Environment and Social Psychology (2026) Volume 11 Issue 2
doi: 10.59429/esp.v11i2.4495
ISSN: 2424-8975 (O)
2424-7979 (P)

RESEARCH ARTICLE

A Study on the Influence of University Teachers' Innovative Intention on Innovative Behavior under the Pressure of Digital Transformation

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ABSTRACT

Digital transformation has profoundly impacted the field of higher education. Under the pressure of this transformation, university teachers must engage actively in innovation to achieve breakthroughs. Through purposive sampling, this study conducted in-depth interviews with teachers from 24 universities in Guangdong Province, systematically collecting their cognitive, emotional, and behavioral manifestations during the innovation process. By employing directed content analysis on the interview data, the study systematically examined the factors influencing innovative behavior based on the Theory of Planned Behavior and Stress Management Theory, exploring the interaction mechanisms among these factors. The findings indicate that university teachers' innovative behavior is primarily influenced collectively by behavioral attitude, creative self-efficacy, perceived organizational support, and challenge stress, with challenge stress playing a critical moderating role in the process through which innovative intention affects innovative behavior. This research directly responds to scholarly calls for clarifying the mechanisms among influencing factors, effectively advancing the refinement and contextualization of innovative behavior theory in specific scenarios.

Keywords: Theory of Planned Behavior; Stress Management Theory; Innovative Behavior; Challenge Stress; University Teachers

1. Introduction

Innovation has become a core driving force for societal development, with abundant research existing at both macro (industry) and meso (enterprise) levels [1, 2]. However, innovation at these levels largely relies on the impetus of micro-level individual innovation [3]. Therefore, micro-level studies on employee innovative behavior in various organizations are essential. In the higher education sector, employee innovative behavior has not yet received sufficient attention. In China, a lack of innovation is observed among many university teachers. Research indicates that only about 20% of papers (including those in natural sciences) published by

ARTICLE INFO
Received: 24 December 2025 | Accepted: 28 January 2026 | Available online: 13 February 2026

CITATION
Zhang X, Sukpasjaroen K, Boonkrong A. A Study on the Influence of University Teachers' Innovative Intention on Innovative Behavior under the Pressure of Digital Transformation. *Environment and Social Psychology* 2026; 11(2): 4495. doi:10.59429/esp.v11i2.4495

Chinese university teachers in national academic journals are considered innovative [4]. Another questionnaire survey involving 33 universities in Guangdong Province found that most teachers still focus primarily on delivering theoretical professional knowledge in their teaching, lacking the design of creative practical components, which results in insufficient innovation and entrepreneurship awareness among students [5].

With the deepening of digital transformation, university teachers are required to adopt a more proactive stance in exploring and utilizing digital technologies, continuously broadening their horizons, and working and solving problems creatively to achieve better development within a rapidly changing society and secure competitive advantages for their higher education institutions [6]. However, due to unclear conceptual understanding of digitalization and the absence of a clear usage framework, the innovation process for many employees is hindered. Some universities fail to invest adequate resources in digital training, preventing digital tools and technologies that should foster creativity from becoming widespread [7]. Furthermore, some institutions still adhere to traditional curriculum systems, evaluation standards, and operational models, which struggle to support the creative teaching and learning needs of teachers and students in the digital era [8]. Therefore, against the backdrop of digital transformation, universities must seek breakthroughs in innovation to stand out in the global competition of higher education [9].

Existing research on innovative behavior often focuses on technology itself, exploring the generation of innovation from the perspective of the application and potential of specific technologies [10], paying less attention to the creators themselves, particularly regarding how to stimulate their intrinsic motivation. The Theory of Planned Behavior related to innovative behavior also faces considerable debate. Meanwhile, research on innovative behavior within the digital context remains insufficient [11]. Additionally, studies specifically targeting university teachers' innovative behavior are scarce, and literature examining innovative behavior from a stress management perspective is even rarer. Based on this, this study primarily addresses the following questions: In the context of digital transformation, what are the main factors influencing university teachers' innovative behavior? How do these factors influence their innovative behavior? Can a model of innovative behavior applicable to this context be constructed?

This study integrates the context of digital transformation, the specific field of higher education, and employee innovative behavior, connecting the relationships between external digital pressure, individual intrinsic motivation, and ultimate innovative behavior. It not only enriches research on the antecedents of innovative behavior but also provides a deeper theoretical explanation for understanding why "providing technology" does not equate to "stimulating innovation" in a changing context. It holds the potential to generate new knowledge at the intersection of the Theory of Planned Behavior, Stress Management Theory, and Innovation Theory.

2. Materials and methodology

2.1. Literature review

2.1.1. Theory of planned behavior

The Theory of Planned Behavior (TPB) is regarded as a classic theory for explaining individual behavior. It posits that behavioral attitude, subjective norm, and perceived behavioral control jointly influence an individual's behavioral intention toward a specific behavior, which in turn affects whether they perform that behavior. The theory encompasses five key elements: attitude, subjective norm, perceived behavioral control, behavioral intention, and behavior. It considers both internal cognitive and emotional factors of the individual and the influence of the external environment. Its core lies in using psychological methods to explain and predict individual decision-making processes, asserting that behavioral intention is a major determinant of

actual behavior, shaped collectively by the three aforementioned antecedent variables [12]. Generally, positive correlations exist among behavioral attitude, subjective norm, perceived behavioral control, and behavioral intention. That is, the more positive an individual's attitude toward performing a behavior, the stronger the perceived support from significant others, and the higher the confidence in behavioral control, the stronger the behavioral intention and the greater the likelihood of executing the behavior [13].

Academic application of TPB is subject to debate. Downs and Hausenblas noted through meta-analysis that the model has strong explanatory power for behavioral intention but weaker predictive power for actual behavior [14]. Sniehotta et al. highlighted the critical role of factors such as implementation intentions, habits, and self-regulatory skills on behavior, emphasizing the need to move beyond intention models toward comprehensive process models encompassing goal setting, planning, and action control [15]. The meta-analysis by McEachan et al. provided robust evidence for TPB's predictive power in the health domain, showing that TPB variables on average explained 44.3% of the variance in intention and 19.3% of the variance in behavior [16]. To enhance the prediction of behavior from intention, scholars have proposed two improvement pathways: introducing new variables between intention and behavior, or integrating the existing model. For example, Li Yan added a social support variable to the original model, enhancing the new model's explanatory power [17].

2.1.2. Stress management theory

Stress Management Theory is a broad field integrating multiple theoretical perspectives, including the Transactional Model by Richard Lazarus and Susan Folkman [18], the Conservation of Resources Theory by Stevan Hobfoll [19], the Job Demands-Resources Model by Demerouti, Bakker, and colleagues [20], and contemporary intervention theories like that of Hayes [21], among others. The contemporary core view has shifted from a simple "stimulus-response" model to an "individual-environment" interaction model, emphasizing the central role of cognitive appraisal and coping processes.

Stress Management Theory is applicable for exploring the mechanisms of stress in specific environments. Stress management refers to a series of management interventions where individuals and organizations utilize coping resources, adopt appropriate coping strategies and methods, engage in reasonable cognition and responses to maintain good health, alleviate individual stress, and maximize organizational performance [22]. Stress management mainly involves three levels: first, managing external environmental stressors to improve adverse organizational or social environments; second, managing employees themselves to encourage shifts in perspective, behavioral adjustments, and the development of healthy habits; third, managing stress responses to help employees regulate emotional and physiological behaviors [23]. Stress management does not seek to eliminate stress entirely but to control it within a moderate, beneficial range. Therefore, work stress management includes three aspects: maintaining "beneficial stress," reducing or eliminating "harmful stress," and conducting "de-stressing" activities when beneficial stress becomes excessive.

Stress management holds significant importance for both organizations and individual employees. Positive stress management can fully mobilize employees' initiative, maximizing organizational and individual performance, whereas negative stress management can hinder employees' physical and mental health and potentially trigger organizational crises [24]. Therefore, organizations should formulate effective policies and measures to help employees regulate work stress, thereby enhancing organizational efficiency and enabling employees to achieve more with less effort [25].

2.1.3. Digital transformation

Digital transformation is not merely a technological upgrade but a systematic change in organizational processes, culture, and even individual work methods. In higher education, digital transformation manifests in the widespread application of digital technologies such as Learning Management Systems, artificial

intelligence tools, and online collaboration platforms. These technologies bring potential efficiency gains but also introduce new forms of pressure like skill updating and information overload [26]. In recent years, international scholarship has begun focusing on the antecedent mechanisms of employee innovative behavior in digital contexts. For instance, Korzynski et al. pointed out that in the digital era, employee creativity is mediated by technological tools like social media [11]. However, for specific organizational types like universities, especially within the Chinese cultural context, in-depth qualitative exploration is lacking on how digital transformation influences employee innovative behavior through stress mechanisms.

2.1.4. Research hypotheses

Based on the literature analysis, this study posits that the Theory of Planned Behavior and Stress Management Theory are closely related to university teachers' innovative behavior and can provide influencing factors for it. Digital transformation is also expected to significantly impact university teachers' innovative behavior.

2.2. Methodology

2.2.1. Principal method

Qualitative research is a paradigm of social science research based on understanding, interpretation, and the exploration of meaning. It does not pursue quantitative measurement and statistical inference but aims to depict the nature, process, and internal logic of social phenomena in a deep and comprehensive manner. It can reveal rich details, contradictions, context dependencies, and individual subjective experiences that are simplified or overlooked in quantitative research. In qualitative research, interviews are an important data collection method for understanding the unique perspectives of respondents [27]. Interviews help researchers grasp the full picture of the lives or work of specific groups, explore the formation processes of social phenomena, and propose problem-solving ideas. This study adopts a theory-informed grounded theory methodology, wherein semi-structured interviews were designed under the guidance of the Theory of Planned Behavior and Stress Management Theory. Throughout the coding process, a deliberately open stance was maintained to facilitate the natural emergence of new categories from the data. This methodological choice also aligns with the recommendations by Churchill and Bly regarding theory extension and conceptual clarification [28].

2.2.2. Research subjects

This study focuses on university teachers in Guangdong Province for the following reasons: First, digital technologies have altered the ways university teachers access teaching information and convey knowledge, also expanding the depth and breadth of information utilization in teaching and learning. The use of digital technologies by university teachers for creative activities has become a necessary means for imparting knowledge to students [29]. Therefore, selecting university teachers as research subjects holds practical significance. Second, the number of higher education institutions and their employees in Guangdong Province each accounts for approximately 4.3% of the national total, giving its higher education sector strong representativeness within China. Previous research supports this view; for example, Li Yan et al. argued that Guangdong's higher education institutions possess geographical advantages and strong capabilities in serving the local economy, making them a representative research sample [30].

2.2.3. Sample size determination

According to Hennink and Kaiser, a basic sample size for in-depth interviews is 12 individuals [31]. Mason noted that interview numbers in multiples of 12 are often suitable [32]. Creswell suggested that a sample size range of 20 to 30 is representative for grounded theory studies [33]. Simultaneously, an important criterion for

determining sample size in qualitative research is "data saturation," meaning no new information or themes emerge in subsequent interviews. Synthesizing the literature and previous scholars' recommendations, this study, premised on data saturation, initially determined a sample size of 20-30 individuals, with flexibility to adjust based on actual interview conditions.

2.2.4. Sampling method

Common sampling methods for in-depth interviews include purposive sampling, heterogeneous sampling, and snowball sampling. Among these, purposive sampling focuses on specific populations, facilitating efficient access to valuable respondent information and the rational use of limited research resources [34]. Based on the research purpose and characteristics of the target population, this study employed purposive sampling. Project team members selected interviewees based on preset characteristics (e.g., position type, teaching experience). According to data from the Guangdong Provincial Department of Education in December 2024, there are 38 public undergraduate universities in Guangdong Province. After comprehensively considering the representativeness of university types and geographical locations, and based on sample size needs, this study ultimately selected one teacher from each of 24 universities as an interviewee. Participants were recommended by respective university offices of research or human resources. Based on these recommendations, the research team conducted a balanced selection considering faculty category, length of service, and disciplinary background to mitigate selection bias. Selecting only one person per institution might not fully capture internal heterogeneity but aids in obtaining a broad cross-institutional perspective.

2.2.5. Data collection

Interviews were primarily conducted in the interviewees' offices or public sports venues. Before the interviews, respondents were fully informed about the research purpose, data usage, and the principle of anonymity, and their written informed consent was obtained. Each interview lasted approximately 40 minutes, was audio-recorded in full, and transcribed verbatim for subsequent content analysis [35].

Interviews were conducted in two rounds. The first round involved open-ended interviews, contacting six respondents to develop a preliminary interview guide, followed by interviews scheduled based on appointment times and locations. This approach, while potentially leading to weaker data convergence, was conducive to comprehensive and in-depth exploration of the issues. The second round consisted of semi-structured interviews. Building on consensus questions formed in the first round, a semi-structured guide was used to focus the discussions more sharply. The researchers perceived evident theoretical saturation by the 22nd interview, reaching complete saturation by the 24th. This study ultimately involved interviews with 24 university teachers.

To enhance the authenticity, accuracy, rigor, and verifiability of the research conclusions, a research team comprising 3 teachers, 3 master's students, and 12 undergraduate students was formed. Through summarizing interview records, participatory observation, and other means, the team gained multi-faceted understanding of the respondents, enabling cross-referencing and verification of data [36].

2.2.6. Data analysis

This study employed directed content analysis. After organizing the raw data and following the coding logic of qualitative research, systematic analysis of the textual data on university teachers' innovative behavior was conducted through open coding, axial coding, and selective coding [37-39] to form core concepts and categories and clarify the logical relationships among them.

Open Coding

Open coding involves breaking down interview materials and summarizing them into terms representing the core ideas of the data—concepts [40]. Subsequently, several lower-level concepts are grouped and integrated based on common attributes to form higher-level categories.

Axial Coding

Axial coding is an inductive process from subcategories to main categories, aiming to reveal the organic connections among different parts of the data [41]. Specifically, this stage involves delineating appropriate main categories based on the similar contexts, conditions, and action strategies of behavioral phenomena. Following a storyline logic of "phenomenon/condition/cause — action/interaction strategy — outcome," connections between categories are discovered to flesh out the content of the main categories.

Selective Coding

Selective coding is the process of identifying a core category and integrating other secondary categories around it to ultimately distill a theoretical framework [42]. At this stage, based on in-depth analysis of the existing conceptual categories, a single "core category" is aggregated. The process of excavating the core category is also the process of evolving from describing phenomena to constructing theory.

3. Results

3.1. Descriptive statistical analysis

The in-depth interviews involved 24 teachers from 24 universities in Guangdong Province, covering various university types and counties/cities. The participants included both teaching-oriented and research-oriented teachers distributed across different lengths of teaching experience, giving the sample a certain degree of representativeness.

Table 1. Basic Information Statistics of Interviewees

Item	Content	Count	Percentage (%)
Gender	Male	13	54.17
	Female	11	45.83
Teaching Experience	≤ 5 years	6	25.00
	5 - 10 years	10	41.67
	≥ 10 years	8	33.34
Position Type	Research-oriented	9	37.50
	Teaching-oriented	15	62.50
University Type	Comprehensive	9	37.50
	Science & Engineering	5	20.83
	Medical	3	12.50
	Normal	2	8.33
	Other*	5	20.83
University Location	Guangzhou	7	29.17
	Shenzhen	2	8.33
	Zhuhai	2	8.33
	Others**	13	54.17

***Note:** The "Other*" category for University Type includes one respondent each from art, sports, agriculture & forestry, political science & law, and finance & economics institutions.*

***Note:** The "Others**" category for Location includes one respondent each from Zhaoqing, Meizhou, Chaozhou, Dongguan, Shantou, Shaoguan, Foshan, Jiangmen, Zhanjiang, Maoming, Zhongshan, Yunfu, and Huizhou.*

3.2. Reliability, validity, and theoretical saturation tests

To enhance the study's reliability and validity, the following measures were taken: Researcher triangulation was conducted, where multiple researchers independently analyzed the same data set and then compared and discussed their findings. Member checking was performed by returning preliminary analysis results (e.g., themes, summaries) to participants to ask if they accurately reflected their intended meaning and experience. Peer debriefing was conducted by regularly discussing the research design, findings, and confused with peers not involved in the study (supervisors, classmates, colleagues), using external perspectives to examine one's own reasoning. Negative case analysis was undertaken by actively searching for cases or data contradictory to the main patterns or interpretations and analyzing and explaining them. This study established a complete "research audit trail," preserving original interview recordings and transcripts, clearly documenting participant recruitment and interview locations, and retaining different versions of coding manuals and analytical memos. Two researchers independently coded 20% of the text. After discussion and consensus, a final coding manual was formed, with an inter-coder reliability (Cohen's Kappa coefficient) of 0.78. The researchers recoded part of the data they had previously coded at different time points (with a two-week interval) to check for consistency and reflect on reasons for any discrepancies.

For the theoretical saturation test, this study randomly selected 3/4 of the interview materials for coding and modeling, reserving the remaining 1/4 for testing. The results showed that for the three main categories related to innovative intention (behavioral attitude, creative self-efficacy, perceived organizational support), no new concepts or categories emerged, and no new factors were discovered within the main categories, indicating that coding had reached theoretical saturation.

Table 2. Saturation test table

Interviewee IDs	Emergence of New Concepts/Categories	Remarks
P01-P06	Basic categories emerged (e.g., workload, innovative ideas)	First round of open-ended interviews
P07-P12	Subcategories gradually formed (e.g., workload pressure, organizational support)	Repetitive patterns began to appear
P13-P18	Main categories became stable (challenge stress, behavioral attitude, etc.)	Theoretical saturation became evident after the 18th interview
P19-P22	No new categories emerged; existing categories were enriched	Complete theoretical saturation reached
P23-P24	No new information; used to verify saturation	Final supplementary samples

3.3. Results of the three-level coding

3.3.1. Open coding

Through open coding of all interview materials, 25 initial categories were extracted. Based on merging and classifying conceptual meanings, 13 subcategories were ultimately formed.

Table 3. Examples of Initial Category Extraction

Initial Category	Representative Original Statements

Heavy Workload	"I am often overwhelmed by massive amounts of information, excessively occupying work and personal time, depleting my own resources."
Large Work Volume	"I am unclear about which digital tools are most suitable for teaching, requiring constant experimentation. Unfamiliarity with operations leads to underutilization of features."
Overtime Completion	"Information technology brings various new demands, such as skill learning, mastering new things, taking on responsibilities, etc., often resulting in overtime work."

Table 4. Results of Subcategory Extraction

Initial Category	Subcategory
Focusing on opportunities for change	Idea Generation
Generating innovative ideas	
Personally implementing ideas	Idea Implementation
Promoting ideas to others	
Believing innovation is necessary	Cognitive Attitude
Believing innovation is feasible	
Personally supporting innovation	Affective Attitude
Personally encouraging innovation	
Capable of identifying problems	Idea Generation
Capable of generating ideas	
Capable of solving problems creatively	Problem Solving
Capable of implementing innovation	
Caring about growth	Affective Support
Protecting innovation	
Adequate funding	Instrumental Support
Appropriate measures	
Heavy workload	Workload Pressure
Large work volume	
Overtime completion	Time Pressure
Time constraints	
Responsibility for change	Responsibility Pressure
Challenging responsibility	
Extensive use of digital technology	Salient Characteristics
Creativity and innovativeness	
Proactively participating in training	Personal Development

3.3.2. Axial coding

Based on the 13 subcategories, through repeated comparison and interaction with the raw data, the logical relationships (e.g., causal, contextual, typological, structural) among the categories were explored. After clustering and integration, 5 main categories were ultimately formed.

Table 5. Results of Main Category Extraction

Subcategory	Main Category

Idea Generation	Innovative Behavior
Idea Implementation	
Salient Characteristics	
Personal Development	
Cognitive Attitude	Behavioral Attitude
Affective Attitude	
Idea Generation	Creative Self-Efficacy
Problem Solving	
Affective Support	Perceived Organizational Support
Instrumental Support	
Workload Pressure	Challenge Stress
Time Pressure	
Responsibility Pressure	

3.3.3. Selective coding

Selective coding revealed that the four main categories—Behavioral Attitude, Creative Self-Efficacy, Perceived Organizational Support, and Challenge Stress—could be subsumed under the core category of "Factors Influencing Innovative Behavior," forming the main storyline of innovative behavior. "Salient Characteristics" and "Personal Development" served as auxiliary lines, reflecting other perceptions of innovative behavior by the respondents.

The three-level coding results indicate that understanding the innovative behavior of Guangdong university teachers encompasses four aspects: meaning, characteristics, influencing factors, and suggestions. Influencing factors can be divided into individual factors (innovation attitude, innovation capability) and environmental factors (organizational support, challenges of digital transformation). In summary, the main factors influencing the innovative behavior of Guangdong university teachers are: Behavioral Attitude, Creative Self-Efficacy, Perceived Organizational Support, and Challenge Stress.

Finally, the results of the three-level coding were visualized as Figure 1.

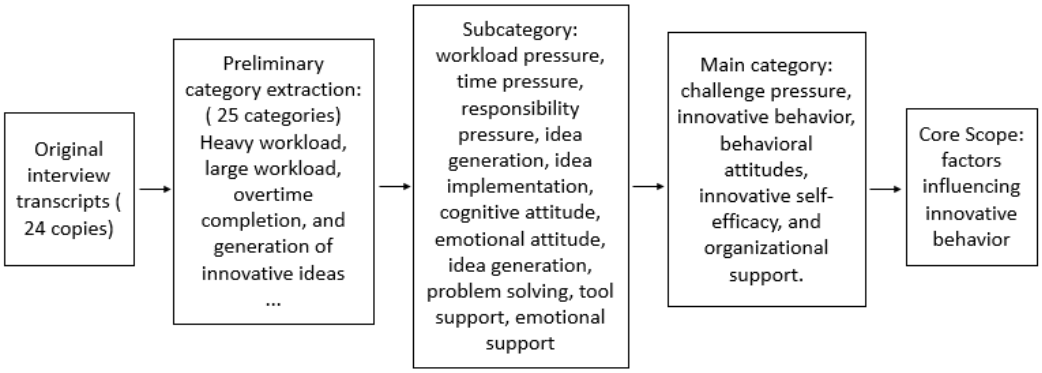

Figure 1. Coding Structure Diagram

4. Discussion

4.1. Mechanisms of the main influencing factors

This study found that university teachers' innovative behavior is primarily influenced by four major factors: Behavioral Attitude, Creative Self-Efficacy, Perceived Organizational Support, and Challenge Stress. Among these, Behavioral Attitude, Perceived Organizational Support, and Creative Self-Efficacy correspond respectively to Attitude, Subjective Norm, and Perceived Behavioral Control in the Theory of Planned Behavior. Together, they shape employees' innovative intention, serving as the core antecedents of innovative behavior. Challenge Stress, as a key variable from Stress Management Theory, constitutes the fourth influencing factor for innovative behavior.

First, Behavioral Attitude positively influences innovative behavior, consistent with the findings of Lü et al. [43] and Li et al. [44]. Employees with a positive attitude towards innovation often possess higher achievement needs, are more interested in teaching, research, and other tasks, and are more inclined to engage in challenging and creative work, thereby exhibiting more innovative behavior. Perceived ease of use is a critical factor influencing attitude, and familiarity has a significant positive impact on perceived ease of use. Providing university teachers with gradual, low-threshold exposure opportunities (e.g., workshops, case sharing) to enhance their familiarity with digital tools will directly and powerfully strengthen their perception of the ease of use of new tools like intelligent assistants [45]. This undoubtedly provides the crucial flintstone for igniting the spark of innovation.

Second, Creative Self-Efficacy promotes innovative behavior, aligning with the conclusions of Yang et al. [46], Gong et al. [47], and Phelan and Young [48]. Employees with high self-efficacy are confident in their technical abilities, feel assured about innovation activities, and engage more actively in innovation to validate their ideas and prove their capabilities. As mentioned earlier, when users perceive a tool as easy to use, their confidence in being able to use it effectively and produce novel outcomes is greatly enhanced. This belief of "I can innovate using this tool" is a key driver for triggering innovative intention and persisting in innovative attempts.

Third, Perceived Organizational Support enhances innovative behavior, consistent with the research of Wang et al. [49] and Wang and Zhao [50]. High perceived organizational support signals to employees that the organization recognizes innovation, motivating them to work more proactively and autonomously undertake more innovative behaviors. Especially when employees perceive leadership's affirmation of their innovation, their innovative intention is further strengthened [51]. In the context of digital transformation, organizational support often manifests concretely as digital leadership and data-driven decision support. Research indicates that digital leadership and data-driven decision support are key mechanisms for achieving digital integration and creativity; they act as moderating factors that can amplify positive organizational outcomes [52].

Fourth, Challenge Stress influences innovative behavior, consistent with the studies by Prem et al. [53], Hon et al. [54], and Sacramento et al. [55]. Challenge stress can promote goal achievement and individual growth. Employees facing such stress possess strong internal motivation, pursuing an "ideal self" and striving towards positive goals like development, hope, and success. They tend to adopt proactive strategies to change the status quo, thereby catalyzing innovative behavior.

4.2. Specific technological context of digital transformation

This study found during interviews that the "challenge stress" faced by teachers is closely related to specific digital technologies. Commonly used digital tools include Learning Management Systems, smart classroom systems, AI-assisted teaching tools, online collaboration platforms, and administrative management

systems. Frequent updates, functional complexity, and insufficient integration of these tools often lead to "skill anxiety" and "information overload" among teachers. For example, one university teacher mentioned: "Every system upgrade requires readjustment; it feels like forever chasing technology" (P07). If this stress can be reappraised as an opportunity for learning and growth, it may transform into a driving force for innovation. This also indicates that when discussing the background of digital transformation, it is necessary to consider specific technological contexts rather than viewing it merely as generalized organizational change.

4.3. Generative artificial intelligence and creative self-efficacy

With the rapid proliferation of Generative Artificial Intelligence (GenAI), its impact on university teachers' creative self-efficacy warrants attention. GenAI tools (e.g., ChatGPT, ERNIE Bot) can directly assist in content generation, course design, and research ideation, potentially altering employees' perceptions of their own innovative capabilities. One interviewed university teacher stated: "AI helped me generate multiple activity plans, making me feel my creative space has expanded" (P18). Recent research also indicates that the combination of GenAI's technological characteristics and organizational support can significantly drive employee innovative behavior and performance [56]. Therefore, future research should further explore how GenAI influences the two stages of innovative behavior (idea generation and implementation) by enhancing self-efficacy.

4.4. Differences in influencing factors across the two stages of innovative behavior

This study found that different influencing factors may carry varying weights across different stages of innovative behavior. The "idea generation" stage relies more on intrinsic motivation and positive behavioral attitude, while the "idea implementation" stage is more influenced by perceived organizational support and resource availability. For instance, one teacher noted: "I have many new ideas, but without funding support and team cooperation, they are difficult to implement" (P12) .This suggests that managers need to provide differentiated support when promoting innovation: encouraging free exploration and idea exchange during the creative inspiration stage, and ensuring sufficient resources and institutional safeguards during the implementation stage.

4.5. Moderating role of cultural context

Based on a sample from Guangdong Province, China, the conclusions of this study may be influenced by the cultural context. Chinese universities typically exhibit higher power distance and collectivist tendencies, which may strengthen the role of perceived organizational support and incline employees to view stress more as a collective responsibility than an individual burden. Future research could conduct comparative studies in Western individualistic cultural contexts to test the cross-cultural applicability of this model and further clarify the moderating role of cultural factors in stress transformation and innovation mechanisms.

5. Conclusion

5.1. Theoretical implications

Based on the data from this study and previous research by scholars, we have constructed an explanatory model for employee innovative behavior applicable to the digital transformation context in universities. The model contains the following elements:

Innovative intention is a necessary but insufficient condition for innovative behavior. For example, one teacher stated: "Clear intention indeed often leads to innovation, but innovative behavior can also occur incidentally without a clear intention" (P11). This aligns with McEachan et al.'s discussion on the explanatory power of behavioral intention for behavior [16].

Attitude, self-efficacy, and stress form a triangular interactive relationship. For example, one teacher expressed: "A positive behavioral attitude can enhance creative self-efficacy, thereby increasing tolerance for challenge stress; conversely, if there is a lack of efficacy support in high-pressure situations, even with a positive attitude, innovative behavior is difficult to sustain." (P04). This echoes Bandura's view on "efficacy moderating stress coping" [57].

Perceived organizational support acts as a bridge buffering stress. When perceived organizational support is strong, employees are more inclined to interpret challenge stress as a "growth opportunity" rather than a "threat." For example, one teacher said: "AI has a huge impact on us, but the support from leadership and the team provides me with confidence to overcome the pressure" (P02). This is consistent with Eisenberger et al.'s discussion on the buffering role of perceived organizational support [58].

Challenge stress plays a crucial role in the process of innovative behavior. For example, one teacher remarked: "Innovation implies higher demands. The resulting stress can enhance employees' work proactivity, prompting more rational utilization of existing resources, while also stimulating intrinsic motivation, encouraging the generation of innovative behavior" (P15). This is consistent with the view of Abbas that individuals with strong innovative intention, when facing challenge stress, often perceive greater group expectations and responsibility, and are granted more decision-making autonomy, thereby driving the emergence of innovative behavior [59].

Although this model presents a linear pathway, it actually includes feedback mechanisms (e.g., innovative behavior in turn enhances self-efficacy). Future research could further verify its dynamic nature through longitudinal designs.

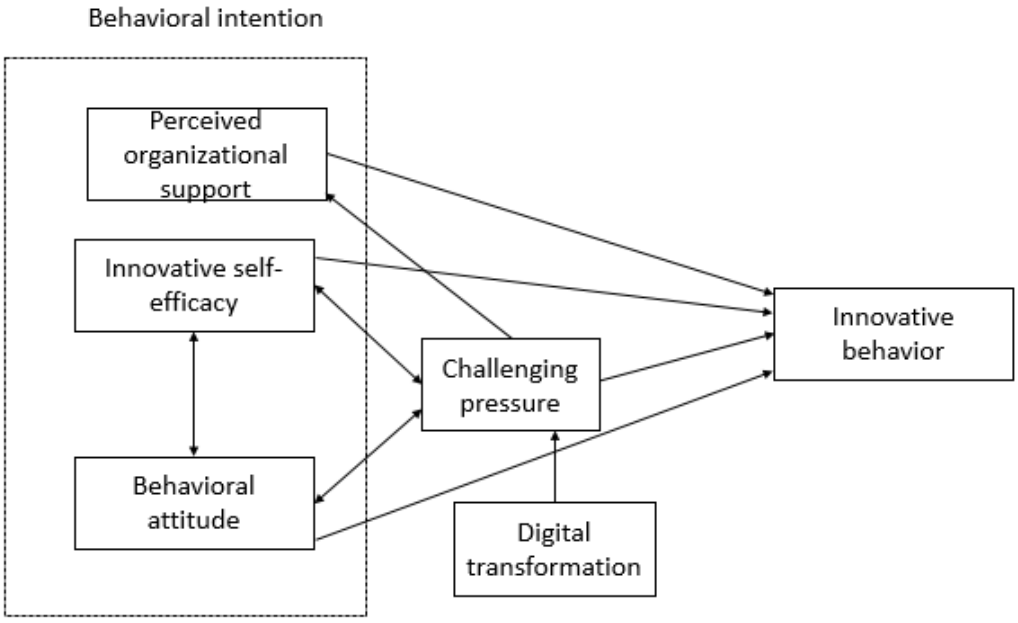

Figure 2. Model of Innovative Behavior

5.2. Managerial implications

For university administrators, this study proposes the following recommendations:

First, strengthen organizational support and foster an innovation-conducive climate. Universities should pay attention to employees' emotional needs, respect and recognize their professional competence, and provide

positive feedback for innovation efforts and outcomes. Simultaneously, systematic digital training should be provided to update employees' knowledge structures and enhance their ability to integrate technology use with innovation. Furthermore, infrastructure should be improved to ensure investment in innovation resources, and employees should be granted appropriate autonomy during the innovation process to enhance their sense of resource control.

Second, optimize stress management to facilitate stress transformation. Universities should clearly define employees' roles and responsibilities in digital transformation, strengthen information communication and psychological counseling to help them adapt to changes in work models. In particular, a "challenge stress monitoring mechanism" should be established. Through regular surveys and support interventions, stress can be maintained within the optimal range for promoting innovation. Additionally, attention should be paid to the ease of use and usability of digital tools, providing targeted skill training to alleviate the sense of insecurity caused by rapid skill iteration.

5.3. Limitations and future research directions

This study has certain limitations. First, the sample is limited to Guangdong Province. Although it has a certain degree of representativeness, caution is needed when generalizing the conclusions to other regions or cultural contexts. Second, the use of cross-sectional interview data makes it difficult to capture dynamic changes and causal sequences among variables. Future research could expand the sample scope, conducting cross-regional or cross-cultural comparisons. Longitudinal designs or experimental methods could also be employed to dynamically monitor changes in innovative intention and behavior. Furthermore, further exploration of the moderating effects of individual differences (e.g., personality traits, digital literacy), cultural factors, and emerging technologies (e.g., GenAI) on the mechanisms of innovative behavior is warranted to continually refine the theoretical model.

Author contributions

Conceptualization: Xinjian Zhang and Khunanan Sukpasjaroen; methodology: Xinjian Zhang and Khunanan Sukpasjaroen; software: none; validation: Xinjian Zhang; formal analysis: Xinjian Zhang; investigation: Xinjian Zhang; resources: Xinjian Zhang, Khunanan Sukpasjaroen and Aroonroj Boonkrong; data curation: Xinjian Zhang; writing—original draft preparation: Xinjian Zhang; writing—review and editing: Xinjian Zhang, Khunanan Sukpasjaroen and Aroonroj Boonkrong; visualization: Xinjian Zhang; supervision: Khunanan Sukpasjaroen; project administration: Xinjian Zhang and Khunanan Sukpasjaroen; funding acquisition: none. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest

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Appendix: Semi-Structured Interview Guide (Excerpt)

I. Basic Information Confirmation

1. What is your position type (teaching/research)? Years of work experience?

2. What typical initiatives related to digital transformation are implemented in your department/school?

II. Digital Transformation and Work Experience

1. What digital tools or systems do you use daily (e.g., LMS, AI tools, administrative platforms)?

2. What specific changes (positive/negative) have these tools brought to your work?

3. Do you feel your work pressure has changed due to digitalization? Please provide examples.

III. Perceptions and Attitudes Towards Innovation

1. In your view, what does "work innovation" mean in the context of digitalization?

2. Are you willing to try new digital tools or teaching methods? Why or why not?

3. What attitudes do you perceive from your school/colleagues towards innovation?

IV. Self-Efficacy and Organizational Support

1. How confident are you in using digital tools to complete innovative tasks?

2. When you encounter difficulties in innovation, how do you typically seek help? (From colleagues/leadership/institutional support)

3. Does the school provide sufficient training, resources, or incentives to support innovation?

V. Stress Coping and Behavioral Transformation

1. When facing digital tool updates or skill challenges, how do you usually cope?

2. Can you recall an experience where you transformed work pressure into motivation for innovation?

3. What factors do you believe most effectively prompt you to put innovative ideas into practice?

VI. Suggestions and Outlook

1. What improvements do you hope the school will make regarding digital transformation and innovation support?

2. Regarding the future integration of digital technology and education, what are your expectations or concerns?