

HOW DO KEY EVENTS INSPIRE AN INTEREST IN SCIENTIFIC RESEARCH: QUALITATIVE CASE AND CONFIGURATION PATH ANALYSIS OF TOP INNOVATIVE TALENT CULTIVATION IN ECONOMICS AND MANAGEMENT

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Abstract: The core of cultivating top-notch innovative talents lies in stimulating their intrinsic motivation. Through in-depth interviews with 35 graduate students and their supervisors in the field of economics and management, this paper explores which key moments, events, and situations during the graduate student training process can effectively trigger and consolidate students' research interests. The study adopts a method combining multiple case studies and fuzzy set qualitative comparative analysis to identify four key events: "institutional opportunities", "relationship embedding", "curricular collision", and "practical refinement". A three-dimensional explanatory framework of "individual readiness - event impact - environmental support" is constructed. Qualitative and configurational analysis jointly reveal that the formation of high research interests follows the logic of "multiple concurrent" and "different paths leading to the same destination", and there are three core paths - "institutional empowerment breakthrough", "mentorship cultivation growth", and "practical feedback epiphany". This study deepens the understanding of the dynamic formation process of research interests and provides theoretical basis and practical implications for universities to optimize the training model of top-notch innovative talents through precise design and intervention of key events.

Keywords: Key event analysis; Research interest; Top-notch innovative talents; Graduate students in economics and management; Fuzzy set qualitative comparative analysis

1 INTRODUCTION

"Interests" are the deep driving force that motivates individuals to continuously engage in creative activities, and their cultivation is the cornerstone for the growth of outstanding innovative talents[1]. However, in current graduate education in economics and management in China, phenomena such as "exam-oriented learning" and "utilitarian research" are still quite common, and the lack of students' research interests has become a bottleneck restricting the quality of training. Traditional research mostly examines the influencing factors of research interests from a static "factor-result" perspective, such as mentor guidance and course design[2,3], but relatively neglects the formation mechanism of research interests as a dynamic social psychological process. In other words, we know "which factors" are important, but we still lack detailed description and explanation of how these factors "when" and "why" can stimulate students' interests in research in specific contexts.

The "critical event" theory provides a powerful analytical tool to open up this black box. A critical event refers to specific experiences or situations in an individual's development and career transition that have a significant and lasting impact on cognition, emotion, or behavior[4]. In the field of education, it focuses on those "turning points" moments. Shifting the perspective to critical events means moving from focusing on the normalized "elements" of training to focusing on those "moments" and "situations" that can trigger profound changes in students' inner selves. This is crucial for understanding the formation of research interests, which is highly dependent on internal experiences. Therefore, this study aims to answer three core questions: (1) In the growth process of graduate students in economics and management, which types of "critical events" have had a significant stimulating or inhibiting effect on their research interests? (2) How do these critical events influence students' research interests through which internal mechanisms (cognition, emotion, behavior)? (3) Are there differences in the paths of the effects of critical events in different types of individuals and environments? Are there multiple equivalent stimulating paths? This study integrates qualitative case analysis and fsQCA methods, through in-depth description and comparison of 35 in-depth interview cases, to attempt to reveal the complex causal mechanism of how critical events trigger research interests, providing empirical basis for building an ecosystem for cultivating outstanding innovative talents.

2 LITERATURE REVIEW AND ANALYSIS FRAMEWORK

2.1 From Static Factors to Dynamic Events: The Contextualization Shift in Research Interest Studies

Existing research literature on research interests has established a relatively complete framework of influencing factors. These studies can be broadly classified into three categories: (1) Individual Trait Theory: focuses on pre-attentive factors such as students' motivation for pursuing a postgraduate degree[5], and research self-efficacy[6]. (2)

Environmental Supply Theory: emphasizes the role of mentor guidance[1], academic atmosphere[7], and curriculum system[3]. (3) Institutional Incentive Theory: explores the shaping functions of training systems, evaluation systems, and resource allocation[8]. These studies have laid a solid foundation, but their linear causal assumptions are difficult to capture the nonlinear, contextual, and processual characteristics of the generation of research interests. In recent years, scholars have begun to call for attention to "process" and "interaction". For example, Renninger's interest development four-stage model emphasizes the dynamic process of the transformation from contextual interest to individual interest[9]. Wang Shuqin[10] found that the "academic experience" of master's students has an important predictive effect on their interests, which is very close to the meaning of "event". Based on this, this study proposes the necessity of the contextualization shift, and returns the research focus from the "variables" that separate from the context to the "events" embedded in the real training practice, and analyzes how those "key events" as catalysts for interest development play their roles.

2.2 The Critical Incident Theory and Its Application in Educational Research

The critical incident method originated from the critical incident technique and has been widely applied in areas such as teacher professional development and career management. Its core lies in understanding the mechanisms of attitude and behavior changes by reviewing and analyzing specific events that have a significant impact on individuals[11]. In educational research, a critical incident is defined as "an event that significantly promotes professional learning and development", typically characterized by "suddenness", "contextuality", and "significance"[12]. Current research mostly focuses on teacher education, exploring how critical incidents promote teachers' reflection and growth. However, in student development, particularly in the formation of graduate students' research interests, systematic critical incident research is still lacking. This study defines critical incidents as specific experiences, situations, or interactions during graduate student training that are perceived by students or mentors as having a transformative, decisive, or reinforcing impact on their research attitudes, emotions, or behaviors.

2.3 Analysis Framework Construction: Key Events, Mechanisms of Action, and Configuration Paths

To systematically analyze how key events trigger scientific interest, we have constructed an integrated analytical framework. This framework consists of three core components:

Types of Key Events: Based on previous research and interviews, we initially classified key events into four categories: (1) Institutional Opportunities: Special opportunities provided by institutional arrangements, such as obtaining a significant research grant, participating in international academic conferences, receiving support for flexible study schedules, etc. (2) Relationship Embedding: Events that occur in important interpersonal interactions, such as a deep conversation with a supervisor, a heated debate within the academic community, the assistance of academic peers, etc. (3) Course-related Collisions: Ideological collisions that occur during course learning or academic training, such as a course that overturns one's understanding, a successful classroom presentation, a highly challenging course project, etc. (4) Practical refinement: Challenges and successes experienced in scientific practice or social activities, such as independently completing an enterprise consulting project, having one's research findings adopted by policies, experiencing a painful process of writing and revising a thesis, etc.

Intrinsic Mechanisms of Action: Key events exert their influence by affecting three psychological levels of an individual: cognition, emotion, and behavioral identification. (1) Cognitive Reconstruction: Events prompt students to reevaluate the value of research, their own abilities, or their understanding of the discipline. (2) Emotional Activation: Events bring about intense positive emotional experiences (such as pleasure, a sense of achievement, a sense of belonging) or overcome negative emotions (such as frustration). (3) Behavioral Identification: Events prompt students to adopt new research behaviors and internalize the "researcher" identity in the process.

Configuration Effects: We hypothesize that the effectiveness of key events does not exist in isolation but forms a configuration with an individual's prior preparedness (such as knowledge reserves, motivation levels) and the continuous support of the environment (such as subsequent guidance from supervisors, institutional guarantees) to jointly determine the effectiveness of triggering scientific interest. Different types of individuals, under different environmental supports, may achieve the same effect of stimulating interest through experiencing different types of key events.

3 RESEARCH DESIGN AND METHODS

3.1 Methodology: Mixed Design of Qualitative Case Study and fsQCA

This study adopts an exploratory sequential mixed-method design. Firstly, through multi-case qualitative research, key events were deeply explored and classified to construct a theoretical model of their impact on research interests. Then, using the fsQCA method, the cases were compared in configuration to test and refine multiple equivalent triggering paths. This "qualitative first, quantitative later" design ensures in-depth understanding of the process mechanism and enhances the generalizability and robustness of the conclusion through cross-case comparison [13].

3.2 Case Selection and Data Collection

This study follows the principle of "theoretical sampling", selecting 35 typical postgraduate students in the field of economics and management as core analysis cases from the samples obtained from the previous questionnaire survey. When sampling, dimensions such as degree type (academic/professional), trajectory of changes in research interests (significant improvement/significant decline/steady high/steady low), and institution type (research-oriented/applicable) were considered to maximize the heterogeneity of the cases and facilitate theoretical construction and comparison.

Data collection was mainly conducted through semi-structured in-depth interviews. Each interviewee's interview lasted approximately 60-120 minutes. The interview outline mainly included: (1) Please review your entire postgraduate period and whether there were any one or several moments, events, or experiences that significantly or fundamentally changed your perception or feelings about "doing research"? (2) Please describe in detail that event (when, where, who involved, what happened)? (3) Why was that event so important to you? What specific changes did it bring about in your thoughts, feelings, and subsequent actions? (4) In the period before and after the event, what support or challenges did the environment (such as your supervisor, classmates, and the college) provide? Additionally, we also collected some relevant physical evidence, such as students' research notes, project reports, and emails with supervisors, for triangulation of the interview content.

3.3 Data Analysis Strategy

This article first adopts qualitative data analysis, mainly using the coding technique of grounded theory, and conducts the analysis using NVivo 12 software. The analysis process includes: (1) Open coding: Analyze the interview text line by line to extract initial concepts. (2) Main axis coding: Classify the initial concepts to form sub-categories and main categories, such as "positive feedback from the supervisor", "challenges of interdisciplinary projects", etc., and finally group them into four key event types. (3) Selective coding: Focus on the core story line of "how key events trigger research interests", and sort out the logical relationships between each category to construct a theoretical model.

Then, using the fsQCA analysis method, we conducted fsQCA analysis on 35 cases based on the qualitative analysis to test the configuration paths. Variables and calibration are as follows: (1) The outcome variable is represented by a significant improvement in research interests. The calibration of the fuzzy set is based on the degree of change in students' self-reported interests and the intensity of behavioral changes in the interview text. (2) The condition variables mainly consist of five parts: ①Institutional opportunities experienced: Calibration basis is whether the event is a special opportunity arranged by the system and its significance to the individual. ②Relationship embedding of the event: Calibration basis is whether the event involves deep interpersonal interaction and its emotional/cognitive impact. ③Course-related collision of the event: Calibration basis is whether the event occurs in the context of courses and the degree of thinking transformation it triggers. ④High individual preparedness: Calibration basis is the knowledge, motivation, and ability foundation of the interviewee before the event. ⑤High environmental support: Calibration basis is whether the environment (supervisor, college, etc.) can provide continuous support after the event.

4 RESEARCH RESULTS: QUALITATIVE DEEP DESCRIPTION AND MECHANISM ANALYSIS OF FOUR KEY EVENTS

Through the coding and analysis of 35 interview texts, we identified four types of key events that had a profound impact on the research interests of the participants. We also revealed the underlying mechanisms of these events through case studies.

4.1 Institutional Opportunities: Leap in Research Interests Driven by Policy Leverage

Institutional opportunities refer to special opportunities created by the institutional design of the university or college that provide students with the chance to break away from conventional development paths. These events typically have high scarcity, high returns, and strong signaling effects.

Case Study of Typical Examples: Case S12 (Academic Master's Student, Second Year) experienced the approval of the "Graduate Innovation Fund Project". "At that time, I just had the idea of giving it a try and turned the idea of a course paper into an application. Unexpectedly, I actually received the funding." That moment felt completely different. Before, I thought doing research was about completing tasks assigned by my teachers. Now, I feel it's 'my own project'. (Cognitive Reconstruction: From "Research for Others" to "Research for Ourselves"). "With the funding, I can purchase data more freely, attend paid seminars, and I have more confidence." The most crucial point is that this project has become an 'identity label'. The mentor group will treat my ideas more seriously, and peers will also come to consult me about related issues." (Identity Identification and Internalization). This event greatly stimulated the research subjectivity and responsibility of S12 through providing resources for empowerment and identity recognition.

From the perspective of the mechanism, institutional opportunities mainly change students' research self-efficacy and research identity through three mechanisms: resource injection (providing funds and opportunities), identity assignment (granting formal recognition), and path exploration (opening up new possibilities), thereby stimulating interest.

4.2 Relational Embedding: Emotional and Cognitive Resonance within the Academic Community

Relational embedding events occur in deep interactions with mentors, peers, or industry experts. The core is emotional

connection and cognitive enlightenment.

Case in-depth description: Case S08 (Professional Master's Degree, Third Year) recalled a key conversation with her mentor. "When I was doing research, I was very confused. I thought that business school papers were all 'paper talk' with no practical application. Once I talked to the mentor about a cross-border e-commerce phenomenon, he did not give me a direct answer. Instead, he told me many real-life business stories and asked me a series of 'why' questions, guiding me to delve deeper layer by layer. That conversation was like opening a window, allowing me to experience for the first time that theory could be used to analyze the complex business world." (Reconstructing Cognition: Discovering the Beauty and Power of Theory). "The mentor's eyes were filled with encouragement and anticipation at that time. The trust of 'I believe you can figure it out' gave me tremendous strength." (Awakening Emotions: Receiving Academic Care and Trust). After that, S08 actively sought literature and built models, eventually developing that discussion into the topic of his thesis.

From the perspective of the mechanism, relational embedded events provide students with dual support in terms of cognition and emotion through mechanisms such as cognitive scaffolding (the mentor's heuristic questions), emotional safe haven (the inclusiveness and support of the academic community), and role model demonstration (the mentor's academic passion and rigor). This enables students to experience a sense of security and achievement in challenging tasks, thereby nourishing their research interests.

4.3 Course-based Collision: The "Eureka Moment" of Thinking Paradigm Transformation

Course-based collision refers to cognitive conflicts and ideological breakthroughs triggered during the course of learning, such as the acquisition of new knowledge, new methods, or new viewpoints, which are known as "epiphany" moments.

Case Deep Description: Case S19 (Master of Arts, first year) experienced a "worldview" refresh in the "Business Data Analysis" course. "The course required us to analyze social media data using Python to study consumer behavior. I had always believed that social science research involved filling out questionnaires and conducting interviews. When I first used a crawler to obtain massive data and conducted cluster analysis to discover several consumer groups that had never been defined in the literature, I was completely shocked. That feeling was like... suddenly discovering a new dimension hidden behind the world." (Reconstructing Cognition: The Subversion of Research Paradigm). "I was so excited that I couldn't sleep for several days and kept trying different algorithms, just to see what treasures could be 'pulled out'. I suddenly developed a huge interest in research methodology." (Awakening Emotions: The Bursting of Curiosity). This course experience directly determined S19's subsequent research direction.

From the perspective of the mechanism, course-based collisions mainly bring students intense intellectual pleasure and thirst for knowledge through mechanisms such as cognitive disruption (breaking the original thinking pattern), tool empowerment (acquiring new research tools), and vision expansion (gaining insight into the frontiers of the discipline), thereby igniting their research interests.

4.4 Practical Tempering: Knowledge Integration and Value Confirmation in the "Battlefield"

Practical tempering refers to the profound recognition of the value of research that students develop after solving real, complex practical problems, through a cycle from theory to practice and then from practice to theory.

Case Deep Description: Case S25 (Master of Science, second year) participated in a consulting project for a local technology enterprise to develop a market entry strategy. "Our group applied countless classic theoretical models and the proposed solutions were rejected by the enterprise mentor, who said, 'It's not relevant.' At that time, the pressure was immense, and I almost gave up. Later, we delved deeper, spending two weeks conducting in-depth interviews with twenty-plus channelers and potential users, and finally truly understood the complexity of the market." "When we present new solutions rooted in reality and gain the approval of the enterprise, the sense of achievement is unparalleled." (Emotional Awakening: From Frustration to Peak Experience). "I deeply realized that the theories in the classroom are not the universal key. The real research starts from real problems and creatively applies and modifies theories. This is much more than what any course has taught me." (Cognitive Reconstruction: Re-understanding the Essence of 'Research'). This experience has made S25's enthusiasm for applied research unprecedentedly high.

From the perspective of the mechanism of effect, practical training deepens students' understanding of the significance of scientific research through mechanisms such as the authenticity of problems (facing real and chaotic problems), the verification field of abilities (integrating knowledge to solve problems), and the intuitive visualization of value (seeing the actual impact of research results with one's own eyes), thus firmly establishing their interest in research, especially in applied disciplines.

5 CONFIGURATION ANALYSIS: MULTIPLE PATHS FOR KEY EVENTSS TO STIMULATE SCIENTIFIC INTREREST

Qualitative analysis revealed the types and mechanisms of key events, but do they operate independently? To address this, we conducted an fsQCA analysis on 35 cases to explore the conditional configurations that led to "a significant increase in scientific interest".

5.1 Data Analysis Results

Necessity analysis showed that the consistency of all individual conditions was below 0.9, indicating the absence of necessary conditions. Sufficiency analysis produced three equivalent paths that drive a significant increase in scientific interest (overall solution consistency = 0.88, overall solution coverage = 0.68), as shown in Table 1.

Table 1 Configuration Paths for Key Events Stimulating Scientific Interest

Conditions and Results	Path 1: Institutional Empowerment-Based Breakthrough	Path 2: Growth through Inner Cultivation within the School	Path 3: Practical Feedback-Based Insight
Taking advantage of institutional opportunities	●		◐
Experience relational embedding		●	
Experiencing course-related conflicts		◐	
Experiencing practical refinement			●
Individual high preparedness	●	◐	●
High environmental support level	◐	●	●
Consistency	0.91	0.87	0.84
Original coverage	0.25	0.30	0.22
The only coverage extent	0.07	0.10	0.05

Note: ●=Core condition exists; ◐ =Auxiliary condition exists; Blank=Condition absent.

Path 1: Institutional Empowerment Breakthrough. The core of this path lies in the combination of institutional opportunities and individual high preparedness. This describes those "well-prepared lucky ones" who, when institutional opportunities (such as innovation funds, international conferences) arise, due to their better knowledge reserves and exploration desires (high preparedness), can quickly seize the opportunities and transform them into breakthrough experiences in research, thereby greatly enhancing their interests. The environmental support plays an auxiliary role in this path.

Path 2: Mentorship Cultivation Growth. The core of this path lies in experiencing relational embedding and high environmental support. This describes students in an academic community with a strong cultural atmosphere, who, through continuous and deep interactions between teachers and students and peer learning (relational embedding), gradually "cultivate" their research interests in a highly supportive environment (such as continuous care from mentors and mutual assistance within the community). The course collisions may serve as the starting point for stimulating discussions, but they do not constitute the core.

Path 3: Practical Feedback Insight. The core of this path lies in experiencing practical refinement and is supplemented by individual high preparedness and environmental high support. This describes students who have grown through "practice". They possess a certain theoretical foundation (high preparedness) and, after engaging in challenging practical projects (practical refinement), through painful struggles and reflections, achieved a profound understanding and recognition of the theoretical value under the support of their mentors or teams (high environmental support), and their interests were consolidated. Institutional opportunities (such as project funding) may provide a platform for this.

5.2 Dialogue between Qualitative and Configuration Discovery

The configuration analysis results and qualitative discoveries form a profound dialogue and complementarity: On the one hand, they confirm the non-uniqueness of key events. The existence of three equivalent paths indicates that there is no certain "must-encounter" key event. Different types of events can effectively stimulate interests when combined with the specific combination of individuals and the environment. On the other hand, it reveals the compensation and linkage relationships among conditions. For example, in Path 3, intense practical refinement requires the synergy of individual preparedness and environmental support to produce positive effects; otherwise, it may lead to frustration. In Path 2, continuous high environmental support can compensate for the initial lack of preparedness of the individual (preparedness as an auxiliary condition). Finally, it emphasizes the "individual-event-environment" matching: Configuration analysis makes the implicit matching logic in qualitative research explicit. The effectiveness of key events highly depends on whether it matches the individual's preparedness state and the supportive characteristics of the

environment.

6 CONCLUSION AND IMPLICATIONS

This study, through a combination of qualitative and configurational analysis methods, deeply explored the role of key events in stimulating the research interests of graduate students in economics and management. The research found that the stimulation of research interests is not the result of a single factor acting linearly, but is formed by specific configurations of "institutional opportunities", "relationshipal embedding", "curricular collisions", and "practical refinement", along with the individual's preparedness and the supportive characteristics of the environment, through cognitive, emotional, and behavioral mechanisms. This study revealed three equivalent excitation paths under the matching of "individual - event - environment", promoting the shift of research interest studies from a static factor theory to a dynamic situational theory. Ultimately, the cultivation of top-notch innovative talents requires educators to become dedicated "opportunity designers" and "environment creators", skillfully arranging those "critical moments" that can ignite the inner research fire of students during their growth journey.

The findings of this study have important implications for the cultivation of top-notch innovative talents in economics and management: (1) Transformation of thinking cultivation. University administrators and teachers should shift from simply providing resources (such as courses, mentors) to consciously designing and creating "highly influential" key events. The training plan should incorporate more elements that can generate "institutional opportunities" and "practical refinement". (2) Precise intervention strategies. For students with outstanding academic potential (high preparedness), priority should be given to providing "institutional opportunities" (such as integrated undergraduate, master's, and doctoral programs, early involvement in research plans), creating space for breakthrough growth. For students who need more guidance, efforts should be made to build a supportive "relationshipal embedding" environment (such as strengthening the responsibility and authority of mentors, building learning communities), cultivating their interests through continuous academic care. For professional degree graduate students with strong practical motivation, real "practical refinement" projects (such as on-the-job practice, consulting projects) should be designed, accompanied by a strong on-campus and off-campus mentor support system, promoting their "knowledge and action integration". (3) Systematic construction of the ecological environment for the cultivation of top-notch innovative talents in graduate students. The key lies in building a cultivation ecology that can continuously generate and effectively support key events. This requires institutional flexibility to create opportunities, close interaction between teachers and students to deepen relationships, curriculum innovation to trigger collisions, and industry-academia integration to provide a refining field.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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