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Research Article

# The Evolution and Hotspots of Expectancy-Value Theory Research

**Chuhui Hu[1], Zihui Zhang[1], Yufeng Cai[1], Peixuan Chen[2], Xiaofeng He[2], Yongheng Duan[2], Xusheng Wu[2,*], Dehua Hu[1,*]**

[1]Department of Biomedical Informatics, School of Life Sciences, Central South University, Changsha, Hunan 410078, CHINA.
[2]Shenzhen Health Development Research and Data Management Center, Shenzhen, CHINA.

## ABSTRACT

The Expectancy-Value Theory (EVT) has undergone rapid, which has guided many researches related to social cognition and learning motivation, and effectively addressing practical challenges across various scientific domains. However, a research gap exists regarding the quantification and visualization of the evolutionary trajectory of EVT. Therefore, this study utilizes 704 research articles related to EVT published between 1999 and 2023, this paper employs bibliometric and content analysis methods to delineate the developmental stages of EVT research. A framework is proposed, "theory-context-method" knowledge, to comparatively analyze the research content across different developmental stages. The main findings are: ①EVT research can be divided into three periods based on publication volume: the initial stage, slow development stage, and rapid publication stage; ②The developmental trajectory of EVT research from 1999 to 2023 is clear and can be divided into the instrumental stage (1999-2006), application exploration stage (2007-2016), and feedback optimization stage (2017-2023), each with distinct research themes and focal points; ③Current research focuses on the interdisciplinary and systematic study of EVT in fields such as education, psychology, and sociology, leading to a renewed understanding and further development of the theory itself; ④The research status and deficiencies of EVT are systematically discussed from the three aspects of the knowledge framework. This study reveals the research progress and trend systematically and intuitively on the EVT based on published literature, and to contribute to a deeper understanding and development of the theory itself.

**Keywords:** Expectancy-Value Theory, Evolutionary Lineage, Bibliometrics, Content Analysis.

**Correspondence:**
**Xusheng Wu**
Shenzhen Health Development Research and Data Management Center, Shenzhen, CHINA.
Email: 1257451869@qq.com

**Dehua Hu**
Departsment of Biomedical Informatics, School of Life Sciences, Central South University, Changsha, Hunan-410078, CHINA.
Email: hudehua@csu.edu.cn

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## INTRODUCTION

Expectancy-Value Theory (EVT) is one of the important viewpoints in the construction of achievement motivation theory and holds a significant position in the field of motivational psychology. The core hypothesis of this theory posits that the greater an individual's likelihood of achieving a goal, the higher the incentive value derived from it, thereby enhancing motivation to complete the task.[1] The development of EVT is a complex, multi-stage dynamic process. Initially, the concept of achievement motivation was proposed by Murray in 1938, who defined achievement need as the intrinsic drive to overcome obstacles, demonstrate talents, and efficiently solve complex problems.[2] Since then, McClelland, the pioneering researcher in achievement motivation, has explained achievement motivation as competition and excellence, that is, the concern for success in competition with a certain standard of excellence.[3] Due to McClelland's groundbreaking research, achievement motivation has emerged as a significant area within psychology. The originator of expected value theory, John William Atkinson, was actively involved in early research on achievement motivation as a student under the guidance of McClelland.[4] However, influenced by the research of Murray, Tolman,[5] and other scholars, Atkinson conducted microscopic research to delve into the essence of achievement motivation and its occurrence and developmental processes. Employing a hypothesis analysis approach, he proposed the expected value theory model to elucidate various achievement-related behaviors such as striving for success and task selection and persistence. Between the early 1960s and early 1980s, the EVT proposed by Atkinson gained widespread acceptance among psychologists and held a prominent position in the field of achievement motivation research for two decades,[1] Based on this foundation, numerous researchers have expanded and revised the connotation of expected value theory. Among them, Eccles' expectancy-value theory[6-11] and Feather's studies on value[3,12,13] are the most influential, as they focus on how expectations and values are linked to employment performance and choice, and how motivational beliefs and subjective task

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values influence an individual's development during and after their studies. These studies, collectively referred to as modern expectancy-value theory, have significantly expanded the conceptualizations of expectancy and value perception. In 2023, Eccles and colleagues formally introduced the Situational Expectancy-Value Theory (SEVT).[6] Compared to other motivation theories, EVT offers a more comprehensive theoretical framework for elucidating the motivation and behavior of individuals across diverse tasks, and enjoys broader application in explaining motivation within various fields and contexts. Over more than half a century, EVT has been extensively applied in various domains including education[14-18] and medicine,[19-22] with scholars primarily investigating intrinsic and utility values, resulting in a wealth of research findings.

As the social environment becomes increasingly intricate and data analysis methods advance, the application scenarios and research methodologies of EVT undergo continuous changes, presenting a dynamic and complex research landscape that is open to exploration. Despite the considerable attention received by EVT's development, there has been a lack of comprehensive studies analyzing the temporal evolution of existing research, which hinders further advancement of this theory. In light of this, the present study employs a combined quantitative and qualitative approach through bibliometric analysis and content analysis to systematically review the literature published between 1999 and 2023 in the three major core databases of Web of Science (WOS) as well as the cited references from related review articles. By delineating the developmental stages of EVT, this study aims to provide a dynamic perspective that elucidates the evolutionary context of existing research and establishes a solid foundation for future studies. Additionally, this research proposes a knowledge framework named as theory-context-method to facilitate the comparison of research content across different developmental stages, thereby offering a comprehensive review of EVT research. This work presented in this paper primarily contributes to deepen understanding of EVT and showcases the expansion of existing ideas and the emergence of novel perspectives within the realm of continuous exploration, rather than a complete paradigm shift.

# METHODOLOGY

## Data source

### *Searching Strategy*

We conducted a thorough search in the Web of Science Core Collection database to ensure comprehensiveness and accuracy. Utilizing insights from previous review articles, the search criteria were defined as TS= ("expectancy-value theory" OR "achievement motivation theory" OR "behavioral motivation theory" OR "self-efficacy theory" OR "modern expectancy-value theory"). In order to reduce the impact of limiting its feasibility as a basis for this review due to copyright restrictions and low degree of digitization. In addition, the literature in the last 25 years is relatively more widely available, higher quality, more rigorous peer review and reliability, all of which contribute to enhancing the academic value of review. Therefore, the search was confined to documents published between January 1, 1999, and December 31, 2023, yielding a total of 1,712 relevant articles. Furthermore, to include essential literature on EVT research more complete, we supplemented our findings with an additional 79 pre-cited and post-cited documents from three prominent national and international publications.

## Literature Inclusion and Exclusion Criteria

Inclusion Criteria: (1) Literature published between 1999 and 2023 that investigates the refinement and revision of the EVT; (2) Empirical literature testing and validating the EVT; (3) Literature developing evaluation scales, interaction models, questionnaires, or interview outlines based on the EVT; (4) Literature applying the EVT either independently or in conjunction with other interdisciplinary theories to real-world contexts.

Exclusion Criteria: (1) Letter, conference digest, editorial material, conference paper, documents withdrawn, reprinted, or corrected; (2) Documents with incomplete information in their titles, such as authors' names, title keywords, source publications, or abstracts; (3) Documents not utilizing or exploring the EVT.

## Literature Screening

Manual screening was conducted based on the inclusion and exclusion criteria, examining the titles, keywords, and abstracts to determine whether the literature met the study requirements. If initial screening failed to identify suitability, a full-text re-screening was conducted to make final inclusion determinations. Out of the initially identified 1,712 articles, 25 duplicates were removed, and 108 articles did not meet the publication type criteria. Additionally, 71 papers with incomplete title information were excluded, along with 837 papers eliminated after reviewing their titles and abstracts. Furthermore, 46 pieces of weakly relevant literature were excluded after reading their full texts as they could not definitively be included in the remaining corpus related to the study topic. Ultimately, a final sample comprising 704 strongly relevant articles aligned with EVT was retained. The macro steps for conducting this research are presented in Figure 1.

## Methods

This study employs a comprehensive quantitative and qualitative research approach, combining bibliometric and content analysis methods for an in-depth review of literature related to EVT. Bibliometric methods, through multivariate statistical techniques and knowledge mapping, reveal the development trajectory, current status, and trends in a specific field. In contrast, content analysis provides an in-depth examination by summarizing, abstracting, and comparing specific content within the literature. The integration of these methods allows for an objective

identification of research themes and developmental stages within the discipline.

First, the study utilizes bibliometric software CiteSpace and the R-based Bibliometrix visualization tool to analyze the keywords of the 704 articles to identify research themes. Next, according to Schneider's scientific discipline evolution theory, the study segments the evolutionary process of EVT research into distinct stages. Finally, using the "theory-context-method" knowledge framework, the study conducts a comparative analysis of the research content across different developmental stages of EVT, summarizing the research status and gaps from the three aspects of this framework.

## BIBLIOMETRIC ANALYSIS RESULTS

### Analysis of Annual Publication Volume

The variation in the number of publications based on a single theoretical perspective over a period can significantly reflect the level of research development and indicate scholars' attention to and progress in that field.[23] Overall, there has been an upward trend in the annual publication volume in the field of EVT. As shown in Figure 2, the number of studies related to EVT from 1999 to 2023 has generally increased, experiencing three distinct periods: an initial period, a slow development period, and a rapid publication period, with a significant increase in the number of related articles in the WOS Core Collection database.

In the initial stage of EVT research (1999-2006), except for 1999, which saw 18 publications, the annual number of publications on EVT did not exceed 10. At this time, most scholars had not yet recognized the practical value of the theory. Additionally, due to data scarcity and the lack of more applicable research methods, EVT research was somewhat constrained, resulting in relatively slow development. However, some scholars continued to delve into EVT research. A possible explanation is that modern EVT research had already established its own characteristics, and a certain number of influential theoretical critiques and revision articles were published during this period, increasing academic attention to the field.[24,25] We must acknowledge that the deepening and expansion of any theory are subject to a certain delay, necessitating sufficient time for the academic community to settle and subsequently generate substantial research output. Consequently, during that period, the discourse surrounding expected value theory did not emerge as a prominent research focus.

In the slow development stage of EVT research (2007-2016), the annual publication volume gradually increased from 11 in 2007 to 27 in 2016, albeit at a relatively low but stable rate. During this period, several representative EVT research articles that reviewed and extended the theory were published, encouraging the academic community to apply EVT to explain or empirically study phenomena in other fields.[26-28] The application of EVT expanded from relatively single-domain in-depth research to broader explorations across various fields. However, extending research into new areas required sufficient time and more rigorous empirical studies. As a result, the output rate of research articles during this period was relatively slow but showed a more stable trend.

In the period of rapid EVT research publication (2017-2023), there was a significant increase in annual publication volume, surpassing 90 articles and continuing to grow. Since 2018, cutting-edge technologies such as deep learning and machine learning have been extensively employed in natural language processing and outcome prediction, enhancing the convenience and precision of data analysis compared to previous methods. These advancements have greatly facilitated scholars' experimentation with and application of EVT across diverse scenarios.[29, 30]

### Significant Authors

To identify the authors who have made significant contributions to EVT research, this paper compiles a list of the top 10 prolific authors based on their publication records (Figure 3). The data reveals that Jacquelynne Sue Eccles (20 articles), Ulrich Trautwein (20 articles), Hanna Gaspard (17 articles), Benjamin Nagengast (16 articles), and Allan Wigfield (16 articles), among others, have emerged as the leading authors since 1999. Among them, Ulrich Trautwein, the most prolific author in this field, has conducted research in educational psychology using EVT and has published several influential papers.[31,32] Benjamin Nagengast, also affiliated with the University of Tübingen and a frequent collaborator with Trautwein, primarily focuses on studying educational psychology, educational intervention, and adolescent character development. He has conducted numerous studies utilizing the EVT model to enhance students' learning motivation, improve their academic performance, and optimize teachers' instructional interventions.[33,34] A well-established collaboration network has been formed, with the aforementioned two scholars at its core, concentrating on enhancing or refining the theoretical model boosting students'academic self-efficacy.

To comprehend the potential disparities and progression of prominent contributing authors across distinct time periods, this study presents a dot plot that visually depicts the number of papers published by different authors over the years and their annual average citation count during the retrieval period (Figure 4). The size of each bubble corresponds to the quantity of papers published, while the intensity of color indicates the total yearly citations received. It is worth noting that most of these authors began publishing extensively after 2010, and the number of citations per author increased, which is consistent with the situation depicted in Figure 2. Among them, Jacquelynne Sue Eccles and Allan Wigfield, who are important research partners, have the longest research trajectory, being the only scholars

who have consistently contributed to EVT for over 25 years throughout the entire search period. The emergence of novel theoretical paradigms[35] and advancements in cutting-edge technologies have also witnessed a cohort of emerging scholars, including Reinhard Pekrun and Alison C. Koenka, who began actively contributing after 2018.

## Research Hotspot Analysis: Expectancy-Value Theory

### *Keyword co-occurrence*

In this investigation, CiteSpace was utilized to create a network diagram showcasing the co-occurrence relationships among high-frequency keywords, as illustrated in Figure 5. Additionally, a compilation of the top 20 most frequently occurring keywords in both domestic and foreign literature was conducted and is presented in Table 1.

In the keyword contribution map, the most frequently occurring node keyword is "expectancy-value theory", which appears 290 times. Additionally, other prominent keywords in this field include motivation, achievement, task value, self-efficacy, gender, performance, mathematics, and student. These topics are highly relevant within the scope of this study.

From the high-frequency keywords shown in the table above, it is evident that research concerning EVT demonstrates the following characteristics:

(1) The exploration of the interaction between factors and variables within the EVT model has been conducted throughout its research. For instance, during the early stages of EVT's development, some scholars pointed out that behavioral motivation is strong only when both expectation and task value are high. However, at that time, most studies defaulted to combining expectation and value by accumulating them.[36,37] Subsequent studies by Busemeyer[38] and Trautwein Ulrich,[39] among other scholars argued that expectancy and value should be multiplicatively combined to determine motivation, guide choices, and predict behavior. They re-established the multiplicative synergy between expectancy and value in predicting motivation. These related research findings contributed to revising and advancing the theoretical system.

(2) The research of EVT has endeavored to provide the field of education with a paradigm for managing teaching and learning that can be learned from and implemented. This research often focuses on the factors that influence students' academic performance, learning behaviors, and outcomes,[40] attaching great importance to the role of teachers and parents in shaping students' personalities and learning strategies,[41] as well as their character development, construction of learning strategies,[32] and achievement of learning goals.[42] These findings provide a scientific and theoretical basis for educational communities to conduct interventions aiming at improving students' engagement in learning and the effectiveness of teaching.

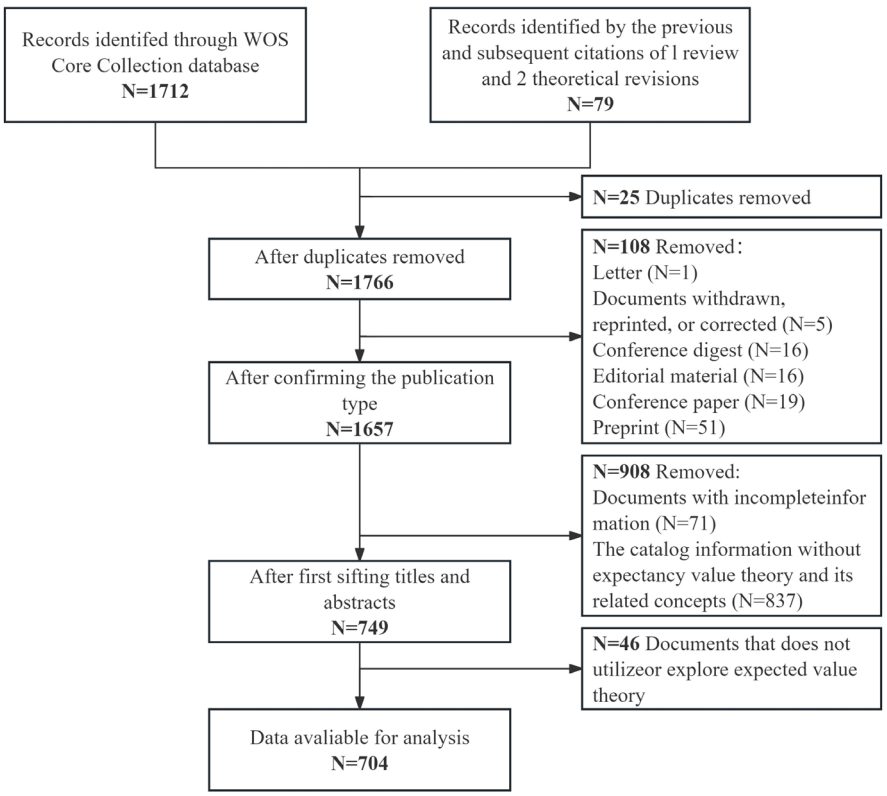


**Figure 1:** Data collection process.

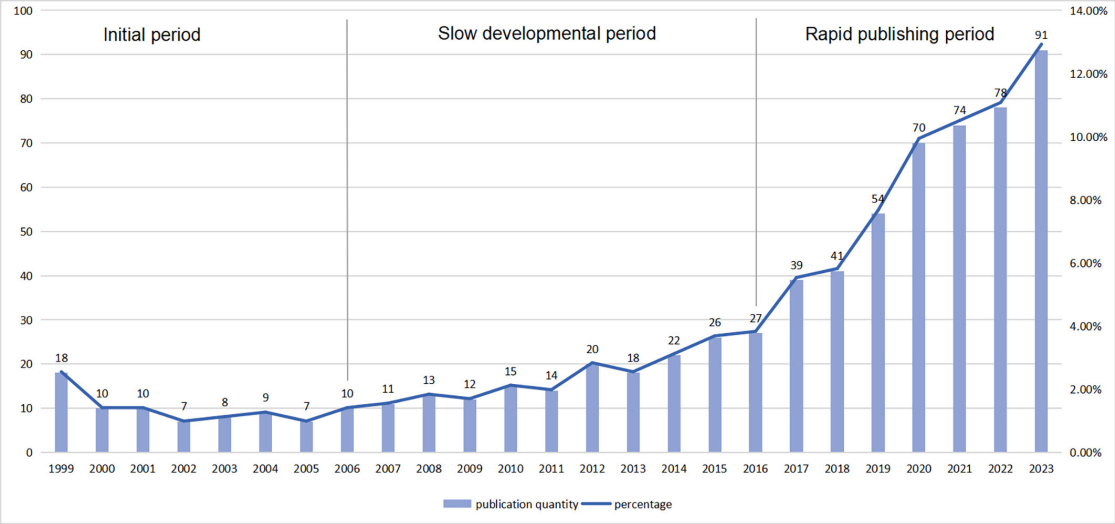


**Figure 2:** Number of publications (articles) and their percentage (%) in the research literature.

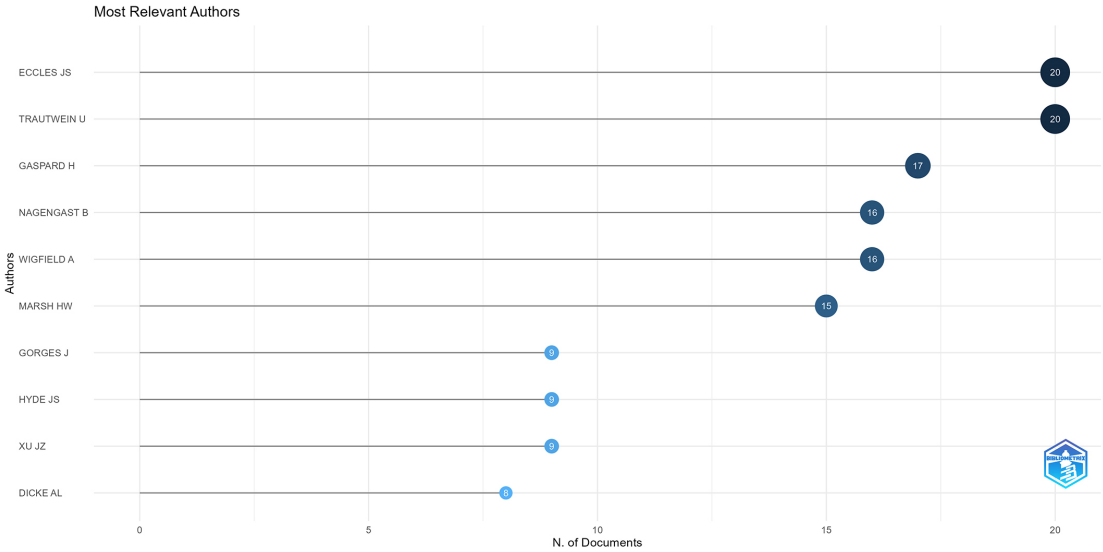


**Figure 3:** Top 10 ranking authors with the highest number of publications.

(3) The main research targets of the EVT study are disadvantaged groups such as minors and the unemployed. It may be that disadvantaged groups, affected by factors such as lack of economic resources and information asymmetry, are more sensitive and cautious in the face of uncertainty. Therefore, research on intervention behaviors for disadvantaged groups can provide a reference for broader population interventions. There are significant differences in how different target groups understand and adapt to tasks, which can affect individual perceptions and attitudes towards endeavor. Moreover, studies on disadvantaged groups tend to be relatively more representative of the population as a whole. Additionally, some longitudinal studies have shown that the relationship between expectations, values, and behaviors becomes stronger as minors grow up; however, the connotations of expectations and values change significantly during this process. For example, from childhood to adolescence, children's expectations of success decrease or become negative gradually along with their positive perceptions of task value.[43] These developmental changes are significant for studying expectancy value theories in specific areas, particularly in education.

## Keyword clustering

Keyword cluster analysis is a statistical technique that utilizes similarity measures to quantify the degree of association between keywords, facilitating researchers in comprehending the commonalities among research hotspots within a particular field and serving as the foundation for classification. In this study, we utilized CiteSpace and applied the LLR algorithm for keyword cluster analysis, enabling us to generate a diagram illustrating clusters of keywords related to EVT as depicted in Figure 6.

The keyword cluster map shows a total of 6 cluster categories. Cluster #0 academic motivation primarily focuses on the research direction of academic interests and outcome prediction, teacher intervention strategies, and the role of learning environments;

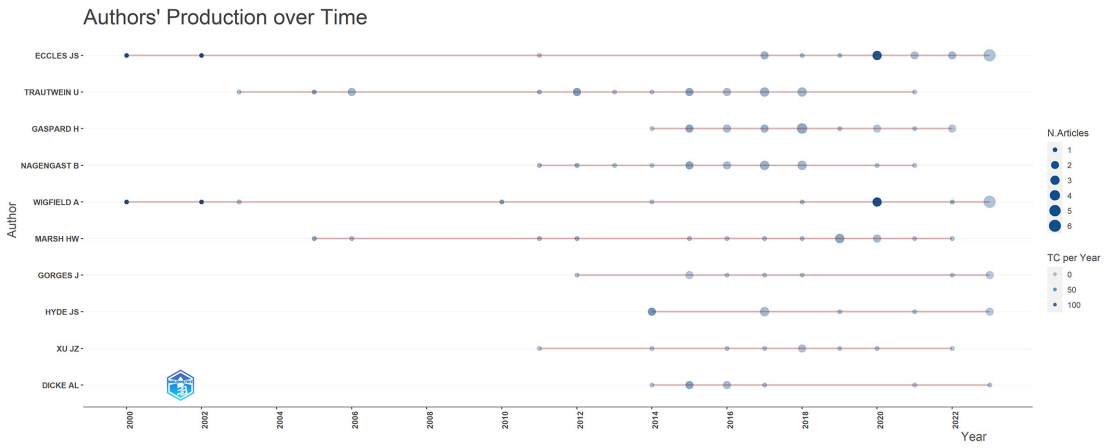


**Figure 4:** Authors' production over time (top 10).

**Table 1: High-frequency keywords related to expectancy-value theory research.**

| Sl. No. | Keyword | Frequency |
|---|---|---|
| 1 | expectancy-value theory | 290 |
| 2 | Motivation | 216 |
| 3 | achievement | 195 |
| 4 | task value | 150 |
| 5 | self-efficacy | 144 |
| 6 | Gender | 135 |
| 7 | Performance | 119 |
| 8 | Mathematics | 102 |
| 9 | belief | 101 |
| 10 | student | 82 |
| 11 | self-concept | 73 |
| 12 | model | 62 |
| 13 | science | 56 |
| 14 | choice | 51 |
| 15 | academic achievement | 46 |
| 16 | children | 44 |
| 17 | adolescent | 43 |
| 18 | perception | 38 |
| 19 | attitude | 37 |
| 20 | education | 37 |

#1 gender gap examines the impact of gender differences on job selection, subject preferences, risk assessment, etc.; #2 planned behavior delves into planned behavior's role in family education, social contributions, personal expectation realization, etc.; #3 validation study represents the research investigation that pertains to EVT, employing questionnaires or scales to validate the impact of a specific variable factor in practical scenarios, or assess and authenticate the efficacy of newly developed research tools; #4 career self-efficacy entails an analysis of career expectations and choices within a particular group, such as college students, unemployed individuals and so on, while considering self-efficacy as the basis for examining differences between them; #5 motivational disposition aims to explore the factors that influence motivational disposition and its effects on individuals in educational, socio-economic, and other domains.

Based on the aforementioned clustering characteristics, it's evident that scholars worldwide have conducted extensive research on EVT, integrating it with various disciplines and applying it to practical scenarios. Notably, the field of education has emerged as a leading contributor, accounting for a significant proportion of research findings pertaining to the application of EVT.

## Evolution of Research Themes

Shneider and Alexander have identified four stages in the evolutionary theory of scientific disciplines, namely, the conceptualization stage (identifying the problem, defining the object of study and its concepts), the instrumentalization stage (transforming developed concepts or mechanisms into operational tools), the application stage (attempting to use the theory to explain more problems and broaden application contexts so that it can be used in more diversified ways), and the integration stage (integrating existing knowledge, expanding concepts, and reconstructing thinking frameworks).[44] Scientific development follows an inherent pattern, and theory is no exception. The paper employs a Sankey diagram (Figure 7) to illustrate the relationship between the co-occurrence of high-frequency keywords in research on EVT and various research topics across different periods, offering a clearer and more comprehensive portrayal of the developmental context of EVT. In this study, node parameters are defined as the keywords found in the literature. The Sankey diagram consists of two main components: nodes and data flows. The extended branches in the graph represent the data flows, with their widths corresponding to the sizes of these flows.

As depicted in Figure 5, research on EVT during 1999-2006 often matches with other keywords that appear in the same research, such as "performance/choice/program/behavior/model", while

other keywords mostly pertained to related concepts of EVT. During this period, the main focus of the research was to transform the EVT into a tool and method for decision analysis, aiming to quantify risk and uncertainty; from 2007 to 2016, the majority of data was channeled into "performance/expectancy-value theory", signifying its prominence in educational research during this period. Moreover, novel education-related topics such as "adults/literacy/examinee/middle school" emerged, reflecting the evolving landscape of scholarly inquiry. Concurrently, investigations on self and physiological activities also gained traction, with researchers actively exploring the application of EVT across diverse domains; and from 2017 to 2023, the data on various topics have been flowing into the "expectancy-value theory", indicating that it has become a prominent research area during this period. In comparison to the years between 2007 and 2016, there has been a decline in interest regarding our

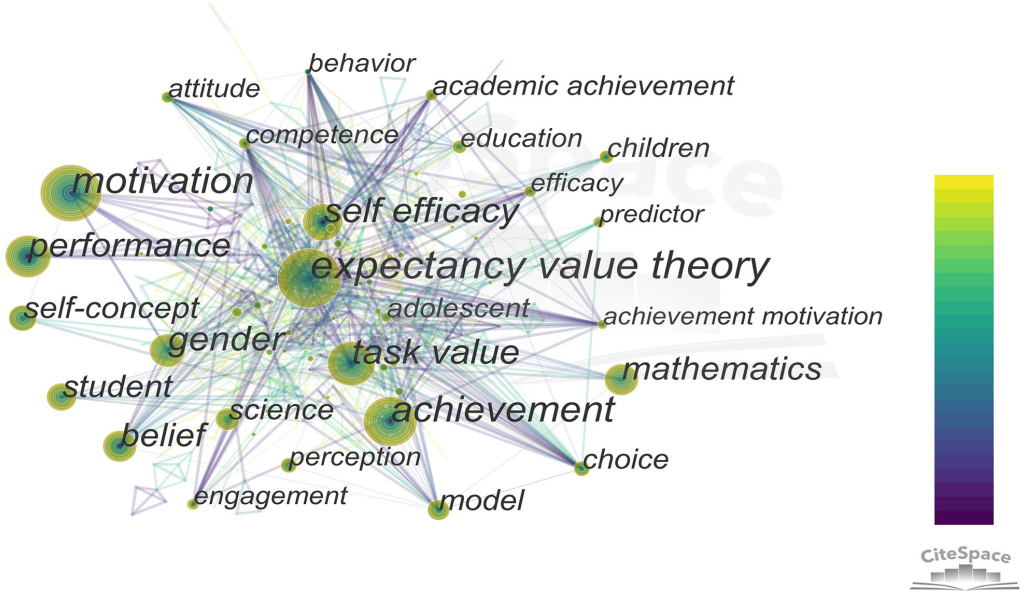


**Figure 5:** Co-occurrence of keywords of expectancy-value theory research from 1999 to 2023.

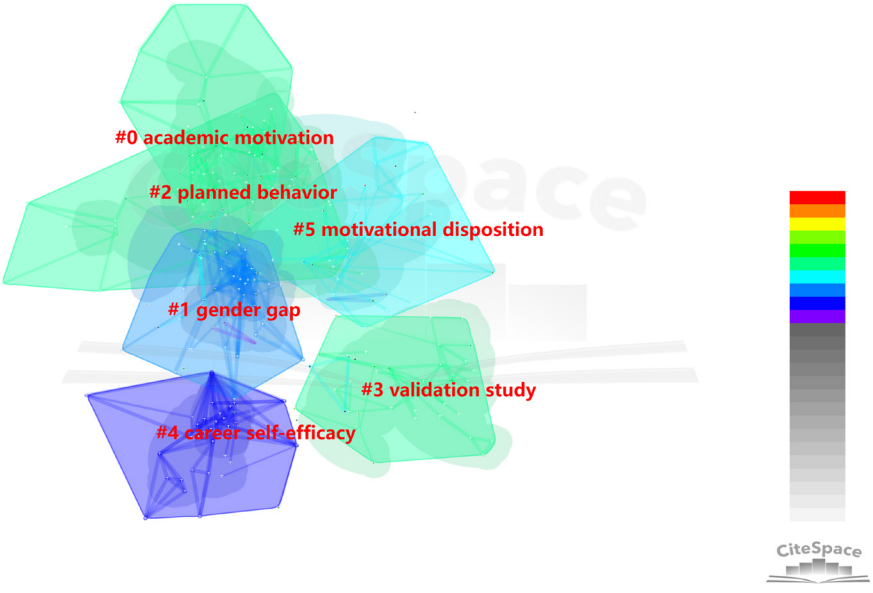


**Figure 6:** Keyword cluster map of expectancy-value theory research from 1999 to 2023.

adherence to specific scenarios. However, there is an increased focus on broader concepts and theoretical frameworks, such as "education/task value/adherence".

The evolution of prominent research on EVT reveals distinct research themes and notable differences in research priorities at each stage. Emerging themes over the past 25 years underscore EVT research's concern for physiological, psychological, social, economic, and cultural factors. While these topics have remained relevant, their developmental trajectories vary significantly.

Based on this, the study divides international health promotion research from 1999 to 2023 into three phases: the instrumentalization phase of EVT (1999-2006), the exploratory phase of applying EVT (2007-2016), and the feedback and optimization phase of EVT (2017-2023).

## Instrumental Stage (1999-2006)

The instrumental stage is indispensable for theoretical research, and imperfections and immaturity in the instrumentalization process may reduce the discernment of the theory and impede its dissemination and in-depth application.[45] High-frequency keywords such as gender difference, classroom, and model that appear in this stage show high academic influence, indicating that research hotspots are more related to gender difference and school education. In this stage, scholars widely use quantitative research methods to understand and apply EVT from a perspective of research tools, constructing models,[46-48] calculation formulas,[49] evaluation scales,[50] etc. These changes have expanded EVT research from a relatively single field of health science, clinical treatment, and education to social governance, workplace behavior, and other areas; however, there are still limitations on the research topic. Discussions on how to integrate existing expected value models were held at this stage with new directions proposed for future research which had a positive impact on subsequent stages by reducing superficial analyses relying only on concepts without exploring problems' essence.

## Application Exploration Stage (2007-2016)

The goal of the EVT in the exploratory phase of application is to verify the feasibility and validity of the theory and its relationship with the actual problem. The researcher or practitioner gradually adjusts the theory to better meet actual needs, collects data and feedback to evaluate its performance in practice. Important keywords at this stage include mathematics, attitude, and motivational belief, and these keywords complement each other with related theories such as self-efficacy and expectancy value theories, forming a cross-theoretical model for practical application that can be further tested for effectiveness in different real-world scenarios. For example, Magidson *et al.*,[51] utilized EVT to establish guiding principles for bottom-up theory-driven modification of target personality traits, highlighting its importance and feasibility in designing methods to change personality traits. Dever[52] constructed and tested a structural equation model within the framework of EVT to examine the relationship between students' motivation, behavior, emotional problems, predicting internal risks (e.g., worry, feeling isolated or blamed), as well as hyperactivity-distraction risk.

In this stage, the exploration of EVT transcends its theoretical foundations and endeavors to shift research perspectives towards practical applications in clinical medicine, pedagogy, sociology, art, and humanities. The objective is to empirically examine specific objects and phenomena using interdisciplinary models. At present, the academic community widely acknowledges that effectively harnessing the interplay between expectations of

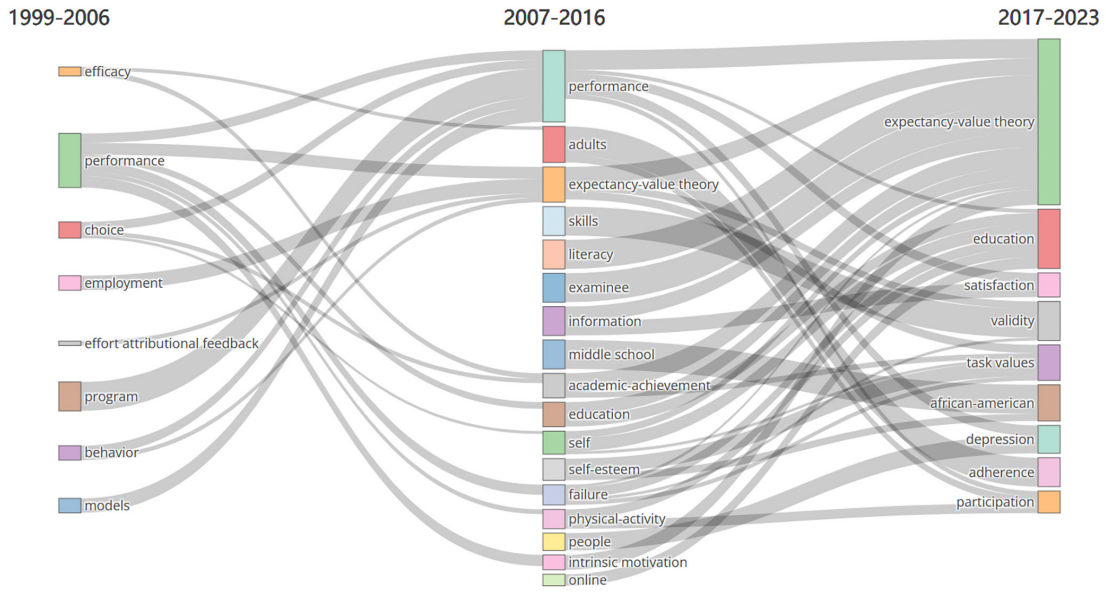


**Figure 7:** Sankey diagram of research theme changes.

success, incentive value, and achievement motivation can partially elucidate or address issues across diverse fields. It is during this stage that most professional knowledge emerges.

## Feedback Optimization Stage (2017-2023)

In the feedback and optimization stage of EVT, the research focuses on richer and more balanced keywords. Motivation, achievement, task value, and self-efficacy remain as core topics in EVT research. During this stage, scholars aim to revisit the theory itself, summarize and integrate existing knowledge in this field. They also attempt to explain, break through, and modify the theory and its model based on empirical cases from different fields. For instance, Rovan *et al.*,[53] developed a reconceptualized model of motivational beliefs in the mathematics learning process by examining secondary school students' motivational beliefs' role in predicting two outcomes of learning self-regulation (engagement or procrastination), and this study improved the quality and usefulness of the theory. Eccles Jacquelynne S.[30] proposed a SEVT that justified five issues related to Wigfield's SEVT proposal. Additionally, it effectively expanded EVT by suggesting further research based on this new perspective.

## Characterization of the Evolution of Thematic Directions

The evolution of the thematic direction of research on EVT over the past 70 years has been characterized by a balance between continuity and intersectionality in theoretical research.

Taking the field of education as an example, its application and research in EVT are representative. In 1999, the keyword "classroom" appeared, followed by "mathematics" in 2004, both strongly related to the education industry. These keywords synergistically co-occur with other keywords at various time intervals, becoming current research hotspots. Subsequently, "education" emerged in 2006 and "children's self" in 2008, along with terms like "high school", demonstrating different degrees of continuity and depth in related research. This suggests that this topic area still holds a relatively important position within EVT studies. On the other hand, the appearance of keywords such as goal theory and academic self-concept also reflects how research hotspots within the field of education are converging and integrating with other fields. This convergence produces rich and diverse content for research while highlighting varying degrees of intertwining between EVT and other theories.

In addition, ongoing research on EVT continues to systematically and comprehensively explore and analyze existing theories. For instance, terms such as value belief, validity, and motivational belief have been frequently employed in the past decade. The temporal occurrence and frequency of these terminologies reflect a resurgence in the foundational stage of EVT research in recent years, with an increased emphasis on micro-foundations and interpreting the influences that shape academic discussions. During this period, the primary focus lies in investigating how various factors impact decision-making orientations and anticipated outcomes based on individual motivations and personal characteristics. Consequently, attention is given to refining the structure and applicability of the theory for practical implementations.

## Analysis of Research Trend

CiteSpace utilizes emergence detection algorithms to extract emergent words from the titles, abstracts, keywords, and extended keywords of literature records. It then analyzes the frequency of emergence of these words in different time intervals to identify terms and phrases that exhibit a high rate of change, representing the frontiers of research. This helps users discover and understand cutting-edge issues in their respective fields.[54]

**Table 2: The use of theoretical perspective in each stage.**

| Theoretical Perspectives | From 1999 to 2023 | | 1st stage: 1999-2006 | | 2nd stage: 2007-2016 | | 3rd stage: 2017-2023 | |
|---|---|---|---|---|---|---|---|---|
| | no. of articles | % of 704 | no. of articles | % of 79 | no. of articles | % of 178 | no. of articles | % of 447 |
| self-efficacy theory | 147 | 20.88 | 36 | 45.57 | 47 | 26.40 | 64 | 14.32 |
| motivation theory | 76 | 10.80 | 6 | 7.59 | 23 | 12.92 | 47 | 10.51 |
| self-determination theory | 48 | 6.82 | 3 | 3.80 | 14 | 7.87 | 31 | 6.93 |
| social cognitive theory | 36 | 5.11 | 5 | 6.33 | 6 | 3.37 | 25 | 5.59 |
| achievement goal theory | 24 | 3.41 | 0 | 0.00 | 7 | 3.93 | 14 | 3.13 |
| attribution theory | 19 | 2.70 | 3 | 3.80 | 5 | 2.81 | 11 | 2.46 |
| control-value theory | 9 | 1.28 | 0 | 0.00 | 0 | 0.00 | 9 | 2.01 |
| Others | 67 | 9.52 | 11 | 13.92 | 25 | 14.04 | 31 | 6.94 |
| No clear theory | 375 | 53.27 | 29 | 31.19 | 73 | 41.01 | 273 | 61.07 |

Note: Among the entire sample, 89 articles involve multiple theories; in the first stage, 12 articles involve multiple theories; in the second stage, 21 articles involve multiple theories; and in the third stage, 56 articles involve multiple theories.

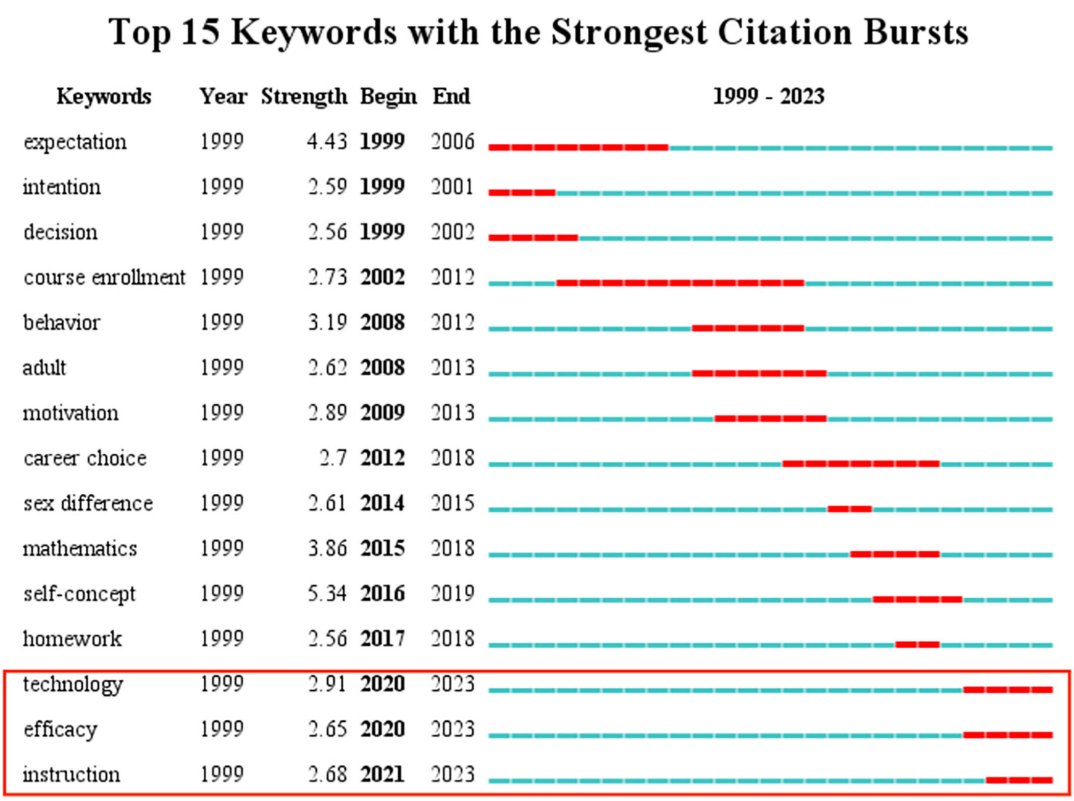


**Figure 8:** Emergent keyword map of top 15 keywords with the strongest citation bursts.

The present study employed CiteSpace software to identify research frontiers. Specifically, we used the software to analyze the selected literature samples and identified 15 emergent keywords as shown in Figure 8, including course enrollment, career choice, career development, etc., based on their order of emergence, and these are emerging research themes. Additionally, there are theoretical conceptual level emergent words such as anticipation, expectation, motivation, and self-concept. Analyzing the internal logic behind these key terms reveals that research involving them focuses on interpreting, modifying, or even advancing concepts related to EVT. Notably, the intensity score for "expectation" is remarkably high at 4.43; this indicates that intervention and evaluation regarding individual or group expectations across various domains have consistently been crucial aspects within EVT research. Furthermore, accurately determining interrelationships between expectation and other variables in motivational processes (e.g., motivation and behavior) serves as a fundamental basis for subsequent investigations.

Furthermore, only three keywords, namely efficacy, technology, and instruction, are identified with a time span from 2020 to 2023. Therefore, the research on these three keywords is considered to be at the forefront of hotspots in the field of EVT. Based on their distinct characteristics, these frontier hotspots can be classified into fundamental theoretical research, comprehensive theoretical research, and applied theoretical research:

Firstly, fundamental theoretical research pertains to the examination of expectancy value theories grounded in efficacy and related concepts. This form of research entails the analysis, critique, expansion, and revision of existing theories with the aim of fostering disciplinary advancement and enhancing theoretical frameworks. For instance, Anderman conducted a systematic review encompassing significant studies generated by achievement motivation theory within the past two decades, scrutinizing contemporary achievement motivation theory while elucidating noteworthy contributions.[43]

Secondly, in recent years, studies on STEM education based on EVT have continued to emerge. With a respect for the laws of nature as a premise, technology has the potential to change the world and achieve harmonious coexistence with nature while addressing challenges in social development. As a result, technology has become a focal point in related research. Research that represents the further integration of EVT with other subject areas or theoretical perspectives can be classified as comprehensive theoretical research. This involves forming a comprehensive theoretical framework by integrating theories and models from different disciplines to explain and understand complex phenomena and problems. For instance, Hsieh TY et al., combined the EVT with an intersectionality theory framework to conduct research suggesting that adolescents' belief patterns in math motivation are linked to their math scores and classroom participation in grade 11. Relevant factors also include previous

math scores, family socioeconomic status, gender, racial and ethnic differences.[55]

Finally, the majority of articles containing keywords such as "instruction" primarily consist of theoretical studies that are applied to address practical challenges across various fields. Scholars strive to tackle real-world problems by employing EVT and emphasizing the integration of theory and practice. They utilize theoretical concepts and frameworks to guide practical operations and decision-making processes in real-life situations. For instance, Buric et al. developed a multilevel structural equation model based on EVT to investigate the relationship between teacher self-efficacy, teaching quality, and students' motivational beliefs.[17] Similarly, Rosenzweig *et al.*, compared two interventions grounded in EVT with the aim of enhancing students' performance on exams, aiming to identify a more suitable approach for promoting motivation and performance among college students enrolled in introductory physics courses.[56]

## COMPARISON OF RESEARCH CONTENT AT DIFFERENT DEVELOPMENTAL STAGES

### Proposal of Knowledge Framework

Through the keyword cluster analysis and temporal evolution analysis, it was determined that six key research topics are obtained of the research on EVT, and the investigation of it has undergone three distinct developmental stages. These analyses mitigate the bias and subjective judgment associated with manually delineating research themes and developmental stages. However, they do not specifically elucidate the similarities and differences in research content across different developmental stages. To address this gap, this study refers to the FTCMR (focus-theory-context-method-response) knowledge framework constructed by Yang Zhi *et al.*,[57] and puts forward the knowledge framework of "theory-context-method". This framework systematically integrates the entire process mentioned in mainstream research on EVT, from expectancy and value assessment to achievement performance prediction, in a logical and coherent manner. Each aspect is treated independently yet bears certain logical relations, ensuring comprehensive coverage and adherence to the standards of knowledge framework construction. Based on the 17 Sustainable Development Goals of the United Nations, this study divides the main application scenarios of expected value theory research, and the research methods are divided into seven major classes: mathematical modeling, experimental research, scale survey method, theoretical research, secondary data analysis, literature reviews, and others.

### Theoretical Perspectives

Given that researchers can draw inspiration from other theories and engage in substantive and targeted reflections to improve and advance their own research questions, this study compiles the usage of theoretical perspectives across different stages. From Table 2, it can be observed that the most frequently used theory is the self-efficacy theory. This prevalence can be attributed to the fact that Eccles *et al.*'s EVT has served as the primary foundation for research over the past 25 years, and it incorporates certain expectancy-related viewpoints from Bandura's self-efficacy theory. At this stage, EVT's construction of expectancies bears greater resemblance to the efficacy expectations of the self-efficacy theory. Additionally, motivation theory is also the main theoretical perspective. This is because scholars consider EVT as a type of motivation theory, with achievement motivation theory being the precursor to EVT. Introducing other motivation theories serves an irreplaceable role in explaining the practical utility of EVT or addressing its shortcomings in application.

In the first stage, scholars predominantly confined their theoretical perspectives within the framework of self-efficacy theory, and

**Table 3: The application context in each stage.**

| Application Context | From 1999 to 2023 | | 1st stage: 1999-2006 | | 2nd stage: 2007-2016 | | 3rd stage: 2017-2023 | |
|---|---|---|---|---|---|---|---|---|
| | No. of articles | % of 704 | No. of articles | % of 79 | No. of articles | % of 178 | No. of articles | % of 447 |
| Quality Education | 477 | 67.76 | 41 | 51.90 | 103 | 57.87 | 333 | 74.50 |
| Good Health and Well Being | 104 | 14.77 | 21 | 26.58 | 34 | 19.10 | 49 | 10.96 |
| Gender Equality | 27 | 3.83 | 2 | 2.53 | 7 | 3.93 | 18 | 4.03 |
| Reduced Inequality | 19 | 2.70 | 0 | 0.00 | 4 | 2.25 | 15 | 3.36 |
| No Poverty | 8 | 1.14 | 3 | 3.80 | 2 | 1.12 | 3 | 0.67 |
| Industry Innovation and Infrastructure | 8 | 1.14 | 0 | 0.00 | 4 | 2.25 | 4 | 0.89 |
| Others | 10 | 1.42 | 3 | 3.80 | 6 | 3.37 | 1 | 0.22 |
| No clear classification | 51 | 7.24 | 9 | 11.39 | 18 | 10.11 | 24 | 5.37 |
| Quality Education | 477 | 67.76 | 41 | 51.90 | 103 | 57.87 | 333 | 74.50 |

**Table 4: The use of research methods in each stage.**

| Research Methods | From 1999 to 2023 | | 1st stage: 1999-2006 | | 2nd stage: 2007-2016 | | 3rd stage: 2017-2023 | |
|---|---|---|---|---|---|---|---|---|
| | No. of articles | % of 704 | No. of articles | % of 79 | No. of articles | % of 178 | No. of articles | % of 447 |
| Mathematical modeling | 258 | 36.65 | 38 | 48.10 | 67 | 37.64 | 153 | 34.23 |
| Experimental research | 196 | 27.84 | 17 | 21.52 | 45 | 25.28 | 134 | 29.98 |
| Scale survey method | 91 | 12.93 | 9 | 11.39 | 29 | 16.29 | 53 | 11.86 |
| Theoretical research | 70 | 9.94 | 8 | 10.13 | 16 | 8.99 | 46 | 10.29 |
| Secondary data analysis | 58 | 8.24 | 8 | 10.13 | 9 | 5.06 | 41 | 9.17 |
| Literature reviews | 25 | 3.55 | 4 | 5.06 | 8 | 4.49 | 13 | 2.91 |
| Others | 96 | 13.64 | 16 | 20.25 | 24 | 13.48 | 56 | 12.53 |

Note: Among the entire sample, 76 articles utilize multiple research methods; in the first stage, 15 articles utilize multiple research methods; in the second stage, 18 articles utilize multiple research methods; and in the third stage, 43 articles utilize multiple research methods.

31.19% of studies did not explicitly incorporating other theories, which contributed to the relatively sluggish development of EVT. From the subsequent stage onwards, scholars began to more extensively introduce micro-level explanatory mechanisms (such as attribution theory and self-determination theory). These theoretical perspectives were employed to elucidate diverse decision responses among decision-making groups with distinct characteristics when confronted with identical value expectations and were further advanced in the third stage. However, during the second stage, theoretical perspectives primarily continued from the first stage by focusing on self-efficacy theory and motivation theory. Control-value theory was solely utilized to explain expectancy-performance mechanisms in the third stage. The proportions of various theories in this latter phase were comparatively balanced, indicating a relatively mature development of EVT characterized by abundant and varied research content. The percentage of studies not explicitly integrating other theories increased from 31.19% in the initial stage to 61.07% in the third stage, suggesting that scholars prioritize redirecting their research focus back towards EVT itself while actively summarizing and integrating existing knowledge within this field and endeavoring to interpret, innovate upon, and refine theories along with their models.

## Application Context

Previous research has shown that different application contexts may emphasize different factors of EVT research, and models may be modified according to target tasks to achieve better fit. The 17 Sustainable Development Goals, which were formulated by the United Nations, aim to solve the global sustainable development problem in a comprehensive way. These goals include environmental, social, economic and other fields, and cover a variety of application scenarios involved in the study of expected value theory. Therefore, based on the United Nations' 17 Sustainable Development Goals, this study divided the main application contexts of EVT research and summarized and compared them (Table 3). From Table 3, it can be seen that Quality Education is the primary application context of EVT research, accounting for the largest proportion of total articles. For instance, researchers like Greene *et al.*,[58] and Doménech-Betoret *et al.*,[59] have applied EVT to predict or explain the educational outcomes and satisfaction of students. Good Health And Well Being also holds a certain proportion throughout the period, with articles mainly studying the application of EVT in providing treatment interventions for patients,[60,61] explaining the theoretical mechanisms of mental health disorders or addictive behaviors[62] and predicting the mental health symptoms explaining the theoretical mechanisms of mental illness or addiction. Additionally, although Gender Equality and Reduced Inequality have smaller proportions, they have increased in the third stage, indicating an increase in attention to these areas.

## Research Methods

Through statistical analysis and stage comparison of research methods, this study summarizes the progress of EVT in the scientificity and standardization of research paradigms. The statistical distribution of research methods (Table 4) mainly exhibits the following three characteristics: Firstly, the proportion of research using modeling and simulation methods in EVT research ranks first in all three stages but shows a gradual decrease. This is partly due to the poor availability of data in the first stage, leading scholars to pay more attention to methods like mathematical modeling, which are less constrained by data limitations. Additionally, subsequent research relies more on experimental research and secondary data analysis, resulting in a decreasing proportion of studies using mathematical modeling in each stage. Secondly, there is insufficient attention from EVT scholars towards research methods relying on primary data. Due to the convenience of archival data and the prevalence of regression methods, research methods relying on primary data such as scales have decreased in relevant studies since the second stage. Lastly, theoretical articles consistently occupy a relatively

stable proportion throughout the stages of EVT research. As EVT becomes increasingly mature, scholars begin to focus on theoretical discussions within specific subfields or on specific issues.

## CONCLUSION

This study systematically reviews 704 literature pieces on EVT published between 1999 and 2023, using a combination of bibliometric analysis and content analysis to delineate three developmental stages and compare the research content at each stage using the constructed "theory-context-method" knowledge framework. The results indicate that research on EVT is characterized by rich research hotspots, diverse theoretical perspectives, and varied research methods. However, the application contexts are relatively concentrated, and existing research still has certain limitations, with potential areas for future development.

This study makes several noteworthy contributions to the content and practice of EVT. By analyzing the trends in literature publication and changes in research topics, this paper offers a comprehensive understanding of the evolving pattern of EVT research for researchers and educators, thereby guiding them to further contemplate its expansion and application. Furthermore, this paper focuses on the evolution of EVT research and frontier hotspots, such as quality education and career planning, aiming to guide future feasible research directions and paths that address urgent obstacles hindering its development, dissemination, and wide application. Additionally, it contributes to facilitate multidisciplinary communication and understanding. Finally, by employing both qualitative and quantitative methods to review the literature on expected value theory, this paper effectively avoids subjective bias or one-sided interpretations that may arise from a single review method while ensuring comprehensiveness and depth. This approach presents a viable research scheme for studying theoretical evolution with potential reference value for future related studies.

However, this study also has certain limitations. Firstly, data collection is limited to the three major core databases on the Web of Science. Other databases such as CNKI, PubMed, and Scopus are also worth considering. Secondly, this study only focuses on journal articles, while other types of literature such as these, conference papers, and books may be investigated in future research.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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