THE INFLUENCE OF CLASSROOM PARTICIPATION ON COLLEGE STUDENTS' INNOVATION ABILITY - A CASE STUDY OF HEBEI NORMAL UNIVERSITY

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This Independent Study has been Approved as a Partial Fulfillment of the Requirement of International Master of Business Administration

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Title: The Influence of Classroom Participation on College Students' Innovation Ability-A Case study of Hebei Normal University

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ABSTRACT

With the launch of the national innovation development strategy and the promotion of comprehensive quality education in China, the construction of a scientific talent cultivation system and the improvement of college students' innovation ability have become the focus of education in colleges and universities. Classroom teaching in colleges and universities is one of the main means for students to receive knowledge, learn skills, and build their thinking systems. Therefore, based on the perspective of college students' "classroom participation", this paper put forward the following research objectives: 1) To explore the influence of classroom participation on college students' innovative thinking ability; 2) To explore the influence of classroom participation on college students' innovative learning ability; 3) To explore the influence of classroom participation on college students' innovative practical ability.

This paper adopted the quantitative research method and distributed 500 questionnaires to college students of Hebei Normal University in China through the platform of "Wen Juanxing", and collected 491 valid questionnaires, and verified the research hypotheses of the paper with this research sample. The conclusions of the study are as follows: 1) Classroom participation has a significant positive effect on college students' innovative thinking ability; 2) Classroom participation has a significant positive effect on college students' innovative learning ability; 3) Classroom participation has a significant positive effect on college students' innovative practical ability. The corresponding improvement suggestions are proposed from the results of this study.

Keywords: classroom participation, innovative ability, higher education, undergraduate student

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JUNXIA NIU

Declaration

I. NIU JUNXIA hereby declare that the research included in this independent study "The Influence of Classroom Participation on College Students' Innovation Ability - Taking Hebei Normal University as an Example" is original and has not been submitted to any other university or institution for a higher degree.

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Chapter 1 Introduction

1.1 Background of the Study

To further promote the development of China's knowledge economy era and build a talent training system that meets the needs of social development. The State Council clearly stated in the "Outline of the National Medium - and Long Term Education Reform and Development Plan (2010-2020)" that universities should include the cultivation of innovative talents with rich knowledge and skills and all-round development in their higher education training plans, and encourage universities to create talent training bases and actively explore effective ways for innovative knowledge talents (Deng, 2021). With the popularization of higher education and the reform of teaching methods, although the quality of teaching has been greatly improved, the overall quality development of college students is still relatively weak, mainly manifested in a lack of innovation awareness and practical ability, weak information awareness, and a certain gap with the talents required by enterprises (Gong, 2013). At present, Chinese university students generally lack innovation in their thinking, learning, and practical ability, which has a certain negative impact on their employment and career planning development (Xu, Zhang, & Pan, 2013). Therefore, improving the innovation ability of college students has become one of the urgent problems to be solved in the talent cultivation system of the new era.

Zhu and Lu (2003) believe that high participation of college students in the classroom is a prerequisite for building their knowledge system and developing their thinking ability. Wei (2017) pointed out in a study based on classroom transformation that Chinese college students, influenced by traditional indoctrination education, are always accustomed to unilaterally passively accepting knowledge taught by teachers in classroom learning. In this classroom atmosphere for a long time, students cannot truly integrate with the classroom in emotional experience and thinking innovation, and low classroom participation will become an important factor hindering the development of college students' innovation ability. At present, research on the development of innovation ability among college students is in its infancy. As the main venue for mutual participation, two-way communication, and access to knowledge resources between college students and teachers, it is necessary to further explore the impact of classroom participation on the innovation ability of Chinese college students (Chen, 2023).

Therefore, it is necessary to conduct a comprehensive analysis of the actual situation of Chinese college students' classroom participation in this study and to delve into the investigation of college students' classroom participation, explore the factors that affect the development of college students' innovation ability, help universities

improve classroom quality, and promote the comprehensive development of college students.

1.2 Problems of the Study

With the continuous advancement of the knowledge economy era, in the context of China's exam-oriented education, traditional classroom teaching mainly focuses on teachers explaining knowledge, and students mostly adopt a passive learning approach. There are few learning content segments such as questioning or discussion in classroom learning, which over time leads to a significant decline in students' ability in independent thinking and learning, Specifically, students are unable to actively integrate into the classroom during class, lack interest in teaching content, remain silent in the classroom, and cannot think independently and solve problems. This greatly hinders the development of students' comprehensive quality education and innovation ability (Chen, 2023).

1.3 Objectives of the Study

This study further explored the impact of classroom participation on college students' innovation ability through a questionnaire survey, and proposes the following research objectives:

1. To explore the influence of classroom participation on college students' innovative thinking ability.

2. To explore the influence of classroom participation on college students' innovative learning ability.

3. To explore the influence of classroom participation on college students' innovative practical ability.

1.4 Scope of the Study

Because this research activity is aimed at exploring the impact of classroom participation on college students' innovation ability, the total number of participants in the study is 25135 undergraduate students from Hebei Normal University in China, including freshmen, sophomores, juniors, and seniors. Because teacher training colleges are mainly aimed at cultivating a new generation of teachers, they have a certain understanding of classroom participation and how to mobilize students' classroom enthusiasm and promote their ability development. Therefore, selecting this type of population for a sampling survey results in relatively high effectiveness and

accuracy. In this study, designated samples were used and cluster random sampling was used. The minimum number of designated samples was calculated to be 394 people using Yamane's (1973) sample size formula. However, to ensure the accuracy and validity of the sample data, this study expanded the sample distribution to 500 copies, and after excluding invalid data such as errors and omissions, a total of 491 valid questionnaires were collected.

The content of this study is based on the learning Participation theory and student participation theory as the core and further explores the degree to which college students' innovation ability development is affected during their classroom participation process. Further exploration will be conducted by taking college students' classroom participation as the independent variable and their innovation ability as the dependent variable.

1.5 Significance of the Study

This article further explores the impact of classroom participation on the innovation ability of normal university students through a questionnaire survey. The research significance is as follows:

1) This study not only expands the scope of research on students' innovation ability to a certain extent but also compensates for the impact of college students' classroom participation on innovation ability in this field of research. To further verify the importance of classroom participation in the development of students' innovation ability, it adds an empirical basis.

2) Based on the impact of classroom participation and its various dimensions on innovative thinking ability, innovative learning ability, and innovative practical ability in the questionnaire survey, relevant improvement suggestions are proposed to promote students' classroom participation, stimulate their subjective initiative, and provide theoretical reference for the teaching work of improving students' innovative ability development in the talent cultivation system of universities.

3) Due to the differences in education systems and cultures among different countries, the applicability and focus of research on classroom participation and innovation capability vary among different countries. This study is based on a deep exploration of students' classroom participation and innovation ability in the context of Chinese culture, avoiding blind improvement caused by different cultural contexts and reducing educational trial and error costs.

1.6 Limitations of the Study

This article studies the impact of college students' classroom participation on their innovation ability, although based on their perspective, it compensates for the shortcomings of research in this field. However, there are still many shortcomings in the research process and data collection process of this article, as shown below:

1) Although the overall sample size collected in this study meets the minimum sample requirements for statistical sampling surveys, as a strict relational empirical study, sufficient sample size needs to be collected to ensure the accuracy of the study. Therefore, there are still certain limitations in the collection of sample size.

2) In terms of the geographical selection of the sample, only undergraduate students from Hebei Normal University in China were sampled, and no other university students from other provinces were sampled. Therefore, the research scope and universality of the results that led to this issue need further testing.

3) Due to the use of a questionnaire survey in this study, the writing, distribution, and collection of the questionnaire were all conducted through the Chinese "Questionnaire Star" platform. The collected sample data were all cross-sectional data of the sample, and there was no continuous observation of the research variable. The scientific and universal nature of the research results needs further testing.

Chapter 2 Literature Review

2.1 Introduction

This study mainly focuses on exploring the impact of classroom participation on college students' innovation ability (including innovative thinking ability, innovative learning ability, and innovative practical ability). Secondly, Chapter 2 mainly provides a comprehensive review and summary of international scholars' research on classroom participation, innovation ability, and other related fields of college students, covering the definitions of various research variables, influencing factors, and research status. Based on existing research theories and current research status, identify the shortcomings of existing research, and then construct the theoretical framework of this article. On the one hand, it can make up for the shortcomings in existing research, and on the other hand, it can also increase the reference basis for research in this field.

2.2 Literature Review

2.2.1 College Students' Innovation Ability

The concept of innovation capability was originally derived from a combination of "innovation" and "ability". The cultivation of innovation capability is not only a trend in today's social development, but also a valuable source for countries or enterprises to maintain sustained competitiveness (Cardinale, Sposato, Feo, & Fazio, 2018). Sternberg defined innovation ability as a complex and diverse ability in 1991, which includes multiple factors such as innovative thinking ability, innovative personality traits, and academic knowledge and skills (Chen, 2023). Zhang and Liu (2006) defined innovation ability as an individual's ability to identify and solve problems in their research report on innovation ability. Although the exploration of innovation ability by scholars from all over the world is still in its infancy and there is no unified definition of related concepts, the essence of the development of innovation ability cannot be separated from the cultivation of innovative talents, and one of the most effective ways to cultivate talent's innovation ability is to receive higher education (Osman & Faizal Khan, 2019). Therefore, scholars from all over the world have combined the research direction of talent innovation ability cultivation with higher education for in-depth exploration. Boonchan (2017) and other scholars found that factors such as learning atmosphere and classroom teaching can directly or indirectly affect students' creativity. Hallman (2016) and other scholars have proposed that professional knowledge, teaching style, classroom atmosphere, and teacher-student interaction play an important role in the development of college students' innovation ability. Wang (2019) further verified through empirical research that good teacher-student interaction can effectively improve the innovation ability of college students.

In summary, although many factors affect students' innovation ability, they can be roughly summarized as personal traits, environmental factors (such as classroom atmosphere, learning environment, teacher-student interaction, etc.), and knowledge resource factors (Kareen et al., 2017). As proposed by Beghetto (2005), the education system in universities has a significant impact on students' creativity. This study also found that educational practicals (including recognition, support, and encouragement of students' creative thinking development at the school level) have a significant effect on improving students' innovation ability. Based on a literature review of the development of college students innovation ability and the demand for questionnaire survey activities among college students at Hebei Normal University in China, this study selected three dimensions to measure college students' innovation ability and systematically analyzed the specific situation of this variable: 1) innovative thinking ability, 2) innovative learning ability, and 3) innovative practical ability.

1) Innovative thinking ability

The innovative thinking ability of college students refers to the ability to keenly perceive or be aware of problems during the process of thinking and learning, and to combine effective information or existing relationships to further solve problems, make verifications, and improve them to obtain corresponding results (Dong, 2003). Its advantages lie in cultivating college students' flexibility, openness, and seeking diversity in their thinking (Lin, 2012). In addition, Lin (2009) and his research team have proposed five characteristics of creative thinking ability after more than thirty years of research: ① novel, unique, and meaningful thinking activities; ② Solve problems that others have not solved through conceptualization and imagination; ③ The generation of inspiration; ④ The unity of analytical thinking and intuitive thinking; ⑤ Consistent with the unity of thinking and divergent thinking. From this, it can be seen that cultivating the innovative thinking ability of college students is the core focus of China's higher education talent system.

2) Innovative learning ability

Innovative learning ability refers to the ability of college students to learn new concepts and ideas, improve their professional learning through new methods, and creatively solve practical problems related to their major or related knowledge and skills (Yu & Min, 2019). Innovative learning not only requires students to innovate in the process of learning professional knowledge, and abandon the drawbacks of being conventional and superstitious about authority, but also combine their knowledge with learning practical to form new ideas for independent thinking, exploring new problems, and solving problems. Specifically, the innovative learning ability of college students is manifested by actively exploring and paying attention to the dynamics of technological development, continuously absorbing and accumulating new knowledge, mastering skills and knowledge related to their major, and being able to screen effective

solutions suitable for solving specific problems through continuous learning (Yang&Du, 2023).

3) Innovative practical ability

Innovative practical ability refers to the ability of an individual (or group) to propose new ideas, and inventions, creatively propose new theories, and formulate new improvement goals through individual continuous exploration based on previous experience and research (Yu, 2004). The innovative practical ability of college students is specifically manifested in their ability to use the relevant knowledge they have learned to find effective solutions promptly when encountering problems during the learning process or participating in creative competitions, and their ability to summarize the laws of learning or life.

2.2.2 College Students' Classroom Participation

Krumrei Mancuso (2013) and other scholars believe that classroom participation is essentially a form of expression in student social construction, consisting of a series of teacher-student interactive activities, including two-way questioning, discussion, presentation, and other classroom activities between teachers and students. Kong (2003) defined classroom participation as students' participation behavior in the classroom and proposed that classroom participation is not only an important place for students to acquire knowledge resources. Secondly, through a systematic review of relevant literature, it was found that the main factors affecting college students' classroom participation are personal traits, such as gender differences among different students (Beghetto, 2005) and personality differences (Rocca, 2010); School factors, such as class size (Hu & Li, 2014), curriculum planning, classroom environment (Jiang, 2008), etc; Teacher factors, such as gender differences in teachers (Murphy, 2018), teaching style (Bradshaw, 2018), teacher support and encouragement (Blackford, Bassett, & Brown, 2011), and classroom dynamics (Gilboy, Heinerichs, & Pazzaglia, 2015). Weaver (2005) found that good communication and interaction between teachers and students in the classroom can fully stimulate students' enthusiasm and create a good learning environment and atmosphere in the class. Takahashi (2019) found that good classroom communication can effectively stimulate students' learning ability and cognitive thinking. Zhang (2019) proposed that active classroom participation by students is an effective means to improve classroom quality, and the level of classroom quality directly affects the quality of college student training. Bao and Zhang (2012) found that students' autonomous participation in classroom interaction can not only effectively improve their academic performance, professional quality, and interpersonal skills, but also enhance their thinking and cognitive ability. Jiang (2008) found in a study on the impact of students' personality on classroom participation through classroom observation, interviews, and questionnaire surveys that there is a strong correlation between students' classroom language activities and their personality, and

factors such as students' knowledge level, cultural background, and classroom environment have a significant impact on student's classroom participation patterns. Rashidi and Naderi (2012) found that the gender of teachers can affect students' classroom participation behavior. Overall, female teachers are more patient and give students more positive praise than male teachers, so female teachers are more able to motivate students to participate in classroom activities. Scholars such as Bradshaw (2018) argue that the improvement of students' level of classroom participation is closely related to teachers' active classroom intervention behavior and appropriate classroom management strategies. Ahlfeldt (2005) and other scholars found that students' participation is usually higher in problem-oriented classrooms with a smaller number of middle school students in the class and a higher number of senior-grade courses. Therefore, based on the above research on classroom participation, it can be concluded that classroom participation is the foundation and prerequisite for cultivating students' thinking systems and various comprehensive ability, and plays a very important role in the development of students' comprehensive qualities.

In addition, there are significant differences in the standards for dividing classroom participation among international scholars based on their research purposes and perspectives. Although there is currently no unified classification dimension in the academic community, it can be summarized into three types. The first type is divided into two dimensions: active participation and passive participation (Hou, 2022). The second method divides it into three dimensions: behavioral, cognitive, and emotional participation (Kong, 2003; Dunleavy & Milton, 2009). The third type divides it into four dimensions: behavior, cognition, emotion, and psychological participation (Chen, 2023). Based on the research purpose and needs of this article, combined with the characteristics of college students, this article selects three dimensions: behavioral participation, cognitive participation, and emotional participation as important indicators to measure college students' classroom participation research. The details are as follows:

1) Behavioral Participation

College student behavioral participation refers to a series of behavioral participation processes in the classroom learning process, including pre-class preview, classroom attendance, classroom status, note taking, question answering, classroom questioning and discussion, and homework assignments (Zhang, 2019).

2) Cognitive participation

The cognitive participation of college students refers to the shallow participation (including transfer and memory) and deep participation (including thinking, reflection, supervision, and planning) of students in the classroom learning process (Zhu & Lu, 2003).

3) Emotional participation

The emotional participation of college students in the classroom refers to the emotional experience of students in the classroom learning process, which can be further divided into positive emotional participation (such as a sense of achievement, satisfaction, interest, and curiosity, etc.) and negative emotional participation (such as tension, anxiety, and worry, etc.) (Deng, 2021).

2.2.3 Current Situation of Innovation Ability Development of College Students

The cultivation of college students' innovative ability is not only an important task of innovation education in universities but also a necessary way to deepen the promotion of quality education. Although major higher education institutions have begun to attach importance to the cultivation of college students' innovative awareness, spirit, and ability, some college students are currently lacking in innovative awareness, lack innovative learning and motivation, and are unable to use the knowledge they have learned to solve practical problems. Therefore, this article conducts a systematic review and analysis based on the current situation or shortcomings of the development of college students' innovation ability, as follows.

1) Lack of innovative awareness cultivation

At present, although college students can have a certain understanding of innovation through various networks or social media, overall, their innovation awareness is relatively weak, and the cultivation of individual innovative thinking and thinking awareness has not been given sufficient attention. Currently, college students are generally required to complete mandatory courses in higher education within the specified time frame and obtain sufficient credits to successfully graduate. In the higher education curriculum system, the proportion of credits related to the cultivation of innovation ability and innovation practical is relatively low, which leads to a lower level of emphasis on innovation courses among college students. Secondly, influenced by long-term exam-oriented education, college students are generally in a passive state of accepting knowledge in classroom learning, and they also complete assignments passively assigned by teachers, lacking the ability to mobilize their learning enthusiasm and independent thinking. Some universities have long neglected the cultivation of students' innovative ability, and there is still room for further improvement in the planning and setting of innovative courses (Xu, Zhang, & Pan, 2013).

2) Low level of independent participation in innovative projects

At present, different higher education institutions regularly hold different types of innovation activity competitions to cultivate students' innovation ability. Some college students do not have a strong willingness to participate in competitions, which may be due to China's special education system, where students focus more on

knowledge from books and neglect the importance of practical accumulation. It may also be due to students' cognitive biases that they believe participating in innovation competitions requires too much time and energy, which hinders the development of college students' innovation ability (Quan, 2022).

3) Insufficient innovation practical

When universities organize students to carry out innovative practical activities, they often focus more on on-campus cultural construction from the perspective of the school, thus neglecting the importance of students' practical ability. Although competition is used to train innovation ability, the competition content does not cover all majors, and many students are unable to train their majors and competitions from a practical perspective. Without sufficient exercise, it is difficult to generate breakthrough innovation (Chen, 2017).

4) Innovative teaching staff needs to be improved

At present, there are many high school students and limited teacher resources in university education, and many universities are unable to allocate sufficient teacher resources for the cultivation of college students' innovative ability. In the process of teaching, most classes are taught in large classes, and the pressure of teaching and teaching is high, making it difficult to pay further attention to students' learning Participation and motivation. There are few teaching activities such as interaction between teachers and students and discussions in the classroom, making it difficult to guide students' innovation awareness and ability development in a targeted manner (Yu & Min, 2019).

2.3 Theory Review

2.3.1 Learning Participation Theory

The theory of learning Participation refers to the wholehearted Participation of learners in learning, resulting in effective learning outcomes. Fredricks (2004) and other scholars proposed that learning Participation is not a single concept, which is different from previous researchers who divided it into dimensions such as emotional Participation, behavioral participation, and cognitive Participation. At the same time, the study also found that compared to environmental factors, the factors of individual learning Participation have a relatively greater impact on educational outcomes. Scholars such as Wen (2010) found that moderately increasing students' cognitive, behavioral, and emotional Participation in learning can help them improve their sense of academic achievement. The study on the impact of learning Participation theory on classroom participation and college students' innovation ability has certain inspiration and reference value. Therefore, based on the learning Participation theory, this article takes college students' classroom participation as the independent variable in this study

and divides it into three dimensions: behavioral participation, cognitive participation, and emotional participation for measurement. As shown in Figure 2.1:

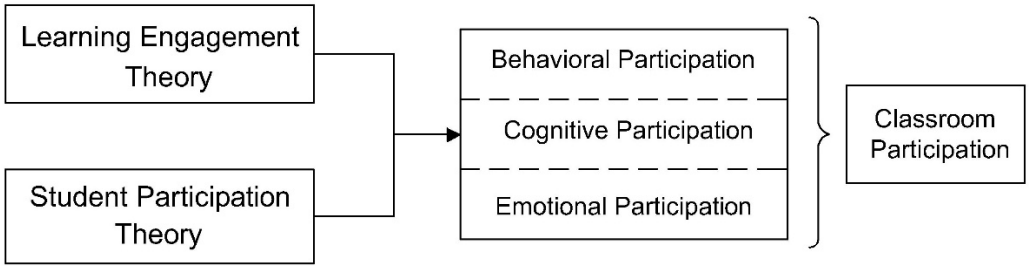

Figure 2.1 Classroom Participation Dimension Division

2.3.2 Student Participation Theory

The theory of student participation was first proposed by Martin in 1984. The scholar believes that student participation is a positive correlation between the gains students receive during the learning process and the time, effort, and effort they spend on learning. That is, the more students participate in learning, the greater the gains they receive. Secondly, students gain corresponding emotional experiences during the process of learning participation. On the one hand, it helps to acquire positive emotions and master relevant professional skills and knowledge. The higher the level of participation, the richer their positive emotional experience, the deeper their mastery of knowledge, and the lower their sense of learning burnout. On the other hand, good student participation can also help cultivate students' interest in learning, form a positive learning attitude, and thereby improve their learning satisfaction (Chen, 2023). In addition, a large number of scholars have also found the impact of campus environment on students' participation in related fields. The scholars believe that student's academic achievement is not only related to their level of effort but also to the support provided by the campus environment and external environment. Its main manifestations are the school's emphasis on student learning participation and policy support, teachers designing teaching content based on students' actual situations during the classroom teaching process, guiding students to actively participate in classroom learning, creating a good teacher-student interaction atmosphere, and paying attention to students' learning behavior and motivation (Huang, 2014).

2.4 Research Relevant

Mayhew (2012) and other scholars proposed in their research on the combination of innovative development and higher education that classroom teaching is one of the important ways to cultivate students' innovation. Through a survey of 700 undergraduate students, it was found that appropriate guidance behavior from teachers in the classroom can effectively enhance students' classroom participation and promote

the development of their innovative ability. Rosa et al. (2017) found in their research on predicting students' innovation ability based on the perspective of classroom participation that learning processes such as classroom interaction and discussion can effectively enhance students' logical thinking ability and contribute to the formation of innovative thinking. In addition, based on the Chinese context, Wang (2021) found through long-term observation of classroom students' performance that students' Participation and active participation in the classroom can contribute to professional knowledge learning and stimulate innovative thinking. Some scholars have found in their research that practical activities such as teacher-student interaction (Zhou, Wang, & Luo, 2017) and discussion-based teaching methods (Wang, 2017) in classroom participation can fully stimulate college students' innovative thinking and promote the development of personal innovation ability.

2.5 Conceptual Framework

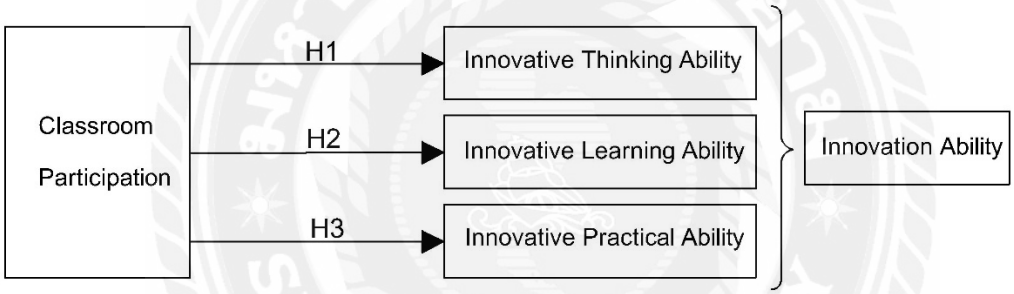

Figure 2.2 Conceptual Framework

2.6 Terms and Definitions Used in This Study

2.6.1 Classroom participation

Classroom participation refers to the process in which individuals fully participate in activities or tasks, both physically and mentally. In the study of student classroom participation, it is further defined as students' physical and psychological involvement in activities related to the classroom, including not only students' behavioral and cognitive participation but also their emotional participation (Kong, 2003). Based on the concept of classroom participation, this study takes college students as the main participants in classroom participation, specifically emphasizing the active psychological and physiological involvement of college students in the process of classroom learning in university classroom teaching. It is divided into three dimensions: behavioral participation, emotional participation, and cognitive participation. Among them, behavioral participation is an explicit form of classroom expression, referring to the degree of effort of college students in learning behavior; Emotional participation refers to the emotional experiences (such as positive or negative emotions) of college

students during the learning process; Cognitive participation refers to the degree of participation of college students in their thinking level.

2.6.2 Innovation Ability of College Students

Innovation ability refers to the ability of individuals to utilize their comprehensive knowledge in their interactions with the environment or others through knowledge, intelligence, personality, quality, etc., to put innovative ideas into practical and generate relatively valuable new things, new perspectives, new ideas, and problem-solving ability (Chen, 2023). Based on this, this article takes college students as the research object of innovation ability and further defines college students' innovation ability as their ability to reflect and associate based on existing knowledge or experience, propose new insights and viewpoints, and apply them to practical innovative problem-solving. Specifically, it is manifested as the innovative thinking ability, innovative learning ability, and innovative practical ability of college students. Among them, innovative thinking ability refers to the logical ability of college students to think and solve problems. Innovative learning ability refers to the ability of students to construct knowledge, absorb knowledge, filter knowledge, and apply it to time. Innovative practical ability refers to the ability of students to participate in innovative practical activities and solve practical problems (Deng, 2021).

2.6.3 Hebei Normal University

Hebei Normal University is located in Shijiazhuang, the capital of Hebei Province. It was jointly built by the Ministry of Education of the People's Republic of China and the People's Government of Hebei Province. It is a provincial-level key university with a century-old history and glorious tradition and a national first-class university supported by Hebei Province. It is one of the earliest and largest normal universities in China, selected for the implementation of the Excellent Teacher Training Plan and the construction of a demonstration base for studying abroad by the Ministry of Education.

As of March 2023, the new campus of Hebei Normal University covers an area of 1829 acres, with a collection of 3.03 million books and 67 Chinese and foreign language databases; Established 21 professional colleges, 1 independent college (Huihua College), with 8 first-level disciplines authorized for doctoral degrees, 1 doctoral degree authorization point, 51-second level disciplines authorized for doctoral degrees, 26 first-level disciplines authorized for master's degrees, 141 second-level disciplines authorized for master's degrees, 11 types of master's degree authorization, 9 postdoctoral research mobile stations, and 95 undergraduate majors; There are 25135 undergraduate students on campus.

Chapter 3 Research Methodology

3.1 Introduction

This study adopts a quantitative research method and measures various variables in this study using mature scales used by international scholars. According to the theory of learning Participation, learning Participation refers to the total physical and mental involvement of learners in learning, resulting in effective learning outcomes. The combination of this theory and student Participation theory can further explore how learners' time and energy investment in classroom participation can effectively improve their professional skills and thinking, and promote the development of learners' innovative ability. Therefore, this study is based on the theory of learning Participation and student participation, and further explores the impact of classroom participation on the development of innovation ability among college students. Based on this, the theoretical model of this article is constructed and corresponding research hypotheses are proposed.

3.2 Research Design

In this study, mature scales commonly used by international scholars were used in both questionnaire design and scale use. To facilitate the respondents' understanding of the questionnaire items, this survey activity divided the questionnaire into three parts for research, including basic information of the respondents, measurement of college students' classroom participation, and measurement of college students' innovation ability. The questionnaire in this article was filled out anonymously and will not disclose the privacy of the respondents. The collected sample data is only used for data analysis in this study. The specific structure of the questionnaire is shown in Table 3.1:

Table 3.1 Questionnaire Structure

		Question items	N
Base Information		1、2	2
Classroom participation	Behavioral Participation	A1-A8	8
	Cognitive Participation	A9-A18	10
	Emotional Participation	A19-A26	8
Innovation ability	Innovative Thinking Ability	B1-B5	5
	Innovative Learning Ability	B6-B10	5
	Innovative Practical Ability	B11-B15	5
Overall questionnaire total: 43 questions			
Note: Measurement items B5, B8, B10, and B11 are scored in reverse			

(1) Basic information: The respondents' gender and grade are composed of two questions.

(2) The 'Classroom Participation of College Students' scale was developed by Chen (2023) and is suitable for measuring college students' classroom participation in Chinese contexts. The advantage of this scale is that the items are simple and easy to understand, and the content covers daily pre-class preparation, classroom questioning, discussion, and other content. It is divided into three dimensions: behavioral participation, cognitive participation, and emotional participation, with a total of 26 questions. Among them, the representative questions include "I often preview carefully before class", "I never arrive late, leave early, or miss class", and "When learning new knowledge, I associate it with what I have already learned and connect it ", "When encountering learning problems, I will find ways to solve them", "I find classroom learning very interesting, and I find learning very enjoyable" Classroom learning is rewarding, and I have a sense of achievement.

(3) The "Innovation Ability of College Students" adopts Deng's (2021) scale for measuring classroom participation and the innovation ability of college students in Chinese contexts, which is based on relevant scales developed by international scholars (Yan, 2012; Bai, 2021). And divide it into three dimensions: innovative thinking ability, innovative learning ability, and innovative practical ability, with a total of 15 questions for measurement. Among them, representative questions include "I always have a logical and clear approach to solving problems." "I am good at summarizing problems and reflecting on my own mistakes." "I like to pay attention to technological development trends and constantly absorb new knowledge." "When encountering problems, I always find effective solutions promptly. In addition, when designing the innovation ability questionnaire for college students, to avoid limitations such as fixed thinking or random filling, this article sets some questions in the questionnaire as reverse questions, with reverse question numbers B5, B8, B10, B11. Designed as a reverse scoring option, there are five levels from completely non-compliant to fully compliant, corresponding to 1-5 points.

3.3 Hypothesis

Hypothesis 1: There is a positive effect of classroom participation on college students' innovative thinking ability.

Hypothesis 2: There is a positive effect of classroom participation on college students' innovative learning ability.

Hypothesis 3: There is a positive effect of classroom participation on college students' innovative practical ability.

3.4 Sampling and Sample Size

Because this research activity is aimed at exploring the impact of classroom participation on college students' innovation ability, the total number of participants in the study is 25135 undergraduate students from Hebei Normal University in China, including freshmen, sophomores, juniors, and seniors. The sampling table proposed by Yamane in 1967 was used for sampling, with a 95% confidence interval of P=0.5. During the sampling process, it was ensured that every research object in the population had a known, non-zero probability of being selected as the research object, and the representativeness and universality of the sample were ensured as much as possible. Calculate the number of people sampled for this sample using the Slovin calculation formula at the 95% confidence interval level. According to the formula, the corresponding values for 25135 undergraduate students were calculated, and under a 5% confidence interval, the sample size was 394. From this, it can be seen that the minimum sample size for this study during the questionnaire collection process should not be less than 394. Considering that there may be errors or omissions in the distribution and collection of samples, ensure to the maximum extent that the samples in this sampling survey meet the requirements of data analysis. Therefore, the distribution of questionnaires was expanded to 500 copies, and a total of 491 valid questionnaires were collected after excluding invalid data such as errors and omissions, with a questionnaire recovery rate of 98.2%.

$$N = \frac{N}{1+(Ne2)}$$

$$N = \frac{25135}{1+（25135(0.05)^2）}$$

$$N = \frac{25135}{1+62.83}$$

$$N = 393.78$$

(Equation 3-1)

3.5 Data Collection

The sample data was collected and distributed to undergraduate students at Hebei Normal University in China through the "Wenjuanxing" platform (www.wjx. cn) in the form of QR codes or links. Online questionnaires are a common form of questionnaire distribution, which is more flexible and cost-effective compared to paper-based questionnaires (Borgobello, Pierella, & Pozzo, 2019).

The Likert 5-level scale was used to measure the perception level of college students in perceived classroom participation and innovation ability variables in this survey questionnaire. The Likert Level 5 scale is currently one of the most widely used and popular attitude scales in the academic community. Its advantage is that it is a psychological measurement instrument with a simple scale structure and is easy to read. This scale typically has five to seven options, ranging from "completely non-compliant" at level 1 to "completely compliant" at level 5, with the remaining levels 2, 3, and 4 representing "average," "uncertain," and "relatively compliant," respectively. The measurement method used in this scale is helpful for data statistical analysis in subsequent studies (Yusof et al., 2019). College students of different grades and genders choose answers that match their situation based on their true feelings and add up the scores for each question to obtain the total score. The comprehensive score will indicate the strength of college students' attitudes and opinions towards each level of agreement or disagreement.

3.6 Data Analysis

After the questionnaire is collected, the sample data is preprocessed based on statistical analysis such as frequency, mean, and regression. After eliminating invalid questionnaires such as errors or omissions, further data analysis is carried out. The specific inspection procedures during the data analysis process are as follows:

1) Descriptive statistical analysis is an important aspect of the data analysis process. This statistical method refers to a series of processes that organize, analyze, and describe sample data collected during the research process, including mean, frequency, standard deviation, and variance kurtosis and skewness to analyze data. It is a method of describing the basic situation and distribution characteristics of sample data using graphical or mathematical methods (Xue, 2021).

2) Correlation analysis refers to the study of whether there is a certain dependency relationship between phenomena and the exploration of the direction and degree of correlation for phenomena with dependency relationships. It is a statistical method for studying the correlation between random variables.

3) Regression analysis refers to the use of statistical data to analyze the quantitative changes of various variables and to reflect and describe any relationship in the form of regression equations. The reasons for choosing regression analysis are as follows: a. Regression analysis can help researchers effectively calculate whether an independent variable or a group of independent variables have a significant relationship with the dependent variable; b. Regression analysis can more easily calculate the relative strength of the influence of different independent variables on the dependent variable;

c. Make predictions (Lin, et al., 2021). According to the number of dependent and independent variables, regression analysis can be divided into univariate linear regression analysis and multivariate linear regression analysis. Univariate linear regression analysis only includes one independent variable and one dependent variable, and the relationship between the two can be approximated by a straight line, while multiple linear regression analysis includes two or more independent variables (Nataraja, Chilale, & Ganesh, 2018). As discussed in the literature review, there were more than two variables in this study, so multiple linear regression analysis was used to determine the relationship between college students' classroom participation and their innovation ability.

3.7 Reliability and Validity Analysis of the Scale

3.7.1 Reliability analysis

The reliability of a questionnaire refers to the reliability of a scale, and the reliability test of a scale usually involves the consistency of the results obtained by repeated measurements of the same variable using the same method. International scholars usually adopt Cronbach α as a measure of questionnaire reliability. In general, when α When the value of is greater than 0.8, it indicates that the reliability of the scale is good, α the closer the value is to 1, the higher the reliability of the scale and the smaller the error of the measured results; When α When the value of is less than 0.6, it indicates that the reliability of the scale is poor, and it is necessary to consider rewriting the scale or modifying it (Xue, 2021). The questionnaire for this study consists of two parts: college students' classroom participation (X) and college students' innovation ability (Y). Therefore, this article will conduct a Cronbach study on the classroom participation, innovation ability, and overall scale of college students α The coefficient test and specific analysis results are shown in Table 3.2.

Table 3.2 Questionnaire Reliability Test

variable	Question items	Cronbach's Alpha
Behavioral Participation	8	0.936
Cognitive Participation	10	0.933
Emotional Participation	8	0.892
Innovative Thinking Ability	5	0.821
Innovative Learning Ability	5	0.840
Innovative Practical Ability	5	0.803
Overall Scale	41	0.936

According to the reliability test results of various parts of the questionnaire in Table 3.2, it can be seen that the Cronbach questionnaire on behavioral participation, cognitive participation, and emotional participation in college students' classroom

participation α the coefficients are 0.936, 0.933, and 0.892, respectively. Cronbach on Innovative Thinking Ability, Innovative Learning Ability, and Innovative Practical Ability in College Students' Innovative Ability α the coefficients are 0.821, 0.840, and 0.803 respectively; Cronbach of the overall scale α the coefficient is 0.936. From this, it can be seen that the reliability tests of each part of the scale and the overall scale are above 0.8, indicating that each item in this study has good reliability, and the design of measurement items is relatively reasonable, which can be used for exploratory factor analysis in the next step.

3.7.2 Validity analysis

Validity testing refers to the effectiveness and accuracy of the scale used in this study. For validity testing, international scholars usually use KMO and Bartlett's spherical test as measurement indicators. In general, when the KMO value reaches 0.6 or above, it indicates that the validity is acceptable; When the KMO value reaches 0.7, the effect of factor analysis will be better. The closer the KMO value is to 1, the stronger the correlation between variables, making it more suitable for the next step of factor analysis. Secondly, Bartlett's sphericity test is also a commonly used method for testing validity. The significance of this statistic is generally within a 5% confidence interval. The smaller the P-value of Bartlett's sphericity test, the higher its validity, indicating that it is more suitable for factor analysis. The validity test results of each scale used in this article are shown in Table 3.3.

Table 3.3 Validity tests for each partial scale

	KMO	Bartlett's Test of Sphericity		
		Approx. Chi-Square	df	Sig.
Behavioral Participation	0.956	2731.276	28	0.000
Cognitive Participation	0.965	2975.859	45	0.000
Emotional Participation	0.938	1695.316	28	0.000
Innovative Thinking Ability	0.856	760.356	10	0.000
Innovative Learning Ability	0.856	879.931	10	0.000
Innovative Practical Ability	0.839	668.938	10	0.000
Overall Scale	0.948	10760.435	820	0.000

According to the validity test results of various parts of the scale in Table 3.3, it can be seen that the KMO values of different dimensions in college students' classroom participation in this study are 0.956, 0.965, and 0.938, respectively; The chi-square values of Bartlett's Test of Sphericity are 2731.276, 2975.859, and 1695.316, respectively. The KMO values of different dimensions in the innovation ability of college students in this study are 0.856, 0.856, and 0.839, respectively; The chi-square values of Bartlett's Test of Sphericity are 760.356, 879.931, and 668.938, respectively.

The KMO value of the overall scale is 0.948, and the chi-square value of Bartlett's Test of Sphericity is 10760.435. The significance level in the validity test of the above scales is 0.000, indicating that the P-value is less than 0.01 significance level. From this, it can be concluded that all the scales used in this study have good validity and are suitable for further empirical analysis and testing.

Chapter 4 Findings

4.1 Introduction

The fourth chapter of this article mainly conducts a questionnaire survey and data analysis on the current situation of classroom participation and innovation ability of college students at Hebei Normal University in China. Through descriptive statistical analysis (mean, standard deviation, frequency, etc.), correlation analysis, and regression analysis of the sample data, further investigate whether there is a significant impact between the variables of classroom participation and innovation ability among college students, and verify the research hypotheses in this article in turn.

4.2 Description of Statistical Variables

This article uses SPSS statistical analysis software to conduct descriptive statistical analysis on 491 sample data to further understand the basic distribution of the sample data, as shown in Table 4.1.

Table 4.1 Descriptive Statistical Analysis

variant		Frequency	Percent	Valid Percent	Cumulative Percent
gender	male	277	56.4	56.4	56.4
	female	214	43.6	43.6	100.0
grade	Freshman year	120	24.4	24.4	24.4
	Sophomore	133	27.1	27.1	51.5
	Junior	126	25.7	25.7	77.2
	Senior	112	22.8	22.8	100.0

According to the description and analysis of the basic situation of the sample in Table 4.1 above, it can be seen that in this survey activity, the majority of respondents were male, with 277 people, accounting for 56.4%; There are 214 women, accounting for 43.6%. The grades of the respondents are as follows: the number of sophomore students is the highest, with 133 students, accounting for 27.1% of the total number; Secondly, the number of third-year and first-year students is 126 and 120, respectively, accounting for 25.7% and 24.4% of the total number; The smallest number is among senior students, with only 112, accounting for 22.8% of the total number. According to the above descriptive statistical analysis, the per capita distribution in this sampling survey is relatively uniform, and the representativeness of the samples is relatively good.

To further analyze the current situation of classroom participation among undergraduate students at Hebei Normal University in China, this study obtained the

scores of various dimensions of classroom participation among college students through descriptive statistical analysis. The specific statistical results are shown in Table 4.2.

Table 4.2 Descriptive Analysis of Classroom Parameters for College Students

	N	Mean	Std. Deviation
Behavioral Participation	491	3.624	0.980
Cognitive participation	491	3.682	0.863
Emotional participation	491	4.066	0.732

According to the above statistical analysis results, the average scores of the three dimensions of college students' classroom participation are from high to low: classroom emotional participation (4.066), classroom cognitive participation (3.682), and classroom behavioral participation (3.624). According to the Likert five-point scoring method adopted in this questionnaire, each option is assigned a score of 1-5 points from "completely non-compliant" to "completely compliant". As shown in Table 4.2, the overall score for each dimension is between 3.5 and 4.1, which is above the average level.

Table 4.3 Analysis of the Current Situation of College Students' Classroom Participation

Question items	Completely inconsistent	Non-Conformance	not sure	Conformance	Full compliance
Behavioral Participation					
A1	41(8.4%)	66(13.4%)	98(20.0%)	189(38.5%)	97(19.8%)
A2	38(7.7%)	67(13.6%)	96(19.6%)	181(36.9%)	109(22.2%)
A3	25(5.1%)	53(10.8%)	81(16.5%)	188(38.3%)	144(29.3%)
A4	36(7.3%)	55(11.2%)	87(17.7%)	180(36.7%)	133(27.1%)
A5	33(6.7%)	61 (12.4%)	96 (19.6%)	178(36.3%)	123(25.1%)
A6	42(8.6%)	53(10.8%)	100(20.4%)	179(36.5%)	117(23.8%)
A7	27(5.5%)	56 (11.4%)	78 (15.9%)	191(38.9%)	139(28.3%)
A8	33(6.7%)	54(11.0%)	79 (16.1%)	192(39.1%)	133(27.1%)
Cognitive Participation					
A9	30(6.1%)	60 (12.2%)	122(24.8%)	179(36.5%)	100(20.4%)
A10	35 (7.1%)	57 (11.6%)	131(26.7%)	171(34.8%)	97 (19.8%)
A11	15(3.1%)	40 (8.1%)	105(21.4%)	180(36.7%)	151(30.8%)
A12	24(4.9%)	53 (10.8%)	97 (19.8%)	186(37.9%)	131(26.7%)
A13	22 (4.5%)	53 (10.8%)	104(21.2%)	201(40.9%)	111(22.6%)
A14	22 (4.5%)	62 (12.6%)	120(24.4%)	186(37.9%)	101(20.6%)
A15	14 (2.9%)	50 (10.2%)	84 (17.1%)	184(37.5%)	159(32.4%)
A16	23 (4.7%)	62 (12.6%)	112(22.8%)	176(35.8%)	118(24.0%)
A17	18 (3.7%)	52 (10.6%)	99 (20.2%)	187(38.1%)	135(27.5%)

A18	19 (3.9%)	42 (8.6%)	98 (20.0%)	194(39.5%)	138(28.1%)
Emotional Participation					
A19	11 (2.2%)	33 (6.7%)	101(20.6%)	178(36.3%)	168(34.2%)
A20	14 (2.9%)	29 (5.9%)	84 (17.1%)	193(39.3%)	171(34.8%)
A21	8 (1.6%)	19 (3.9%)	62 (12.6%)	180(36.7%)	222(45.2%)
A22	10 (2.0%)	29 (5.9%)	72 (14.7%)	178(36.3%)	202(41.1%)
A23	13 (2.6%)	24 (4.9%)	87 (17.7%)	170(34.6%)	197(40.1%)
A24	11 (2.2%)	24 (4.9%)	93 (18.9%)	184(37.5%)	179(36.5%)
A25	11 (2.2%)	13 (2.6%)	73 (14.9%)	183(37.3%)	211(43.0%)
A26	10 (2.0%)	16 (3.3%)	81 (16.5%)	180(36.7%)	204(41.5%)

1) Behavioral Participation

According to Table 4.3, the lowest score for the behavioral participation dimension in the analysis of the current situation of college students' classroom participation is 3.624 points. The participation of college students in classroom behavior includes their attendance status, classroom listening status, pre-class preparation, and post-class homework completion status. According to a questionnaire survey, based on overall data analysis, college students' attendance is relatively good, with 58.3% of students generally not being late, absent, or leaving early; 63.8% of students will take notes while listening attentively; 66.2% of students take each assignment seriously and complete it quickly; But 32.4% of students will do things unrelated to learning in the classroom; Only 58.3% of students will timely preview new knowledge and review old knowledge.

According to the analysis of the current situation of college students' behavioral participation, it can be concluded that although more than 50% of students can ensure attendance and homework submission, their attitude and quality towards homework need to be further improved. Secondly, the study also found that the majority of students did not develop good learning habits, one-third of students did not have the habit of taking notes, and over 40% of students did not prepare and review promptly; At the same time, some students lack binding force on themselves, and their classroom participation is superficial, failing to devote 100% of their energy to classroom learning and doing things unrelated to the classroom. From this, it can be seen that students mostly passively receive knowledge or engage in interaction in classroom behavior, while those who participate in classroom interaction have lower initiative.

2) Cognitive participation

College students' classroom cognitive participation refers to their participation at the cognitive level. According to Table 4.2, the average college student's classroom cognitive participation is 3.682. According to the analysis of questionnaire data in 4.3, 56.9% of students associate knowledge they have already learned and connect old and new knowledge together; When 54.6% of students encounter learning problems, I will find ways to solve them; 67.5% of students will reflect and improve their learning

methods; 64.6% of students have their own arrangements in classroom learning, rather than blindly following the teacher's instructions; 63.5% of students approach new knowledge through understanding rather than rote memorization; 58.5% of students are able to supervise their strict implementation of learning plans; 69.9% of students often think about which key points need to be mastered and understood when reading books; 59.8% of students will think about the role of the knowledge they have learned in practical when learning new knowledge; 65.6% of students are able to arrange their learning time and tasks reasonably; 67.6% of students will use their free time to improve my understanding of the knowledge learned in class.

From this analysis, it can be seen that although more than 50% of college students in this sampling survey have a good level of cognitive participation and can actively explore new knowledge, develop learning plans and self supervise, and use the knowledge learned to solve problems, there are still a small number of students who are relatively weak in cognitive participation and need further guidance or stimulation of students' learning motivation.

3) Emotional participation

College students' emotional participation in the classroom refers to their level of interest in learning content, etc. Yan and Wang (2019) found a significant positive correlation between emotional participation and learning outcomes among college students in their research on emotional participation and learning outcomes. The scholar also proposed that students' emotional participation is the foundation for achieving good learning outcomes. According to Table 4.2, the highest average level of emotional participation among college students in the classroom is 4.066. According to the analysis of questionnaire data in 4.3, 70.5% of students find classroom learning very interesting, and I think learning is very enjoyable; 74.1% of students are very interested in new knowledge; 81.9% of students are always curious about new knowledge; When 77.4% of students achieve excellent results, I feel very satisfied; 74.7% of students believe that classroom learning is rewarding; 74% of students feel nervous when asked questions by teachers in class; 80% of students always feel a bit worried when taking exams; 78.2%% of students may feel anxious when encountering unanswerable questions during exams.

From this analysis, it can be seen that more than 70% of students in B19-B23 have a higher level of positive emotions in emotional participation, but in B24-B26, 30% of students can actively respond to exams or remain calm when problems cannot be solved. From this, it can be seen that emotional participation in college students' classrooms requires further improvement in their negative emotions such as anxiety or tension when facing academic difficulties or asking questions from teachers.

By conducting descriptive statistical analysis on the innovation ability and its scores in various dimensions in the sample data, the specific statistical results are shown in Table 4.4.

Table 4.4 Analysis of the Current Situation of Innovation Ability of College Students

	N	Mean	Std. Deviation
Innovative thinking ability	491	4.025	0.732
Innovative learning ability	491	3.909	0.782
Innovative practical ability	491	3.799	0.731

The measurement of college students' innovation ability in this article adopts Likert's five-point integration method, and each question is assigned a score of 1-5 points from completely noncompliant, noncompliant, uncertain, compliant, and fully compliant. From the statistical results, it can be seen that the average scores of various dimensions of college students' innovation ability are from high to low, followed by innovative thinking ability, innovative learning ability, and innovative practical ability. The overall score is between 3.7 and 4.1, which is above the average level.

Table 4.5 Analysis of the Current Situation of Innovation Ability of College Students

Question items	Completely inconsistent	Non-Conformance	not sure	Conformance	Full compliance
Innovative Thinking Ability					
B1	15 (3.1%)	38 (7.7%)	107(21.8%)	176(35.8%)	155(31.6%)
B2	8 (1.6%)	29 (5.9%)	106(21.6%)	191(38.9%)	157(32.0%)
B3	5 (1.0%)	19 (3.9%)	70 (14.3%)	175(35.6%)	222(45.2%)
B4	8 (1.6%)	19 (3.9%)	74 (15.1%)	199(40.5%)	191(38.9%)
B5	9 (1.8%)	28 (5.7%)	90 (18.3%)	178(36.3%)	186(37.9%)
Innovative Learning Ability					
B6	17 (3.5%)	44 (9.0%)	127(25.9%)	177(36.0%)	126(25.7%)
B7	13 (2.6%)	38 (7.7%)	115(23.4%)	186(37.9%)	139(28.3%)
B8	8 (1.6%)	23 (4.7%)	88 (17.9%)	172(35.0%)	200(40.7%)
B9	8 (1.6%)	29 (5.9%)	93 (18.9%)	178(36.3%)	183(37.3%)
B10	15 (3.1%)	26 (5.3%)	106(21.6%)	182(37.1%)	162(33.0%)
Innovative Practical Ability					
B11	17 (3.5%)	47 (9.6%)	148(30.1%)	180(36.7%)	99 (20.2%)
B12	9 (1.8%)	54 (11.0%)	121(24.6%)	195(39.7%)	112(22.8%)
B13	4 (0.8%)	28 (5.7%)	113(23.0%)	178(36.3%)	168(34.2%)
B14	5 (1.0%)	38 (7.7%)	104(21.2%)	195(39.7%)	149(30.3%)
B15	7 (1.4%)	43 (8.8%)	123(25.1%)	183(37.3%)	135(27.5%)

1) Innovative thinking ability

According to Table 4.4, the highest average of innovative thinking ability is 4.025. According to the 4.5 questionnaire survey, 67.4% of students can analyze problems from different perspectives; 70.9% of students answer questions and always come up with different opinions from others; 80.8% of students can always solve problems logically and with clear thinking; 79.4% of students are good at summarizing problems and reflecting on their mistakes; 74.2% of students generally do not evaluate or criticize things.

Based on the specific analysis of the current situation of college students' innovative thinking ability, it can be found that the characteristics of innovative thinking ability are mainly manifested in the strength of students' problem awareness and critical thinking. According to survey data, it can be seen that college students' innovation ability has not reached the ideal level, and their innovative thinking ability is relatively weak.

2) Innovative learning ability

Innovative learning ability refers to the mastery of professional knowledge and ability by college students, including the absorption of new knowledge and the screening of important knowledge. Its average is 3.909, which is above the average level. According to the questionnaire survey in Table 4.5, 61.7% of students like to pay attention to technological development trends and constantly absorb new knowledge; 52.53% of students like to pay attention to the trends of technological development and constantly absorb new knowledge; 66.2% of students have a good grasp of the professional knowledge they are currently learning; 75.7% of students have relatively weak public basic knowledge; 73.6% of students can absorb and screen useful knowledge to solve specific problems; 70.1% of students are not very familiar with the cutting-edge knowledge of their major.

Based on the specific analysis of the current situation of college students' innovative learning ability, it can be found that the majority of students can master the professional knowledge they have learned. However, nearly 50% or more of college students are too weak in mastering and applying new knowledge. In addition, nearly two-thirds of students believe that their public basic knowledge is relatively weak. Therefore, in cultivating college students' innovative learning ability, it is not only important to focus on how much students master the current professional knowledge but also to regulate the integration of knowledge among various disciplines.

3) Innovative practical ability

Innovative practical ability mainly refers to the ability of students to participate in innovative practical activities and solve problems. The lowest average level is 3.799. According to a questionnaire survey, 56.9% of students are generally prone to giving up when solving difficult problems; 62.5% of students are good at summarizing the

rules of learning and life; 70.5% of students always find effective solutions promptly when encountering problems; 70% of students like to improve their hands-on skills through practical exercises; 64.8% of students are good at using all their knowledge when solving problems.

According to the data analysis of the current situation of college students' innovative practical ability, it can be seen that they are at a disadvantage in terms of innovative practical ability. Due to the limited number of innovative practical activities that students participate in on campus that are suitable for their development, and the lack of rich practical summaries, more than 50% of students are unable to find solutions when solving problems and often choose to give up. Secondly, about 30% of students are unable to integrate their knowledge and solve the challenges they face. However, the good news is that most students are good at demonstrating their willingness to innovate and complete tasks through action.

4.3 Results of the Study

4.3.1 Correlation analysis

Correlation analysis mainly refers to the analysis of observation values of various research variables, which is a commonly used data processing method to determine whether there is a correlation between research variables. Used to determine whether variables have interdependent relationships or how closely they are related. The Pearson correlation coefficient test is commonly used by international scholars to measure the correlation between research variables. The range of Pearson coefficient values is between -1 and 1, and the closer the absolute value of the the Pearson correlation coefficient is to 1, the stronger the correlation between the research variables; The closer the absolute value of the Pearson correlation coefficient is to 0, the weaker the correlation between variables. When the Pearson correlation coefficient is positive, it indicates a positive correlation between the variables; When the Pearson correlation coefficient is negative, it indicates a negative correlation between the variables. The analysis results of the correlation coefficients between various research variables are shown in Table 4.6.

Table 4.6 Related Analysis

variable	Innovative thinking ability	Innovative learning ability	Innovative practical ability
Behavioral Participation	0.468**	0.266**	0.328**
Cognitive Participation	0.449**	0.280**	0.298**
Emotional Participation	0.471**	0.260**	0.295**

**. Correlation is significant at the 0.01 level (2-tailed).

According to the correlation analysis between various research variables in Table 4.6, it can be concluded that:

(1) There is a significant positive correlation between behavioral participation and innovative thinking ability (r=0.468 * *, p<0.01); There is a significant positive correlation between behavioral participation and innovative learning ability (r=0.266 * *, p<0.01); There is a significant positive correlation between behavioral participation and innovative practical ability (r=0.328 * *, p<0.01).

(2) There is a significant positive correlation between cognitive participation and innovative thinking ability (r=0.449 * *, p<0.01); There is a significant positive correlation between cognitive participation and innovative learning ability (r=0.280 * *, p<0.01); There is a significant positive correlation between cognitive participation and innovative practical ability (r=0.298 * *, p<0.01).

(3) There is a significant positive correlation between emotional participation and innovative thinking ability (r=0.471 * *, p<0.01); There is a significant positive correlation between emotional participation and innovative learning ability (r=0.260 * *, p<0.01); There is a significant positive correlation between emotional participation and innovative practical ability (r=0.295 * *, p<0.01). From the correlation analysis, it can be seen that there is a significant correlation between the main variables in this study.

4.3.2 Regression analysis

Conduct regression analysis on classroom participation and its various dimensions with innovation ability, and verify the hypotheses proposed in this study one by one. The details are as follows.

Table 4.7 Regression Analysis of Classroom Participation on Innovative Thinking Ability

	Model	Beta	t	Sig.	R Square	Adjusted R Square	R Square Change	F	Sig.
1	Emotional Participation	0.471	11.800	0.000	.222	0.220	0.222	139.242	0.000[b]
2	Emotional Participation	0.349	8.793	0.000	.326	0.323	0.104	117.876	0.000[c]
	Behavioral Participation	0.345	8.680	0.000					
3	Emotional Participation	0.282	7.208	0.000	.387	0.384	0.062	102.697	0.000[d]
	Behavioral Participation	0.286	7.378	0.000					
	Cognitive Participation	0.269	7.007	0.000					

a. Dependent Variable: Innovative Thinking Ability

b. Predictors: Emotional Participation

c. Predictors: Emotional Participation, Behavioral Participation
d. Predictors: Emotional Participation, Behavioral Participation, Cognitive Participation

According to Table 4.7, it can be seen that the results of multiple regression analysis of Model 1, Model 2, and Model 3 for classroom emotional participation, behavioral participation, cognitive participation and innovative thinking ability show that classroom emotional participation, behavioral participation, and cognitive participation have positive positive effects on college students' innovative thinking ability, and the trend is weakened in order. Research hypothesis H1 is established.

Table 4.8 Regression Analysis of Classroom Participation on Innovative Learning Ability

	Model	Beta	t	Sig.	R Square	Adjusted R Square	R Square Change	F	Sig.
1	Cognitive Participation	.280	6.444	0.000	0.078	0.076	.078	41.529	.000[b]
2	Cognitive Participation	.219	4.891	0.000	0.114	0.111	.036	31.526	.000[c]
	Behavioral participation	.200	4.463	0.000					
3	Cognitive Participation	.184	4.023	0.000	0.131	0.126	.017	24.543	.000[d]
	Behavioral participation	.160	3.456	0.001					
	Emotional Participation	.143	3.079	0.002					

a. Dependent Variable: Innovative Learning Ability
b. Predictors: Cognitive Participation
c. Predictors: Cognitive Participation, Behavioral Participation
d. Predictors: Cognitive Participation, Behavioral Participation, Emotional Participation

According to Table 4.8, it can be seen that the results of multiple regression analysis of Model 1, Model 2, and Model 3 for classroom affective participation, behavioral participation cognitive participation, and innovative learning ability show that classroom cognitive participation, behavioral participation, and emotional participation have a positive impact on college student's ability to think innovatively, and the trend is weakened in turn. Research hypothesis H2 is established.

Table 4.9 Regression Analysis of Classroom Participation on Innovative Practical Ability

	Model	Beta	t	Sig.	R Square	Adjusted R Square	R Square Change	F	Sig.
1	Behavioral Participation	0.328	7.671	0.000	0.107	0.106	0.107	58.837	0.000[b]
2	Behavioral Participation	0.261	5.955	0.000	0.151	0.147	0.043	43.319	0.000[c]
	cognitive Participation	0.219	4.992	0.000					
3	Behavioral Participation	0.217	4.798	0.000	0.172	0.167	0.021	33.639	0.000[d]
	cognitive Participation	0.180	4.031	0.000					
	Emotional Participation	0.159	3.504	0.000					

a. Dependent Variable: Innovative Practical Ability
b. Predictors: Behavioral Participation
c. Predictors: Behavioral Participation, Cognitive Participation
d. Predictors: Behavioral Participation, Cognitive Participation, Emotional Participation

According to Table 4.9, it can be seen that the results of multiple regression analysis of Model 1, Model 2 and Model 3 for classroom affective participation, behavioral participation cognitive participation and innovative practical ability show that classroom behavioral participation, cognitive participation, and affective participation have a positive impact on college students' ability to think innovatively, and the trend is weakened in turn. Research hypothesis H3 is established.

Table 4.10 Research Results

H1	Different traits in classroom participation have a positive effect on college students' innovative thinking ability.	holds
H2	Different traits in classroom participation have a positive effect on college students' innovative learning ability.	holds
H3	Different traits in classroom participation have a positive effect on college students' innovative practical ability.	holds

In summary, the results of the analysis of the sample data show that: 1) classroom participation has a positive effect on college students' innovative thinking ability; 2) classroom participation has a positive effect on college students' innovative learning ability; 3) classroom participation has a positive effect on college students' innovative practical ability. The results of this study are consistent with Deng's (2021)

study on college students of different majors, which not only expands the scope of the study but also adds empirical references to previous studies to a certain extent.

Chapter 5 Conclusion and Recommendation

5.1 Conclusion

5.1.1 Classroom participation has a significant positive effect on college students' innovative thinking ability

The Pearson Correlation between different traits in classroom participation (behavioral participation, cognitive participation, and affective participation) and the innovative thinking ability of college students in the correlation analysis is 0.468**, 0.449**, and 0.471** respectively. It can be seen that the different characteristics in the classroom participation of college students have a significant positive correlation with the innovative thinking ability of college students. In the multiple regression analysis, the different traits of classroom participation (emotional participation, behavioral participation, and cognitive participation) entered the regression equation sequentially, and the P-values were less than 0.01 significance level. This shows that the influence of emotional participation, behavioral participation, and cognitive participation in classroom participation on college students' innovative thinking ability decreases sequentially.

Based on the results of the data analysis, it can be seen that emotional involvement in classroom participation has the greatest impact on the innovative thinking ability of college students, which can indicate that college students in the classroom learning process sense of achievement, satisfaction, interest, or tension, anxiety and worry and other emotions largely affect the development of innovative thinking ability of college students, in improving the innovative thinking ability of college students teachers should focus on the classroom teaching in the Actively mobilize students' positive emotions and reduce the generation of students' bad emotions. Secondly, behavioral participation, such as pre-course preparation, classroom attendance, classroom status, note-taking, question answering, and other behaviors have a greater impact on students' innovative thinking ability at this stage compared to students' independent thinking and cognitive ability in the classroom.

5.1.2 Classroom participation has a significant positive effect on college students' innovative learning ability

The Pearson Correlation between different traits in classroom participation (behavioral participation, cognitive participation, and affective participation) and college students' innovative learning ability in the correlation analysis is 0.266**, 0.280**, and 0.260** respectively. It can be seen that the different characteristics in classroom participation of college students have a significant positive correlation with the innovative learning ability of college students. In the regression analysis, different traits in classroom participation (cognitive participation, behavioral participation, and affective participation) and college students' innovative thinking ability entered the regression equation in turn, and the P-value was less than 0.01 significance level. This

shows that the influence of behavioral participation, cognitive participation, and affective participation in classroom participation on college students' innovative learning ability decreases sequentially.

Behavioral participation in classroom participation has the greatest influence on college students' innovative learning ability, which shows that a series of behavioral participation processes such as pre-study before class, classroom attendance, classroom status, note-taking, answering questions, asking questions and discussion, and post-course homework in the classroom learning process have a great influence on the development of college students' innovative learning ability, whereas students' positive emotions such as achievement, satisfaction, interest, or emotions such as nervousness and anxiety have a weaker impact on the development of college students' innovative learning ability in the classroom learning. Positive emotions such as a sense of accomplishment, satisfaction, interest, etc., or emotions such as nervousness and anxiety have a weaker influence on the development of college students' innovative learning ability.

5.1.3 Classroom participation has a significant positive effect on college students' innovative practical ability

The Pearson Correlation between different traits in classroom participation (behavioral participation, cognitive participation, and affective participation) and college students' innovative practical ability in the correlation analysis is 0.328**, 0.298**, and 0.295** respectively. It can be seen that the different characteristics in classroom participation of college students have a significant positive correlation with college students' innovative practical ability. In the regression analysis, different traits in classroom participation (behavioral participation, cognitive participation, and affective participation) and college students' innovative practical ability entered the regression equation in turn, and the P value was less than 0.01 significance level. This shows that the influence of behavioral participation, cognitive participation, and emotional participation in classroom participation on the innovative learning ability of college students decreases sequentially.

Behavioral participation in the classroom has the greatest impact on college students' innovation and practical ability, which shows that college students' practical and innovation ability in the process of classroom learning largely comes from students' behavior in the classroom, as well as the design of classroom teaching activities. Good design of classroom teaching activities can encourage students to form good learning habits, which in turn provides a solid foundation for college students' innovation and practical ability.

In addition, the results of the study show that among the different qualities of classroom participation, behavioral participation has an important influence on college students' innovative learning ability and innovative practical ability, while emotional participation has the weakest influence on college students' innovative learning ability

and practical ability, which also shows that although it is necessary to fully mobilize students' positive emotions in the process of cultivating college students' innovative learning ability and practical ability, compared with students' emotions and feelings, emotional participation has the weakest influence on college students' innovative learning ability and practical ability. It also shows that although it is necessary to fully mobilize students' positive emotions in the process of cultivating their innovative learning ability and practical ability, scientific teaching methods and systematic classroom learning processes are more helpful in cultivating students' ability in learning and practical activities than students' emotions and feelings.

5.2 Discussion

5.2.1 Different characteristics and innovative thinking ability in classroom participation

In this article, a questionnaire survey was conducted on the classroom participation and innovation ability of undergraduate students at Hebei Normal University in China. SPSS was used to analyze the sample data, and it was found that the impact of emotional, behavioral, and cognitive participation in classroom participation on college students' innovative thinking ability is gradually weakening. Although this research result is consistent with the significant positive impact between variables in Deng's (2021) and Chen's (2023) studies, there are differences in the strength and degree of the impact of different traits in classroom participation on thinking innovation ability. Its manifestation is that in this article, emotional participation has the greatest impact on the innovative thinking ability of college students, while in Deng's (2021) study, emotional participation has the smallest impact on the innovative thinking ability of college students. The reason for this result may be due to differences in the results due to different interviewees.

5.2.2 Different characteristics and innovative learning ability in classroom participation

The impact of cognitive participation, behavioral participation, and emotional participation on college students' creative learning ability in classroom participation is gradually weakening. This research result is consistent with Deng's (2021) research on the impact of classroom participation on innovative learning ability. The reason for the same research results may be that as college students have more and more diverse ways of acquiring knowledge, their cognition and thinking are constantly changing, allowing them to flexibly apply the knowledge they have learned to solve practical problems to a certain extent.

5.2.3 Different characteristics and innovative practical ability in classroom participation

The impact of behavioral participation, cognitive participation, and emotional participation on college students' innovative practical ability in classroom participation has gradually weakened. This research result is consistent with Deng's (2021) research

on the impact of classroom participation on innovative learning ability. However, there are differences in the research results on the impact of different characteristics of classroom participation on innovation practical ability compared to Chen (2023). Its main manifestation is that behavioral participation has the greatest impact on college students' innovative practical ability in this study, while Chen (2023) found that the impact of behavioral participation on college students' innovative practical ability is the weakest. The reason for this difference may be due to Chen's (2023) research mainly based on universities specializing in tourism management, while this study is mainly based on a questionnaire survey conducted by universities specializing in education, which has certain differences in their understanding of innovation ability cultivation and development.

5.3 Recommendation

1) Students establish a sense of active participation

Establishing a proactive awareness of classroom participation is the key to improving the quality of classroom participation. By encouraging students to learn independently and explore knowledge, the quality of classroom participation can be transformed from passive participation to active participation. Secondly, taking personal interests as the starting point combines professional knowledge with learning interests to stimulate students' learning motivation.

2) Teachers optimize classroom teaching mode

The traditional teaching mode leans towards the teaching method, resulting in a lack of thinking exchange between teachers and students. In classroom teaching, teachers should design as many discussion-based classroom teaching activities as possible, which can not only stimulate students' thinking ability but also guide them to a certain extent in a positive emotional state. From the analysis of the current situation of college students' classroom participation and innovation ability in this article, it can be seen that most students often experience tension or anxiety when facing exams or answering questions. Therefore, designing appropriate discussion segments in classroom teaching can effectively help students improve their practical ability. Alternatively, adopting a flipped classroom teaching model requires students to fully utilize online learning resources and engage in autonomous learning through multimedia, the internet, and other learning channels, which can help improve students' cognitive ability.

5.4 Further Study

This study conducts a systematic analysis and research on the variables of classroom participation and innovation ability of college students through a review of relevant literature. Although this study has achieved certain results, it is only limited to

verifying the direct relationship between the two, and no further testing has been conducted on other mediating or moderating variables that exist between the two, In future research, other mediating or moderating effects between the two variables can be further explored to improve research in related fields.

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Appendix:

Dear Student: Hello!

Dear students, hello everyone

We are conducting a survey questionnaire on the innovation ability of college students, and we hope you can provide answers based on the actual situation. The data from this survey will not be made public and will be completely anonymous, and will only be used for research purposes. Thank you for your understanding and cooperation!

Part I: Survey on the situation of questionnaire recipients

1. Your gender is.

A. male B. female

2. Your grade.

A. first year university student

B. Second year of university

C. Third year of university

D. Fourth year of university

Part 2: Please carefully read the following items and choose 1, 2, 3, 4, and 5 based on their compatibility with your situation. Tick (√) on the number. Ensure that the selected numbers accurately describe your situation. 1 represents "completely non compliant", 2 represents "non compliant", 3 represents "uncertain", 4 represents "compliant", and 5 represents "fully compliant".

Table1 Classroom Participation

		Rating level				
		1	2	3	4	5
Behavioral Participation						
A1	I often preview carefully before class	1	2	3	4	5
A2	I never arrive late, leave early, or miss classes	1	2	3	4	5
A3	I listen attentively and do not do anything unrelated to the classroom content	1	2	3	4	5
A4	I will take notes carefully in class	1	2	3	4	5
A5	I will actively answer the teacher's questions	1	2	3	4	5
A6	When I have a place I don't understand, I will ask the teacher questions	1	2	3	4	5
A7	I often participate in classroom discussions	1	2	3	4	5
A8	I can conscientiously complete the homework assigned by the teacher	1	2	3	4	5
cognitive Participation						
A9	When learning new knowledge, I associate it with what I have already learned and connect the old and new knowledge together	1	2	3	4	5
A10	When encountering learning problems, I will find ways to solve them	1	2	3	4	5
A11	I will reflect and improve my learning methods	1	2	3	4	5
A12	I have my own arrangements in classroom learning, not blindly following the teacher's instructions	1	2	3	4	5
A13	I will learn new knowledge through understanding rather than rote memorization	1	2	3	4	5
A14	I can supervise myself to strictly follow the learning plan	1	2	3	4	5
A15	When reading books, I often think about which key points need to be mastered and understood, rather than simply browsing through them	1	2	3	4	5
A16	When learning new knowledge, I will think about the role of the learned knowledge in practical	1	2	3	4	5

A17	I am able to arrange my study time and tasks reasonably	1	2	3	4	5
A18	I will use my free time to improve my understanding of the knowledge learned in class	1	2	3	4	5
Emotional participation						
A19	I think classroom learning is very interesting, and I think learning is very enjoyable	1	2	3	4	5
A20	I am very interested in new knowledge	1	2	3	4	5
A21	I am always curious about new knowledge	1	2	3	4	5
A22	I feel very satisfied when I achieve excellent results	1	2	3	4	5
A23	Classroom learning is rewarding, and I have a sense of achievement	1	2	3	4	5
A24	I feel nervous when the teacher asks questions in class	1	2	3	4	5
A25	I always feel a bit worried during exams	1	2	3	4	5
A26	When encountering unanswerable questions in exams, I feel anxious	1	2	3	4	5

Part 3: Innovation Ability Scale for College Students

Table 2 Innovation Ability

		Rating level				
		1	2	3	4	5
Innovative thinking ability						
B1	I enjoy analyzing problems from different perspectives.	1	2	3	4	5
B2	When answering questions, I always come up with different perspectives from others.	1	2	3	4	5
B3	I can always solve problems logically and with clear thinking.	1	2	3	4	5
B4	Be good at summarizing problems and reflecting on your own mistakes.	1	2	3	4	5
B5	I generally do not evaluate or criticize things.	1	2	3	4	5
Innovative learning ability						
B6	I like to pay attention to technological development trends and constantly absorb new knowledge.	1	2	3	4	5
B7	I am able to master the professional knowledge I am currently learning very well.	1	2	3	4	5
B8	My basic public knowledge is relatively weak.	1	2	3	4	5
B9	I am able to absorb and filter useful knowledge to solve specific problems.	1	2	3	4	5
B10	I am not very familiar with the cutting-edge knowledge of this major.	1	2	3	4	5
Innovative practical ability						
B11	In the process of solving difficult problems, it is generally easy to give up.	1	2	3	4	5
B12	I am good at summarizing the rules in learning and life.	1	2	3	4	5
B13	When encountering problems, I can always find effective solutions in a timely manner.	1	2	3	4	5
B14	I like to improve my hands-on skills through practical exercises.	1	2	3	4	5
B15	When solving problems, I am good at applying all the knowledge I have learned.	1	2	3	4	5