to get new ideas	1.540	4.821	0.620	0.785	0.340			

Composites/Dimension/Indicator	VIF	Mean	SD	Loadings	Weights	ρ_c	ρ_a	AVE
OBS4: By paying attention to everyday experiences, I often get new business ideas.	2.787	5.000	0.555	0.832	0.291			
Questioning (Composite Mode A)	1.234			0.585***	0.207***	0.882	0.895	0.558
QUEST1: I am always asking questions	1.974	5.346	0.699	0.715	0.160			
QUEST2: I am constantly asking questions to get to the root of the problem	2.307	5.467	0.635	0.773	0.185			
QUEST3: Others are frustrated by the frequency of my questions	1.469	4.417	0.810	0.586	0.097			
QUEST4: I often ask questions that challenge the status quo	2.137	4.871	0.588	0.809	0.212			
QUEST5: I regularly ask questions that challenge others' fundamental assumptions	2.147	4.971	0.529	0.849	0.332			
QUEST6: I am constantly asking questions to understand why products and projects underperform	1.406	5.304	0.692	0.722	0.321			
Experimenting (Composite Mode A)	1.645			0.811***	0.363***	0.856	0.822	0.602
EXP1: I love to experiment to understand how things work and to create new ways of doing things	1.435	5.371	0.785	0.619	0.199			
EXP2: I frequently experiment to create new ways of doing things	1.617	4.729	0.647	0.763	0.334			
EXP3: I am adventurous, always looking for new experiences	2.293	5.392	0.594	0.805	0.322			
EXP4: I actively search for new ideas by experimenting	2.686	4.921	0.451	0.892	0.406			
Idea networking (Composite Mode A)	1.522			0.785***	0.345***	0.850	0.790	0.588
IN1: I have a network of individuals whom I trust to bring a new perspective and refine new ideas	1.403	5.196	0.707	0.707	0.298			
IN2: I attend many diverse professional and/or academic conferences outside of my industry/ profession	1.318	3.708	0.751	0.660	0.247			
IN3: I initiate meetings with people outside of my industry to spark ideas for a new product, service, or customer base	1.679	4.654	0.582	0.813	0.366			
IN4: I have a large network of contacts with whom I frequently interact to get ideas for new products, services, and customers	2.005	4.388	0.495	0.869	0.378			

Note: *VIF*: variance inflation factor; ρ_c: Jöreskog's composite reliability, ρ_a: Dijkstra- Henseler`s composite reliability; *AVE:* Average variance extracted; HOC: Higher order construct; DISCO: discovery activities; EXPLOT: exploitation activities; EB: entrepreneurial bricolage; OBS: observation; QUEST: questioning; EXPE: experimentation; IN: idea networking; ***P<.001, **P<.01, *P<.05 based on percentile bootstrapping (n = 10,000; two-tailed test).

RESULTS

Measurement model

Our assessment of the measurement model sought to establish the reliability and validity of the constructs. To this end, we followed the steps and criteria outlined by Hair et al. (2022). First, we assessed the reliability and validity of the Composites in Mode A, including the control variables CON_DEV_SUP and BUS_DEV_SUP. We obtained loadings exceeding the value of 0.7 for both indicators and dimensions, with only a few exceptions (Table 2). To ensure that the Average Variance Extracted *(AVE)* was above the 0.5 threshold, we removed specific items that had the lowest loadings (DISCO1, EXPLOT1, EXPLOT4, EXPLOT6, EXPLOT8, EXPLOT10). Applying the bootstrapping procedure, all item loadings were significant, including the control variables CON_DEV_SUP and BUS_DEV_SUP. We then established composite reliability by using *Cronbach's alpha*, *rho_a,* obtaining values of over 0.7 for all first-order and higher-order composites in Mode A (Table 2). Lastly, we assessed the discriminant validity, employing both the *Fornell-Larcker* and

HTMT criteria. For the latter, we obtained indicator values below the (conservative) threshold of 0.85 (Table 3). For Entrepreneurial bricolage - Innovative behavior, the *HTMT* value is slightly higher (0.877) but still lower than the more liberal threshold of 0.9. Hence, discriminant validity is established.

Table 3. HTMT results for the first-order and second-order models

	Discovery	EB	Exploitation	IB
Discovery	0.707	0.494	0.588	0.607
EB	**0.581**	0.710	0.549	0.722
Exploitation	**0.768**	**0.625**	0.720	0.686
IB	**0.785**	**0.877**	**0.839**	0.761

Note: EB: entrepreneurial bricolage; IB: innovative behavior. The *HTMT* criterion appears below the diagonal in bold. The *Fornell-Larcker* criterion appears above the diagonal.

Robustness checks

To guarantee the reliability and credibility of the PLS-SEM results related to the structural model, we followed the recommendations of Sarstedt et al. (2020) for examining nonlinear effects, endogeneity, and unobserved heterogeneity.

Nonlinear effects

To explore the possibility of non-linear effects in our model, we employed the two-phase method proposed by Hair et al. (2024). Initially, we computed scores for the predictor variables. We then examined the quadratic effects within five specific paths of our model to identify any non-linear relationships. We obtained the following effects: Entrepreneurial bricolage on discovery (β = 0.023, p = 0.797, f^2 = 0.000); entrepreneurial bricolage on exploitation (β = -0.002, p = 0.976, f^2 = 0.000); entrepreneurial bricolage on innovative behavior (β = 0.016, p = 0.780, f^2 = 0.002); innovative behavior on discovery (β = 0.039, p = 0.630, f^2 = 0.000); innovative behavior on exploitation (β = 0.002, p = 0.966, f^2 = 0.000). The findings indicate that the quadratic effect is not significant in any of the relationships, and the effect sizes are minimal. We therefore consider a linear relationship in our model.

Endogeneity

Although endogeneity testing is not required for predictive modeling, we included it to reinforce the explanatory rigor of our analysis. As recommended by Hult et al. (2018), accounting for potential endogeneity strengthens the causal interpretation of path relationships in explanatory PLS-SEM models.

In assessing our model for endogeneity, we followed the method recommended by Hult et al. (2018). Initially, we evaluated the appropriateness of using Gaussian copulas (Park & Gupta, 2012), following the guidelines proposed by Becker et al. (2022). After performing Cramer-Von Mises and Anderson-Darling tests for normality, we found the independent latent variables entrepreneurial bricolage (*CVM* = 0.040, p = 0.676 / *AD* = 0.243, p = 0.760), and innovative behavior (*CVM* = 0.055, p = 0.430 / *AD* = 0.338, p = 0.495) not to be non-normally distributed. These results indicate that the Gaussian copula approach was not appropriate. Thus, as recommended by Becker et al. (2022), we considered other methods.

We evaluated the suitability of using the instrumental variable (IV) technique, but this proved unfeasible since we lacked a suitable extraneous variable that would correlate with the endogenous variable but not with the model's error term (Rutz & Watson, 2019). Therefore, as recommended by Hult et al. (2018) we adopted the control variable analysis, as supported by Bernerth and Aguinis, (2016). After incorporating five control variables —gender, P_ENT_EXP, CON_DEV_SUP, BUS_DEV_SUP, and ENT_FAM_MEM— into our analysis, we found seven of the eight effects analyzed not to be significant: gender -> discovery (β = 0.225, p = 0.118); gender -> exploitation (β = -0.120, p = 0.271); P_ENT_EXP -> discovery (β = 0.151, p = 0.198); P_ENT_EXP -> exploitation (β = -0.118, p = 0.145); CON_DEV_SUP -> discovery (β = 0.004, p = 0.485); BUS_DEV_SUP -> exploitation (β = -0.014, p = 0.451); ENT_FAM_MEM -> discovery (β = 0.115, p = 0.231); ENT_FAM_MEM -> exploitation (β = 0.290, p = 0.039). Given these results, we determined that endogeneity does not pose a problem for our model, although we recognize the possibility of further improvements in this approach.

Unobserved heterogeneity

To assess unobserved heterogeneity, we followed the recommendations of Sarstedt et al. (2017) and applied the finite mixture partial least squares (FIMIX-PLS) method using SmartPLS. We evaluated model fit across segment solutions using the criteria proposed by Hair et al. (2016), including AIC, BIC, and entropy. Unobserved heterogeneity was calculated, analyzed, and presented to demonstrate that the model is robust, following the recommendations of Gudergan et al. (2025). Starting with five different groupings (due to our sample size of 101), our analysis used the procedures suggested by both Sarstedt et al. (2011) and Hair et al. (2016). To determine the optimal segment number, we carefully considered the following criteria: i) *CAIC* (consistent AIC) and *AIC3* (modified *AIC* with Factor 3); ii) *AIC3* with *BIC* (Bayesian information criterion); and iii) *BIC* with *AIC4* (modified *AIC* with Factor 4). However, these results indicated different segment numbers. As shown in Table 4, these comparisons fully favor a one-segment solution. Furthermore, the standardized entropy statistic (*EN*) is above 0.5, proving clear classification of the data. These findings suggest that our data is not affected by unobserved heterogeneity.

Table 4. Unobserved heterogeneity results

	Segments		
	1	**2**	**3**
AIC	688.508	684.633	**679.023**
AIC3	**696.508**	701.633	705.023
AIC4	**704.508**	718.633	731.023
BIC	**709.428**	729.09	747.016
CAIC	**717.428**	746.09	773.016
EN	0	0.947	0.674

Note: AIC: Akaike's information criterion, AIC3: modified AIC with factor 3, AIC4: modified AIC with factor 4, BIC: Bayesian information criterion, CAIC: consistent AIC, EN: normed entropy statistic.

Structural model

To evaluate the structural model, we followed the guidelines of Hair et al. (2022) for assessing the size and significance of the parameters and path coefficients. Initially, we examined collinearity through the Variance Inflation Factor (*VIF*). As mentioned, the results showed that all VIF values remained below the threshold of 3.3 (Table 2), indicating the absence of multicollinearity issues. We then calculated the values of R^2 to determine the percentage of variance accounted for by the endogenous variables. The R^2 value for discovery was 37.3 percent (through entrepreneurial bricolage 5.7 percent and innovative behavior 31.6 percent); for exploitation, it was 47.5 percent (through entrepreneurial bricolage 6.0 percent and innovative behavior 41.5 percent). According to Chin (1998), the two values represent a moderate level of explained variance.

We then proceeded to assess our hypotheses. The resulting analyses are shown in Table 5. First, we tested the total effect of entrepreneurial bricolage on discovery activities (H_1). The results show a positive and significant effect ($\boldsymbol{\beta}$ = 0.494, p = 0.000), therefore the data support H_1. We then continued to test the total effect of entrepreneurial bricolage on exploitation activities (H_2). The results show a positive and significant effect ($\boldsymbol{\beta}$ = 0.548, p = 0.000), thus the data results support H_2. We continued by testing the specific indirect effect of entrepreneurial bricolage on discovery through innovative behavior, which corresponds to H_3. The analysis shows a significant indirect effect ($\boldsymbol{\beta}$ = 0.377, p = 0.000). Considering that the direct effect of entrepreneurial bricolage on discovery is not significant ($\boldsymbol{\beta}$ = 0.116, p = 0.160), this implies that the influence of entrepreneurial bricolage on discovery through innovative behavior is a full mediation. Thus, the data support H_3. With respect to H_4, regarding the specific indirect effect of entrepreneurial bricolage on exploitation through innovative behavior, the results show a positive significant indirect effect ($\boldsymbol{\beta}$ = 0.437, p = 0.000). Since the direct effect of entrepreneurial bricolage on exploitation is not significant ($\boldsymbol{\beta}$ = 0.111, p = 0.138) this also represents a full mediation. Therefore, H_4 is empirically supported. Finally, following the recommendations of Cohen (1988), we calculated the f^2 for effect sizes.

We also assessed the significance of the five control variables (gender, P_ENT_EXP, CON_DEV_SUP, BUS_DEV_SUP, and ENT_FAM_MEM). The results show that seven of the eight effects on the dependent variables were non-significant; only the ENT_FAM_MEM on exploitation was significant.

Table 5. Structural model assessment and mediation analysis

Direct effects	β	CI	p-value	SD	t-value	R^2	f^2	Support
EB -> Discovery	0.117^{ns}	[-0.069 0.315]	0.160	0.117	0.996	0.057	0.010	
EB -> Exploitation	0.111^{ns}	[-0.057 0.279]	0.138	0.102	1.089	0.060	0.011	
EB -> IB	0.722***	[0.647 0.799]	0.000	0.046	15.559		1.092	
IB -> Discovery	0.523***	[0.338 0.706]	0.000	0.113	4.623	0.316	0.209	
IB -> Exploitation	0.606***	[0.460 0.756]	0.000	0.090	6.752	0.415	0.335	
Gender -> Discovery	0.225^{ns}	[-0.080 0.536]	0.118	0.190	1.184			
Gender -> Exploitation	-0.120^{ns}	[-0.435 0.202]	0.271	0.610	0.196			
P_ENT_EXP -> Discovery	0.151^{ns}	[-0.147 0.445]	0.198	0.181	0.850			
P_ENT_EXP -> Exploitation	-0.118^{ns}	[-0.402 0.160]	0.145	0.70	0.691			
CON_DEV_SUP -> Discovery	0.004^{ns}	[-0.114 0.195]	0.485	0.096	0.038			
BUS_DEV_SUP -> Exploitation	-0.014^{ns}	[-0.216 0.163]	0.451	0.113	0.124			
ENT_FAM_MEM -> Discovery	0.115^{ns}	[-0.138 0.384]	0.231	0.157	0.735			
ENT_FAM_MEM -> Exploitation	0.290*	[0.009 0.553]	0.039	0.164	1.717			
Indirect effects								
EB -> IB -> Discovery (H_3)	0.377***	[0.239 0.535]	0.000	0.090	4.209			Yes
EB -> IB -> Exploitation (H_4)	0.437***	[0.324 0.577]	0.000	0.077	5.700			Yes
Total effect								
EB -> Discovery (H_1)	0.494***	[0.387 0.620]	0.000	0.071	6.993			Yes
EB -> Exploitation (H_2)	0.548***	[0.450 0.659]	0.000	0.063	8.688			Yes

Note: β = beta coefficient, *CI*: confidence interval; *SD*: standard deviation. R^2 = explained variance; f^2 = effect size. EB: entrepreneurial bricolage; IB: innovative behavior; P_ENT_EXP: prior entrepreneurial experience; CON_DEV_SUP: concept development support; BUS_DEV_SUP: business development support; ENT_FAM_MEM: entrepreneur family member. ***P<0.001, **P<0.01, *P<0.05, ^{ns}= non-significant (based on t(10.000); one-tailed test).

Predictive model

We evaluated the predictive power of our model to generate accurate predictions (Shmueli & Koppius, 2011) using cross-validation with a hold-out sample (Shmueli et al., 2019). Discovery and exploitation were defined as key target constructs, and we applied the PLSpredict tool with 10 folds. The positive $Q^2_{predict}$ values (Table 6) indicated predictive relevance.

To assess out-of-sample predictive performance, we calculated two standard error metrics: Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE). RMSE penalizes larger prediction errors more heavily by squaring them, making it sensitive to outliers. MAE, in contrast, provides a more robust estimate by averaging the absolute differences between predicted and actual values, treating all errors equally (Shmueli et al., 2019). Using both metrics allows for a comprehensive evaluation of prediction accuracy. We compared the RMSE and MAE values from the PLS-SEM model against those from a naïve linear model benchmark (LM). In our results (Table 6), the MAE–LM values were negative for both constructs, indicating that the PLS-SEM model provided more accurate predictions on average. However, the RMSE–LM values were slightly positive, suggesting that a few larger errors occurred under the PLS-SEM model. This divergence implies that while the PLS model performed better overall, it was more sensitive to occasional extreme values.

To further assess out-of-sample predictions, we used the more restrictive CVPAT (Liengaard et al., 2021), comparing the model to a mean-value benchmark (Sharma et al., 2023). The results showed no significant difference for discovery (*PLS-IA* = -0.161; p = 0.052), but a significant difference for exploitation (*PLS-IA* = -0.510; p = 0.005), confirming high predictive validity for exploitation but uncertain predictive power for discovery.

Table 6. Predictive model assessment

Discovery				**Exploitation**		
PLS-Predict assessment	***Q²predict***	***RMSE***	***RMSE – LM***	***Q²predict***	***RMSE***	***RMSE – LM***
	0.209	0.912	0.703	0.274	0.869	0.595
		MAE	***MAE – LM***		***MAE***	***MAE – LM***
		0.715	-0.506		0.702	-0.428
CVPAT (PLS-IA)	**Average loss difference**	***t*-value**	***p*-value**	**Average loss difference**	***t*-value**	***p*-value**
	-0.161	1.969	0.052	-0.510	2.903	0.005

Note: *RMSE:* Root Mean Square Error; *LM:* linear model.

DISCUSSION

The relationship between entrepreneurial intentions and actions has posed an enduring challenge in the entrepreneurship ecosystem, with studies showing that only about 30 percent of entrepreneurial intentions translate into actual venture creation (Shirokova et al., 2016; Van Gelderen et al., 2015). While previous scholars have examined this intention-action gap from a variety of angles, including cognitive approaches (Blank & Gabay-Mariani, 2023; Van Gelderen et al., 2015), behavioral perspectives (Dlamini & Botha, 2023), and the contextual role (Bogatyreva et al., 2019), our findings offer a more integrated understanding. First, by examining student entrepreneurship through the combined lens of effectuation and bricolage theories, our study shows how these theoretical perspectives work together in practice: effectuation theory's emphasis on leveraging available means and embracing uncertainty (Reymen et al., 2015; Sarasvathy, 2001) provides the strategic framework for opportunity development, while bricolage can be seen as the tactical approach, with its focus on hands-on resource recombination and creative problem-solving (Baker & Nelson, 2005; Fisher, 2012). This strategic/tactical complementarity enables entrepreneurs to identify possibilities using effectual logic and, at the same time, implement solutions through bricolage actions. This theoretical integration addresses what Welter et al. (2016) identified as a critical gap between theories of resource utilization and theories of opportunity creation.

Moreover, combining these theories helps explain the varying outcomes of resourceful behaviors: when entrepreneurs apply effectual reasoning to guide their bricolage activities, they maintain strategic adaptability while making tactical resource decisions, avoiding purely reactive approaches. Although some studies have shown that bricolage enables venture creation through creative resource combinations (Baker & Nelson, 2005; Senyard et al., 2014) and innovative solutions (Davidsson et al., 2017), other studies have found that it leads to suboptimal outcomes (Kickul et al., 2018; Stinchfield et al., 2013) and compromised quality (Lanzara, 1999). Similarly, while Welter et al. (2016) and Fisher (2012) found that bricolage supported opportunity creation, studies by Servantie and Rispal (2018) and An et al. (2020) identified risks of path dependencies and resource constraints becoming self-perpetuating. These contradictions in the literature may stem from different theoretical approaches to studying bricolage, with some focusing solely on resource combinations (Baker & Nelson, 2005), while others examine cognitive and behavioral processes independently (e.g., Davidsson et al., 2017; Kickul et al., 2018; Senyard et al., 2014; Stinchfield et al., 2013).

Our findings also demonstrate that innovative behavior acts as the catalytic mechanism whereby entrepreneurs transform entrepreneurial bricolage practices into entrepreneurial action. Importantly, although innovative behavior is more commonly conceptualized as an outcome in entrepreneurship research, we argue for its role as a mediator based on its behavioral nature and enabling function within entrepreneurial processes. This perspective is supported by studies in organizational contexts that empirically validate the mediating role of innovative behavior between antecedent factors such as leadership or organizational culture and outcome variables like performance or radical innovation (Aryee et al., 2012; Naranjo-Valencia et al., 2017). While these studies are situated in employee behavior contexts, they lend theoretical plausibility to our model, reinforcing the logic that innovative behavior can act as a behavioral conduit through which resourceful strategies like bricolage lead to entrepreneurial action.

Specifically, innovative behavior enables the effective implementation of entrepreneurial bricolage through specific behavioral dimensions: questioning, observing, experimenting, and networking. Building on the work of Scazziota et al. (2023) on cognitive processes in resource reinterpretation, our findings suggest that these behavioral dimensions serve as key mechanisms through which entrepreneurs convert cognitive insights into tangible actions. This is particularly

significant in light of the fact that while the importance of cognitive flexibility in student entrepreneurship has been increasingly recognized (Hägg, 2021; Ou & Kim, 2024), understanding how cognitive insights translate into entrepreneurial action remains elusive. Our findings expand on Politis et al.'s (2012) work by demonstrating how these specific behavioral dimensions enable entrepreneurial thinking to be transformed into concrete discovery and exploitation activities.

Our results particularly challenge and extend current theoretical understanding of how effectuation operates in practice. While Sarasvathy (2001) saw effectuation as leveraging available means under uncertainty, and scholars such as Read et al. (2016) and Reymen et al. (2015) have explored its application in various contexts, the specific mechanisms enabling effectual processes have remained unclear (Grégoire & Cherchem, 2020; Jiang & Rüling, 2019). Our findings show that innovative behavior serves as this crucial enabling mechanism, explaining how entrepreneurs transform available means into new ends. This insight helps address the theoretical tension noted by Arend et al. (2015)regarding how effectuation creates new value. Specifically, innovative behavior enables entrepreneurial action through four key mechanisms: observing recognizes untapped value in resource combinations, questioning identifies novel applications for existing resources, experimenting validates these novel applications through market testing, and networking mobilizes stakeholders to support resource transformation.

This understanding of how innovative behavior enables effectuation is particularly relevant for student entrepreneurs, as it reveals a pathway to success that challenges traditional assumptions about entrepreneurial expertise. While effectuation theory traditionally emphasizes the role of expertise in transforming means into ends (Sarasvathy, 2001), our findings align with studies that highlight the effectiveness of effectual strategies among nascent entrepreneurs (Chandler et al., 2011; Weerakoon et al., 2019). This suggests that student entrepreneurs can effectively engage in effectual processes through innovative behavior, even in the absence of extensive industry knowledge. Moreover, our findings reveal that innovative behavior enables student entrepreneurs to overcome what Longva (2021) identified as their key constraints—limited market knowledge and professional networks—by leveraging their freedom from industry conventions (Ferrante et al., 2019; Wright & Mustar, 2019) in unique ways. While previous research has shown superior opportunity identification capabilities among student entrepreneurs (Zhu et al., 2021) and attributed this either to cognitive factors (Grégoire et al., 2011) or experiential learning (Motta & Galina, 2023), our results suggest a more nuanced mechanism: innovative behavior provides the crucial link between their resourceful thinking and actionable outcomes. This finding extends effectuation theory by demonstrating how it operates in early-stage entrepreneurial contexts, addressing a key limitation identified by Reymen et al. (2015) in the current understanding.

Significant too is our finding on the limited impact of traditional support factors (control variables), with only family entrepreneurial background shown to have a significant influence on exploitation activities. This challenges prevailing assumptions in the literature on the importance of institutional support (Doanh Duong et al., 2024) and prior experience (Grežo, 2024) in student entrepreneurship. Rather, our results are in keeping with new emerging perspectives that emphasize the role of behavioral capabilities and family role models (Edelman et al., 2016; Tarling et al., 2016) in enabling successful venture creation. These findings suggest that the development of innovative capabilities might be more crucial than traditional entrepreneurial prerequisites, challenging conventional wisdom on entrepreneurial support mechanisms.

This study makes several important contributions to entrepreneurship theory. First, we advance understanding of entrepreneurial theory by demonstrating how effectuation and bricolage function in practice as complementary theoretical perspectives, rather than parallel theories (Fisher, 2012; Servantie & Rispal, 2018). While effectuation provides the strategic framework for navigating uncertainty through available means, entrepreneurial bricolage offers a tactical approach for resource mobilization within those uncertain conditions. This complementarity is made operational through innovative behavior, which enables student entrepreneurs to translate both effectual principles and bricolage practices into concrete outcomes. Building on prior work examining the relationship between effectuation and bricolage (Chinyoka, 2020; Scazziota et al., 2023), our study shows innovative behavior to be a key mechanism through which these complementary theories operate in practice. This integration not only addresses the challenge posed by Arend et al. (2015) regarding the differentiation between effectuation and other entrepreneurial theories but also responds to calls for research on ways in which effectuation and bricolage can be integrated in practice (Vasconcelos-Scazziota et al., 2020). In particular, our findings shed light on ways in which student entrepreneurs overcome resource constraints through the relationship between effectual logic and bricolage behavior, with innovative behavior acting as the key mechanism enabling them to be integrated.

Second, we contribute to opening the "black box" of effectuation (Jiang & Tornikoski, 2019) by identifying innovative behavior as the key mechanism linking resourceful behaviors to entrepreneurial action. While previous research has

explored contextual factors influencing effectuation among student entrepreneurs, such as academic environment (Politis et al., 2012), entrepreneurial education programs (Nabi et al., 2017), and resource constraints (Shirokova et al., 2016), our study reveals how entrepreneurs transform available means into ends within effectual processes. Specifically, the full mediation effect shows that innovative behavior bridges cognitive and behavioral aspects of resource transformation; questioning and observing enable cognitive reinterpretation of resources; and experimenting and networking facilitate the behavioral implementation of these insights. This integration of cognitive and behavioral mechanisms addresses the theoretical gap in understanding how the effectual transformation of means occurs (Grégoire & Cherchem, 2020; Jiang & Tornikoski, 2019).

Third, we advance the ongoing debate about means-driven approaches versus predictive strategies (Read et al., 2016) by demonstrating how innovative behavior enables the transformation of means into ends. Our findings reveal a process in which resourceful behaviors, catalyzed by innovative behavior, lead to effective resource mobilization and entrepreneurial action (Williams et al., 2021; Zahra, 2021). This contributes to an understanding of how effectuation and entrepreneurial bricolage operate at the intersection of opportunity creation (Welter et al., 2016), where bricolage's emphasis on creative resource resignification (Scazziota et al., 2023) enables effectual principles for controlling—rather than predicting—the future.

Finally, we extend understanding of discovery and exploitation activities within entrepreneurship by demonstrating how innovative behavior enables both types of activity. Our results show that discovery and exploitation both emerge through the interaction of effectual logic and bricolage behaviors, mediated by innovative behavior. This supports the effectual view that opportunities are not pre-existing entities to be discovered (Alvarez & Barney, 2010), but rather emerge through dynamic interactions with available means and stakeholders (Baron & Ensley, 2006; Zhu et al., 2021). This contribution is particularly relevant for student entrepreneurs, who may lack the resources and experience traditionally associated with opportunity discovery and exploitation but can successfully engage in both activities through effectual approaches.

For student entrepreneurs, our research reveals that venture creation depends primarily on developing specific innovative capabilities. Students should focus on systematically questioning assumptions about resource requirements, observing how others succeed under constraints, conducting small-scale experiments to validate assumptions, and using networking strategically for resource mobilization and knowledge acquisition. These innovative behaviors are particularly crucial when transitioning from opportunity identification to venture implementation.

As for university support programs, our findings suggest that they should shift their focus from merely providing resources to fostering capability development. Programs should create environments that facilitate experimentation and learning through peer communities, problem-solving workshops, and mentoring systems focused on innovative capability development. Given that innovative behavior mediates the relationship between bricolage and entrepreneurial action, such programs should give greater priority to developing these capabilities than providing direct resources.

For entrepreneurship support organizations, our results indicate that there is a need to provide differentiated support according to the stage of the venture. Support at the discovery phase should focus on cognitive flexibility and systematic experimentation, while exploitation-phase support should emphasize strategic flexibility and resource-reconfiguration abilities, reflecting the different way in which innovative behavior operates across these stages.

CONCLUSION

This study examined how student entrepreneurs leverage entrepreneurial bricolage and innovative behavior to overcome resource constraints and engage in entrepreneurial action. Our findings show that the total effect of entrepreneurial bricolage is positive for both discovery and exploitation activities, and innovative behavior fully mediates these relationships, challenging conventional views about bricolage's direct impact on entrepreneurial outcomes. This study expands understanding of the way in which effectuation is manifested in practice by shedding light on the behavioral mechanisms whereby student entrepreneurs transform limited resources into concrete actions. Through the lens of effectuation and bricolage frameworks, we demonstrate how entrepreneurial bricolage operates through innovative capabilities to enable entrepreneurial action. Our results contribute to bridging the gap between entrepreneurial intentions and actions by revealing specific mechanisms that enable student entrepreneurs to overcome resource constraints. The study also offers practical insights for universities and support units on how they can better facilitate student entrepreneurship by focusing on developing innovative capabilities rather than just providing resources.

Whilst our study provides valuable insights into student entrepreneurship, it is not without its limitations. Nonetheless, these very limitations also furnish opportunities for future research. First, while our study provides meaningful insights

into the behavioral mechanisms underlying student entrepreneurship, it is important to acknowledge the limitations associated with our sampling approach. Specifically, we employed a non-probability convenience sample, which may limit the statistical generalizability of our findings to a broader population. Future research using probability-based sampling or replication in different populations would strengthen the external validity of the proposed model.

Second, the cross-sectional design limits causal inferences. While we establish relationships between entrepreneurial bricolage, innovative behavior, and entrepreneurial action, we cannot definitively determine causality. Future research could address this limitation using longitudinal studies, tracking student entrepreneurs over time to observe how their capabilities evolve and impact venture outcomes. Such studies would provide deeper insights into the dynamic nature of capability development and its long-term effects on entrepreneurial success.

Third, while our study focused on positive outcomes of entrepreneurial bricolage and innovative behavior, future research might investigate potential negative consequences in student entrepreneurship. These could include limited scalability of bricolaged solutions, a short-term focus that might hinder long-term strategic planning, or overdependence on the founder's skills. Exploring these potential downsides could provide a more balanced understanding of entrepreneurial bricolage in student entrepreneurship and help identify strategies that would mitigate these risks.

Fourth, while we have monitored a number of variables, there may be other factors influencing the relationships we studied. Future research could explore additional moderating or mediating variables, such as psychological factors (e.g., entrepreneurial self-efficacy), institutional factors (e.g., university support systems) and environmental factors (e.g., industry dynamism). Furthermore, to enhance robustness, future research could estimate the same model using covariance-based SEM (e.g., AMOS) to compare the performance of reflective and composite modeling approaches.

Finally, future studies could benefit from using instrumental variables (IVs) as an alternative method for evaluating endogeneity, especially when the Gaussian Copulas approach is not applicable due to the non-normal distribution of data for the latent independent variables.

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Conflicts of interest

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