# Determining factors influence self-efficacy on graduate leadership ability among university students in Zheng Zhou city

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**Abstract:** With the deepening of economic globalisation and the constant changes in the external environment, the requirements for the quality of human resources are becoming higher and higher, and it has become a consensus that the process of globalisation requires leaders with a "global vision". Leadership, as a basic component of college students' quality, is becoming increasingly important and has been highly valued by governments and organisations [1]. Social Science and Liberal Arts majors are more actively involved in student leadership. Student leaders do not have confidence in their leadership skills. They still lack leadership behaviours to bring exemplary impact to their organisations. The development of student-centred learning and the leadership behaviours of student leaders can complement each other. The adoption of student-centred learning can enhance student leadership behaviours [2].

*Keywords: Graduates, Leadership, Self-efficacy, Social ecology.*

## 1. Introduction

China's compulsory education system plays a fundamental role in fostering academic and social outcomes for students to lead successful lives. There are areas of educational leadership research in China that have not been adequately addressed [3].

Leadership development is a multifaceted phenomenon with multiple definitions and meanings that need to be further explored. There are six categories and different approaches to leadership development: (1) personal development, (2) fulfilling a leadership role, (3) individual development, (4) leader and organisational development, (5) collective leadership development, and (6) human development [4].Youth play an important role in the nation. Young people are seen as the vanguard of change; Therefore, the leadership and talents of youth must be nurtured to the maximum. However, governments must face many challenges in developing youth leadership and talent [5].

Lack of experience as a leader is not conducive to students being "ready" for leadership roles in teams. Students perceive business simulations and work-integrated learning activities as having the potential to enhance their leadership skills. Curricula in higher education should include assessment of leadership development activities [6].Involvement in team leadership, community service, extracurricular activities such as daily family life, and more quality time spent with parents predicted leader self-efficacy. Community service, extracurricular activities, peer mentoring, and perceptions of parental quality time and proactive parenting predicted leader emergence. Student leadership development is influenced by a myriad of systems across the life cycle and suggests that as educators committed to student development, we must be involved in the entire process of student leadership development [7].

Graduates are able to take the lead in sustainability, mostly in terms of minimizing impact on the physical and social environment. Thus, if graduates are expected to take a leadership role in

sustainability in the workplace, it would appear that their educational institutions need to develop curricula to help students resist oppositional influences in the workplace (e.g., market/end users, customers, colleagues) [8].

## 2. Methodology
### 2.1. The Conceptual Framework

This study discusses the relevant factors that affect graduate leadership. The conceptual framework of this study is shown in Figure 1,2,3 which is also designed on the basis of literature review in this chapter.

Individuals, relationships, university,communities and policies have a significant impact on graduate leadership. Self-efficacy was further used as an intermediate variable to explain the effect of 5 socio-ecological factors on graduate student leadership. The effects of individuals, relationships, communities, organisations and policies on graduate leadership need to be further demonstrated. personal preferences mainly include self-esteem, cognition, skills, self-efficacy, beliefs, and attitudes. interpersonal relationship primarily include family, peers, teachers, and social norms. Institutional factors include schools, relevant organisations and departments. community atmosphere include community resources, other aspects of the club. policy formulation are broader and include local facilitation policies implemented by the government and the state [9].
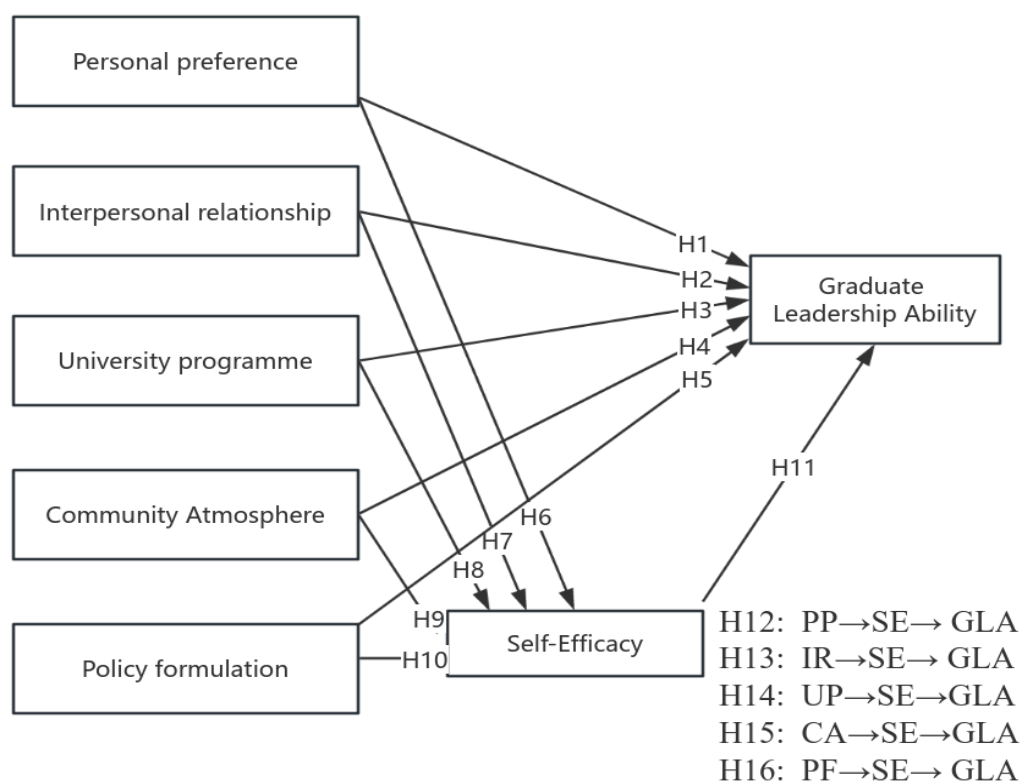


**Figure 1.**
Conceptual Framework.

## 2.2. Research Design

This research used analytical tools such as Reliability Analysis, Validity Analysis, Descriptive, Frequency , EFA Correlation, Regression.

The research design in this chapter is a mapping strategy based on sampling techniques. It consists mainly of methodology, sampling, research strategy, tools and techniques for collecting evidence, analysing data and reporting findings. Thus, research design is a statement of the object of investigation and how to achieve satisfactory results. Research design is the work done before starting the project in this study.

### 2.2.1. Research Approach

Research methods refer to the science of understanding how to systematically arrive at solutions to research problems [10]. It may be implied as the science of studying how research is conducted scientifically [11].Choosing a study design is the most critical step in the research methodology [12]. It shows the path by which researchers develop questions and objectives and present results based on data obtained during the study [13].

Deductive models are based on the validation of a priori hypotheses and experiments through manipulation of variables and measurements; the results of hypothesis testing are used to guide and advance science. Research consistent with positivism typically focuses on identifying explanatory associations or causal relationships through quantitative methods; generalisable inferences and controlled experiments have been the principles guiding positivist science [14].

The deductive approach is used in this study mainly because it provides a clear and logically rigorous framework for analysis. The deductive approach starts from one or more universal premises and draws conclusions about individual or special cases through logical deduction. This approach ensures that the research argument is coherent and persuasive.
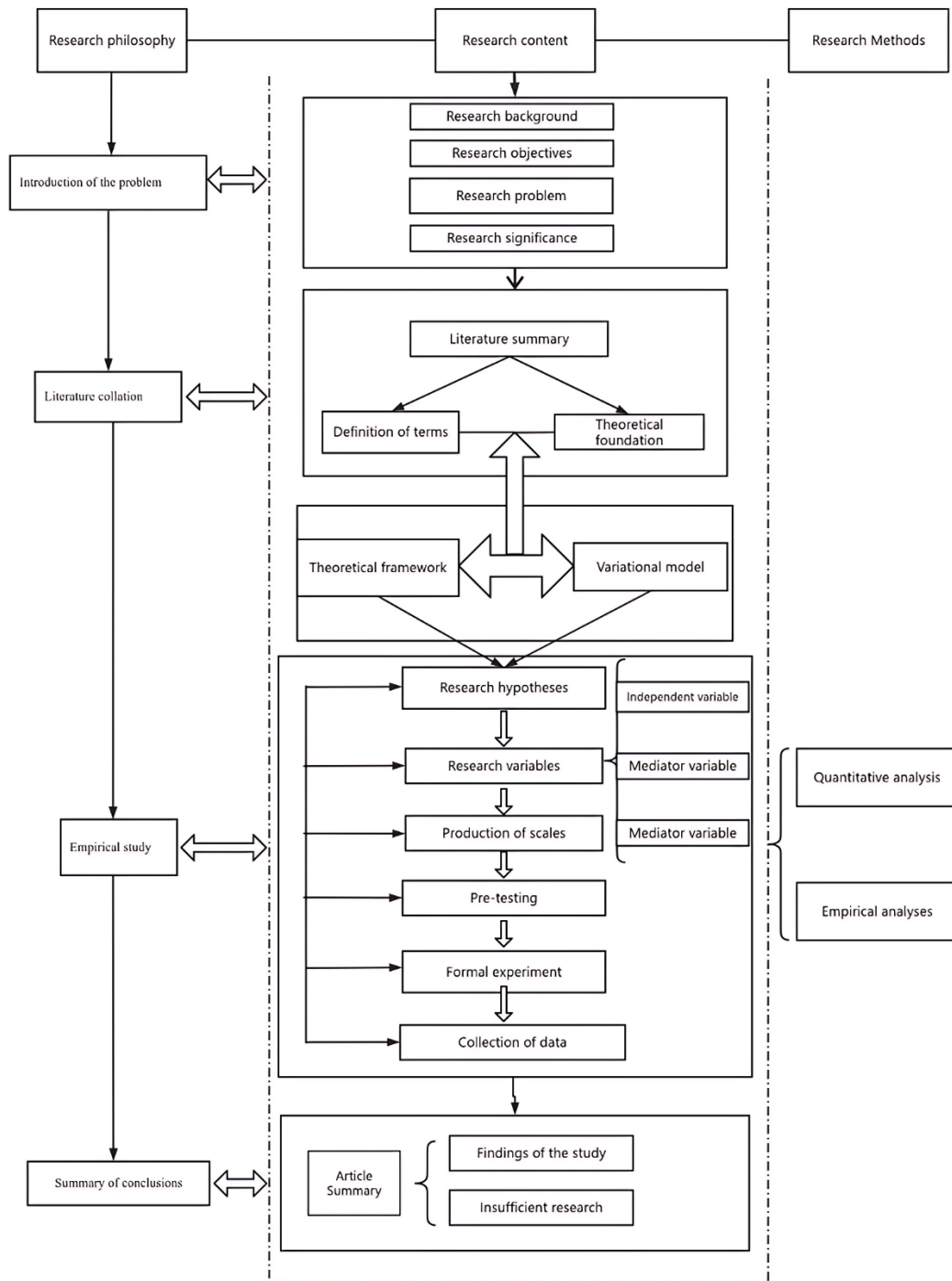
## 2.2.2. Research Flowchart



**Figure 2.**
Research Technical routes.

## 3. Sampling Design Process

Sampling is a statistical process that involves the selection of individual observations. It helps the researcher to make statistical assumptions about the aggregate. Well-designed sampling ensures convenience and exhaustive data collection [15].

The definition of inappropriate sampling procedures can lead to substantial bias in research results and become the subject of controversy. Choosing the relevant sample design and sample size can be a difficult task when trying to build or optimise a survey. The choice of survey design is important to avoid bias and to improve the cost-effectiveness of the survey. It has a significant impact on the sample size required to achieve the target outcome accuracy. and the final cost of the project [16].
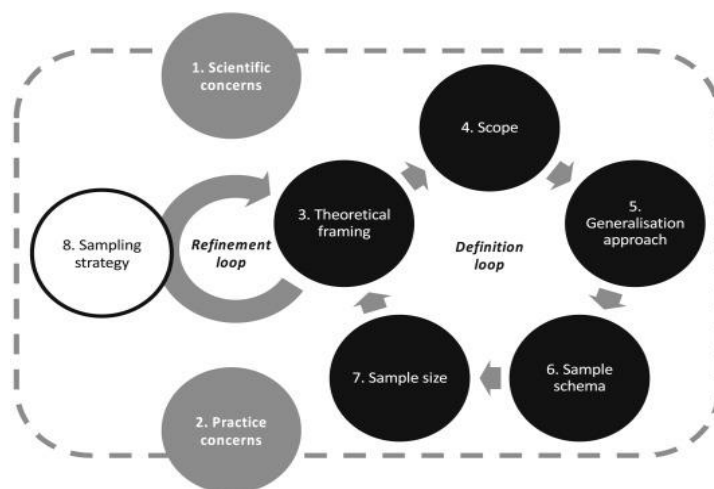


**Figure 3.**
Types of probabilistic and non-probabilistic sampling programmes.
 **Source:** Cash, et al. [9].

Sampling is a key element of research design and different methods can be used to select a sample; sample selection methods vary depending on the research design. Sample size is used to determine the number of subjects needed to answer the research questions. The characteristics of individuals in the desired sample population are specified to determine their eligibility to participate in the study and to improve efficacy [17].

 Sampling research design is the key to scientific research that ensures the reliability and validity of the findings and the researcher needs to select the sample that is applicable for the study. It is very important that when conducting a sampling study design, researchers need to ensure that the minimum sample size is correct [18].

### 3.1. Study Population

Research populations include individuals, dichotomies, groups, organisations or other entities, with the research population being the main group of research interest [19].

In the vast majority of studies, it is not possible to involve the entire target population, so smaller groups are relied upon to collect data. Sampling from a population is often more practical and allows data to be collected more quickly and at a lower cost than trying to reach every member of the population [20].

If researchers are unable to collect data from a sufficient number of respondents using appropriate sampling techniques, it will be difficult for them to achieve the main goal of the study [21].

| Region | Schools (unit) | Educational Personnel | Entrants | General Undergraduate | Vocational Undergraduate | Higher Vocational (Specialist) | Enrolment | General Undergraduate | Vocational Undergraduate | Higher Vocational (Specialist) | Graduates | General Undergraduate | Vocational Undergraduate | Higher Vocational (Specialist) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 156 | 192046 | 936650 | 403834 | 6004 | 526812 | 2823270 | 1357256 | 14157 | 1451857 | 777999 | 343007 | 600 | 434392 |
| Zhengzhou | 68 | 88921 | 438402 | 201591 | | 236811 | 1330098 | 682309 | | 647789 | 371114 | 175621 | | 195493 |
| Kaifeng | 6 | 4555 | 24220 | 6998 | | 17222 | 73396 | 19451 | | 53945 | 24160 | 5318 | | 18842 |
| Luoyang | 8 | 11066 | 50964 | 26651 | | 24313 | 159195 | 93972 | | 65223 | 41637 | 24295 | | 17342 |
| Pingdingshan | 7 | 6230 | 28491 | 8421 | | 20070 | 88697 | 37717 | | 50980 | 22562 | 10148 | | 12414 |
| Anyang | 7 | 8491 | 46410 | 23162 | | 23248 | 129150 | 68701 | | 60449 | 36602 | 17329 | | 19273 |
| Hebi | 3 | 1737 | 12693 | | | 12693 | 30825 | | | 30825 | 7473 | | | 7473 |
| Xinxiang | 11 | 14549 | 72041 | 49306 | | 22735 | 211655 | 151386 | | 60269 | 53810 | 35109 | | 18701 |
| Jiaozuo | 6 | 7745 | 33890 | 16147 | | 17743 | 110642 | 56879 | | 53763 | 31890 | 12513 | | 19377 |
| Puyang | 3 | 2210 | 12781 | | | 12781 | 33012 | | | 33012 | 9040 | | | 9040 |
| Xuchang | 4 | 4648 | 24391 | 6370 | | 18021 | 72664 | 23402 | | 49262 | 19198 | 5944 | | 13254 |
| Luohe | 3 | 6774 | 14895 | | | 14895 | 44332 | | | 44332 | 14600 | | | 14600 |
| Sanmenxia | 2 | 1856 | 12538 | | | 12538 | 35401 | | | 35401 | 8037 | | | 8037 |
| Nanyang | 7 | 9016 | 41134 | 16180 | | 24954 | 130571 | 52769 | | 77802 | 36499 | 13113 | | 23386 |
| Shangqiu | 6 | 8590 | 41429 | 20722 | | 20707 | 134169 | 66513 | | 67656 | 39970 | 18512 | | 21458 |
| Xinyang | 7 | 7128 | 34212 | 17392 | | 16820 | 102057 | 61720 | | 40337 | 24850 | 14152 | | 10698 |
| Zhoukou | 4 | 4413 | 23590 | 5559 | 6004 | 12027 | 70623 | 23175 | 14157 | 33291 | 17901 | 6486 | 600 | 10815 |
| Zhumadian | 3 | 2996 | 17720 | 5335 | | 12385 | 47090 | 19262 | | 27828 | 12440 | 4467 | | 7973 |
| Jiyuan | 1 | 1121 | 6849 | | | 6849 | 19693 | | | 19693 | 6216 | | | 6216 |

**Figure 4.**
Number of college graduates in Zhengzhou in 2022.
**Source:** Henan Province Bureau of Statistics [22].

Zhengzhou, the capital city of Henan Province, has a total of 68 colleges and universities, including undergraduate colleges and vocational colleges, with a total of 371114 graduates. Zhengzhou, the capital city of Henan Province, is a city integrating science and technology, culture and innovation.

This study will sample graduates in this region, in Zhengzhou City, Henan Province, which is a city with a large number of foreign populations, college students have a strong representation by integrating adolescents from all levels of cities in Henan Province, which can make this study more fair.

### 3.2. Unit of Analysis

The unit of analysis (i.e. the entity being investigated), which is closely linked to the phenomenon being studied, the level of analysis, and the context of the case. The case. For example, in project research, cases can be projects, portfolios, or project plans; Project teams, individual project members, certain activities, or project activities. Processes within or between teams, individual project members, certain activities, or projects; And the organizations, networks, or ecosystems involved in certain projects or processes that host them. The organization, network, or ecosystem of the process [23].

One can define a sampling design to fix the sample size of the small regions and thus greatly improve the accuracy of small region estimation. When defining a sampling design for the small area estimation problem, we can assume that each unit in the aggregate has a small area indicator variable [24].

This paper studies 68 universities, including undergraduate colleges, vocational colleges, including private colleges and public colleges. The analysis unit of the study selects representative colleges and universities according to the sampling rule, and then randomly selects the experimental objects, namely college graduates.

### 3.3. Sampling Design

Sampling strategies frequently used in population studies fall into two main categories. The first of these categories is probability sampling, which means that every member of the target population has an equal probability of being selected as a research participant. Based on a large amount of literature as

well as books it can be concluded that the common methods of probability sampling include random sampling techniques, simple random sampling, systematic random sampling, stratified random sampling and cluster random sampling. It is worth noting that random sampling techniques have less risk of bias in the results of the study, and more importantly, statistical methods such as optimal sample size and sampling error can be determined, which can ensure the accuracy of the results. Probability sampling can be quite an important reference for making conclusions and inferences about the target population of the study [25].

In a probability sample, each unit in the population has a known probability of being selected into the sample, and randomness, controlled by the survey designer, involves the selection of units that are actually included in a particular sample [26].

Five probabilistic sampling methods and four non-probabilistic sampling methods. Probability sampling includes simple random sampling, stratified random sampling, cluster sampling, systematic random sampling and multi-stage random sampling. Despite some restrictive assumptions, probabilistic sampling methods can provide more reliable results. Therefore, if possible, researchers should use probability sampling methods to improve the accuracy of their studies [27].

Stratified sampling is one of the probability sampling which divides the whole population into groups called strata. The main purpose of stratification is to minimise the variation between strata [28].

Multidimensional stratified sampling was used, in which demographic variables were sequentially made to divide the data into separate strata, each representing a unique combination of variables. Stratified sampling's provides a more balanced subset than simple randomisation. Multidimensional stratified sampling algorithms allow for the division of large datasets while maintaining a balance between multiple variables, superior to the balance achieved through simple randomisation [29].

*3.4. Sampling Frame*

An important step when designing an empirical study is to demonstrate the sample size that will be collected. The main purpose of sample size proofs for such studies is to explain how the collected data can provide valuable information based on the reasoning goals of the researcher [30].

The "sampling frame" is the sampling units in the population and their locations. It may consist of a list of sampling units, or it may be based on a map of the population area where sampling units can be observed [31].

Each setting (school, social media) limits the study to a small portion of the target population that has the opportunity to participate in the study. This middle ground between the general population and the sample that actually participates in the researcher's study is called the sampling frame. The sampling frame is the list of people from whom the sample is drawn [32].

The sampling objects of this study are graduates from 68 universities in zhengzhou city. This sampling framework is derived from the Statistical Yearbook of Henan Province. Future sampling will be taken from this 371114 sample, and subsequent pre-survey and formal survey will be students in the same sampling framework. In order to ensure the fair distribution of samples in the formal survey, respondents who did not participate in the pre-survey will be excluded from the sample framework.

## 4. Instrument

### 4.1. Instrument Development Process

Among quantitative research methods, empirical research methods are valued for their effectiveness in social science, business management, and health science research. Empirical research methods mainly involve the process of building models to accurately find out the relationship between different variables in the problem. On the basis of proposing hypotheses and testing them, models can be examined and improved to explain real-world phenomena. Empirical research methods include the use of survey-based questionnaires to collect data to identify and correlate variables present in the problem [33].

Questionnaires can be helpful in proactively identifying unexpected bias issues, especially when it is easily integrated into existing processes and facilitates communication with non-technical stakeholders [34].

Developing a self-filling questionnaire using a structured process is a powerful data collection tool that enhances the credibility of the results. Describing this process alleviates the complexity and confusion of the nurse researcher, and adopting a mature, continuous five-step approach ensures that important concepts for questionnaire development are addressed: evaluating existing tools and qualitative data, if available; Consider question style, understanding, default bias, and surface validity when drafting the questionnaire; Panel review to determine content validity and interrater reliability; Pilot tests to assess structural validity; And exploratory factor analysis to establish reliability tests. This approach results in a powerful and reliable data collection tool [35].

A research instrument is a tool for identifying data sources. The influencing factors of the data source are the type of data, data collection techniques, data collection tools, and the steps in preparing the research instrument. The research instrument also determines the validity, difficulty, reliability, discriminatory power and confounding factors of the research data. The tools play a vital role as the quality of the study can be known through the tools. If the tool developed is of good standard then the quality of the research will also be good whereas poorer tools can lead to horrible quality of research. Since tools reveal facts into data, using validity, reliability, good difficulty, discriminatory power and interferences, the tool will obtain data that represents the facts or reality of the field. Inferior tools with lower validity and reliability will reveal some degree of difficulty, discriminatory power, and confounding factors [36].

### 4.1.1. Instrument Development

Questionnaires are the most commonly used method of data collection in applied research to assess or evaluate inputs. It is a more useful tool, especially in socio-demographic, economic, and KAP (Knowledge, Attitudes, and Practice) research. The reliability test is based on Cronbach's alpha test, which is generally accepted. Questionnaire development is necessary to reduce many measurement errors [37].

**Table 1.**
Scale development.

| **Personal Preference** | | | | | | |
|---|---|---|---|---|---|---|
| PP1 | I make plans and goals to develop leadership skills | 1 | 2 | 3 | 4 | 5 |
| PP2 | I am decisive and firm and make good decisions in a timely manner | 1 | 2 | 3 | 4 | 5 |
| PP3 | I like to set clear goals and put them into practice effectively. | 1 | 2 | 3 | 4 | 5 |
| PP4 | I believe that leadership is about calling and organising. | 1 | 2 | 3 | 4 | 5 |
| PP5 | I believe that leadership requires high values and a mature outlook on life. | 1 | 2 | 3 | 4 | 5 |
| PP6 | I have a strong entrepreneurial spirit, which is essential for leadership. | 1 | 2 | 3 | 4 | 5 |
| PP7 | I have a wealth of professional knowledge and other knowledge reserves | 1 | 2 | 3 | 4 | 5 |
| PP8 | I have strong self-learning ability and am good at applying my knowledge in practice. | 1 | 2 | 3 | 4 | 5 |
| Interpersonal Relationship | | | | | | |
| IR1 | Having leadership enables family members to support each other | 1 | 2 | 3 | 4 | 5 |
| IR2 | Leadership enables family members to always work together | 1 | 2 | 3 | 4 | 5 |
| IR3 | Leadership affects the way I relate to people around me. | 1 | 2 | 3 | 4 | 5 |
| IR4 | Better self-efficacy enables me to get along well with my classmates, which is conducive to leadership development. | 1 | 2 | 3 | 4 | 5 |
| IR5 | Better self-efficacy enables me to have a good relationship with my dormitory mates, which is good for leadership development. | 1 | 2 | 3 | 4 | 5 |
| IR6 | Better self-efficacy enables me to help each other in our studies, which is conducive to leadership development. | 1 | 2 | 3 | 4 | 5 |
| IR7 | Leadership enables family members to trust each other. | 1 | 2 | 3 | 4 | 5 |
| IR8 | A better sense of self-efficacy is good for leadership development because we have common rules to follow. | 1 | 2 | 3 | 4 | 5 |

| University Programme | | | | | | | |
|---|---|---|---|---|---|---|---|
| UP1 | Schools are equipped with a variety of leadership development materials for college students | 1 | 2 | 3 | 4 | 5 | |
| UP2 | Teachers often involve leadership-related knowledge in the course of teaching | 1 | 2 | 3 | 4 | 5 | |
| UP3 | The university's leadership training programme is reasonably set up | 1 | 2 | 3 | 4 | 5 | |
| UP4 | Teachers emphasise leadership development in their teaching | 1 | 2 | 3 | 4 | 5 | |
| UP5 | The leadership programmes offered by the university greatly enhance personal qualities and abilities. | 1 | 2 | 3 | 4 | 5 | |
| UP6 | The university offers a wide range of elective courses on leadership. | 1 | 2 | 3 | 4 | 5 | |
| UP7 | Lectures on leadership are often organised by the university | 1 | 2 | 3 | 4 | 5 | |
| UP8 | The university often organises practical training activities related to leadership for students. | 1 | 2 | 3 | 4 | 5 | |
| Community Atmosphere | | | | | | | |
| CA1 | Community members maintain a strong bond with each other, which contributes to leadership development | 1 | 2 | 3 | 4 | 5 | |
| CA2 | Community members are open and honest with each other and can easily agree with each other's good ideas and thoughts. | 1 | 2 | 3 | 4 | 5 | |
| CA3 | A good sense of teamwork in a club is a good example of leadership. | 1 | 2 | 3 | 4 | 5 | |
| CA4 | Leadership promotes good communication between club members and a sense of enjoyment in working together. | 1 | 2 | 3 | 4 | 5 | |
| CA5 | Relationships between community members are very good | 1 | 2 | 3 | 4 | 5 | |
| CA6 | The community values leadership development, even in the face of uncertainty. | 1 | 2 | 3 | 4 | 5 | |
| CA7 | The organisation encourages people to find new ways to do things. | 1 | 2 | 3 | 4 | 5 | |
| CA8 | The community's distribution system is structured to represent the will of the majority of the community. | 1 | 2 | 3 | 4 | 5 | |
| Policy Formulation | | | | | | | |
| PF1 | I am interested in learning about leadership development activities and competitions. | 1 | 2 | 3 | 4 | 5 | |
| PF2 | I pay close attention to the school's leadership development announcements and news. | 1 | 2 | 3 | 4 | 5 | |
| PF3 | I like to accept the majority opinion on public issues. | 1 | 2 | 3 | 4 | 5 | |
| PF4 | I would like to join a political party to develop my leadership skills. | 1 | 2 | 3 | 4 | 5 | |
| PF5 | I am willing to participate in various election meetings to develop leadership skills. | 1 | 2 | 3 | 4 | 5 | |
| PF6 | I am willing to participate in social activities organised by the school to develop my leadership skills. | 1 | 2 | 3 | 4 | 5 | |
| PF7 | I am willing to serve as a student leader in my school, college, or class to develop leadership skills. | 1 | 2 | 3 | 4 | 5 | |
| PF8 | I am prepared to participate in social activities arranged by the school. | 1 | 2 | 3 | 4 | 5 | |
| Self-Efficacy | | | | | | | |
| SE1 | It's easy for me to stick to my vision and reach my goals | 1 | 2 | 3 | 4 | 5 | |
| SE2 | I believe that a high level of leadership can be effective in dealing with anything that comes up. | 1 | 2 | 3 | 4 | 5 | |
| SE3 | With my talents, I can handle the unexpected. | 1 | 2 | 3 | 4 | 5 | |
| SE4 | I can solve most problems if I put in the necessary effort. | 1 | 2 | 3 | 4 | 5 | |
| SE5 | I can face difficulties calmly because I trust my ability to deal with them. | 1 | 2 | 3 | 4 | 5 | |
| SE6 | When faced with a problem, I can usually find several solutions. | 1 | 2 | 3 | 4 | 5 | |
| SE7 | I can usually think of ways to cope with trouble. | 1 | 2 | 3 | 4 | 5 | |
| SE8 | I am able to cope with whatever happens to me. | 1 | 2 | 3 | 4 | 5 | |
| Graduate Leadership Ability | | | | | | | |
| GLA1 | I will take the time and effort to ensure that team members adhere to agreed upon principles and norms. | 1 | 2 | 3 | 4 | 5 | |
| GLA2 | I will describe to team members what we are capable of achieving. | 1 | 2 | 3 | 4 | 5 | |
| GLA3 | I will endeavour to find ways to encourage innovation. | 1 | 2 | 3 | 4 | 5 | |
| GLA4 | I will actively listen to different opinions. | 1 | 2 | 3 | 4 | 5 | |
| GLA5 | I will share with members a positive vision for the organisation. | 1 | 2 | 3 | 4 | 5 | |
| GLA6 | I will not only support members of the organisation, but also recognise and appreciate their contributions. | 1 | 2 | 3 | 4 | 5 | |
| GLA7 | I will seek ways to understand how my behaviour affects others. | 1 | 2 | 3 | 4 | 5 | |

| GLA8 | I give others a great deal of freedom and choice in how they decide to do their work. | 1 | 2 | 3 | 4 | 5 |
|------|------|---|---|---|---|---|

In this scientific research, we use questionnaire survey as an important research means. A series of preparatory work was carried out before the questionnaire was actually sent to the research subjects, the first step of which was to check the validity of the measurement tool of the questionnaire. At the heart of this process is an assessment of whether the components of the questionnaire show the expected correlation with the overall score (that is, the sum of the individual scoring items). The purpose of this process is to ensure that each question accurately and effectively measures the variables of concern, and that there is good internal consistency between the individual questions.

After completing the validity check, we also conducted a rigorous test on the instrumental validity and reliability of the questionnaire. Instrumental validity refers to whether the questionnaire really measures the concept it is intended to measure, while reliability refers to the consistency and stability of the questionnaire, that is, whether the questionnaire results are consistent across time and under different conditions. These tests are a key step in ensuring the reliability and validity of the research results.

When dealing with fairness in questionnaires, we have adopted a series of measures to ensure the fairness of questionnaires. To achieve this goal, we have assembled an interdisciplinary team of experts, including academics from universities, researchers focusing on educational research, experienced teachers, and linguistics experts. The responsibility of this team is to carefully review the language expression, content design and all questions of the questionnaire, with the aim of removing any language that may cause misunderstanding, dissatisfaction or bias of the interviewees, and ensuring that each interviewee can fill out the questionnaire in a fair and objective environment, so as to make our data collection process more fair. And the research conclusions obtained are more objective and credible.

### 4.1.2. Instrument Design

Many researchers will develop several interrelated Likert-style problems and address specific outcomes in the form of a set of questions (survey scales). In this use of Likert-type data, instead of a single question being the focus, three to five questions are typically developed to explore the outcome of interest. The use of Cornbach alpha, Kappa tests, or factor analysis shows that these questions are related. The total scores of the interrelated groups of questions were then used to calculate the average scores for scale items addressing a single topic of interest [38].

Rather than simply asking respondents whether they agree or accept a certain opinion statement, Likert scale items ask how much they agree or disagree with that opinion, usually on a 5 or 7 subscale, from 1 (= strongly agree) to 5 or 7 (= strongly disagree), Where 3 indicates feelings or categories of neutrality [39].

**Table 2.**
likert level five scale.

| Likert Five-Star Scale | |
|------|------|
| 1 | Highly disagree |
| 2 | Disagree |
| 3 | Neutral |
| 4 | Agree |
| 5 | Highly agree |

**Source:** Nemoto and Beglar [40] build this chart (2014, November).

In this scientific study, we plan to use a relatively straightforward data collection method to collect participants' information. This approach aims to minimize the potential bias of respondents caused by the questionnaire itself. It is hoped that this more intuitive data acquisition method can make it easier for participants to understand the meaning of the question, so that they can give more accurate and true answers. Such a data collection strategy is expected to improve the quality and credibility of the

collected data, thus providing more solid data support for our research and ensuring the accuracy and validity of the research results.

### 4.1.3. Translation of the Questionnaire

Since this study uses the mature scale made by Bosch and graduate students in China, the questionnaire will be issued to the subjects according to the original content, and the questionnaire will be translated from Chinese to Chinese in this research.

### 4.1.4. Reliability and Validity

The ability to demonstrate the validity and reliability of research findings is one of the most important factors in determining the value of scientific research. It is necessary for the researcher to describe which criteria are used in the research process to obtain the validity and reliability of the research results. Internal and external validity, internal consistency reliability and external reliability in quantitative research are important credentials to measure the results of research.

The validity and reliability of the scales used in a study is an important factor in ensuring that the study achieves healthy outcomes. Therefore, it is very useful for researchers to accurately measure their reliability and validity [41].

Some of the common procedures for questionnaire development and testing include research objectives, questionnaire conceptualisation, formatting and data analysis, and determining validity and reliability. Reliability testing was based on Cronbach's alpha test which is generally accepted. Attention to reliability and validity in questionnaire development is necessary to minimise many measurement errors. Consideration of validity and reliability of the questionnaire by the researcher will also have a favourable impact on the results of the study [37].

Reliability and validity are among the most important and fundamental areas in assessing any data collection measure used for good research. Validity refers to what an instrument measures and how well it measures it, while reliability relates to the truthfulness of the data obtained and the extent to which any measurement instrument controls for random error [42].

In empirical research, it is important to check the consistency of the data collected using the tool or instrument. The reliability of an instrument indicates that if the instrument is used in any future study, it will publish consistent results. The higher the degree of consistency and stability, the higher the reliability. 'Validity' describes the accuracy of the instrument, i.e. it must measure what it claims to measure. Reliability and validity coefficients take the form of correlation coefficients. In addition, the clarity behind testing reliability and validity is to maintain a balance between qualitative concepts and quantitative results [43].

Reliability and validity are recognised as key measurement attributes of such instruments. Reliability is the ability to reproduce results consistently over time and space. Validity is the property of an instrument to accurately measure what it proposes. The assessment of instrument measurement attributes can help to aid in the selection of valid and reliable instruments, thus ensuring the quality of research results, as the main criteria and statistical tests for instrument reliability (stability, internal consistency, and equivalence) and validity (content, criterion, and structure) [44].

### 4.1.5. Pilot Study

The pilot study aims to understand the feasibility of this approach in investigating users' mental models when performing such tasks [45].

The pilot study asks if something can be done, whether the researcher should proceed with it, and if so, how. However, pilot studies also have a specific design feature; It is smaller in size than a major study or full-scale study. In other words, pilot studies are important to improve the quality and efficiency of the main study. In addition, pilot studies are designed to evaluate the safety and recruitment potential of a treatment or intervention, examine randomization and blinding processes, and provide estimates for sample size calculations.

Pilot studies play an important role in the development and improvement of behavioural interventions by providing information on feasibility, acceptability and potential efficacy. Despite their importance and versatility, the ways in which behavioural scientists can scale up early studies to larger trials have received little attention [4].

Pilot feasibility studies play a unique and important role in the preparation of larger intervention trials by examining the feasibility and acceptability of the intervention and its testing methods [33].

Determination of the minimum sample size requirement for the pilot study should depend on the purpose of the pilot study itself, with careful consideration of all statistical requirements. It involves determining the minimum sample size requirement when designing the pilot study to assess the reliability of the questionnaire. In general, a minimum sample size of at least 30 respondents is usually sufficient to assess the reliability of a questionnaire [29].

## 5. Conclusion

This section aims to reveal the relationships and rules among variables by collecting quantitative data, using statistical analysis, inference and verification of research hypotheses. In the process of research, we attach importance to the numerical and fine processing of data to ensure the objectivity and repeatability of the scale. The objectivity, repeatability and quantification of quantitative research can help verify and infer research hypotheses, thus improving the scientific and reliability of research conclusions.

During the experiment, standardized measurement tools and data collection methods were used to reduce errors and biases.

The research content mainly includes descriptive statistics (such as mean, standard difference, etc.) and inferential statistics (such as T-test, ANOVA, etc.). After the data collection is completed, the experimental results are objectively interpreted according to the analysis results, and their theoretical and practical significance is discussed. When interpreting the results, we should avoid over-interpreting or misinterpreting the data and ensure the rigor and scientific nature of the conclusions.

The shortcomings of the experiment, such as insufficient sample size and limitation of measurement tools, will be evaluated objectively, and corresponding improvement measures will be proposed. At the same time, based on the existing research, the suggestions and directions of future research are put forward to promote the further development of this field.

## Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

## Copyright:

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