DEVELOPMENT OF PROBLEM-BASED LEARNING INSTRUCTIONAL MODEL TO IMPROVE CRITICAL THINKING ABILITY FOR UNDERGRADUATE STUDENTS

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Abstract

The research objectives were structured into three phases. Phase 1 involved a study population of 150 undergraduate students and 3 lecturers from Guangxi Minzu University enrolled in the Innovation Training Course during the first semester of the 2024 academic year. Phase 2 included the involvement of three experts who evaluated and confirmed the suitability of the problem-based learning instructional model. In Phase 3, the sample group consisted of 50 students enrolled in the same course during the second semester of the academic year. Methodologically, the research utilized several instruments: 1) questionnaires for students and interviews for lecturers, 2) a conformity assessment form to validate the instructional model, 3) lesson plans developed using the problem-based learning approach, and 4) a scoring rubric to assess critical thinking abilities. Data analysis involved statistical methods such as percentage calculations, mean values, and standard deviations.

The research findings indicated that undergraduate students' critical thinking ability is influenced by internal and external factors. Internal factors include positive emotions, learning behaviors, teaching behaviors, attitudes, and physical health of both students and lecturers. External factors encompass teaching methods, materials, and classroom environments.

Additionally, a problem-based learning instructional model was developed and evaluated by three experts, achieving a 100% consensus on its utility, feasibility, propriety, and accuracy. The model consists of five components: 1) Principles and rationale derived from the study of course content and students' critical thinking abilities; 2) Objectives based on research goals; 3) Course content structured to facilitate experimentation; 4) Teaching methods and materials aligned with problem-based learning; and 5) Evaluation through a scoring rubric assessing undergraduate students' critical thinking abilities.

Keywords: The Problem-Based Learning} Instructional Model, Critical Thinking Ability

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Introduction

Innovation Training Course is the general education compulsory course for undergraduate students' year 2023, in Guangxi Minzu University, provides the students with a survey and case studies of successful innovations that have led to new ventures, their components, strategies and financial structure. The course combines entrepreneurial, strategic, marketing, legal, societal and financial themes in support of innovative businesses and products. The course addresses the design of effective strategies given technological capabilities and competitive markets; and provides tools for the financial analysis that are essential for obtaining venture capital. The course aims to cultivate innovative, compound and application-oriented talents urgently needed by the society. It aims to improve students' ability to apply interdisciplinary knowledge, find and solve problems, and cultivate students' entrepreneurial skills, critical thinking and practical ability as the main measures and important means (Guangxi Minzu University, 2024).

Critical thinking is one of the necessary abilities for talents in the twenty-first century. It emphasizes that in the process of learning and problem solving, should constantly reflect, revise, evaluate, and constantly correct existing cognition but the most students had the less in critical thinking ability so I studied many academic educators and found that critical thinking ability into six cognitive abilities, there were: 1) Interpretive ability, 2) Analytical ability 3) Reasoning ability 4) Explanatory ability 5) Evaluation ability and 6) Self-regulation ability.

According students' problem in critical thinking ability, the researcher studied from text books, article paper and research and found that Problem-based learning instructional model can improve critical thinking ability for undergraduate students as follows.

Firstly, problem-based learning emphasizes problem-driven learning. The learning in PBL teaching mode starts with problems and ends with problem-solving, with problems running through the entire teaching process. Students need to independently ask questions, research problems, and find solutions. This process encourages students to think about the essence, causes, and solutions of problems, and cultivates their critical thinking abilities (Hao, 2009).

Secondly, self-directed learning: In PBL, students need to actively collect and organize relevant information on their own and conduct in-depth exploration and analysis. This learning style stimulates students' curiosity and thirst for knowledge, prompting them to engage in critical thinking and evaluate the effectiveness of different viewpoints and evidence (Wang, 2010).

Thirdly, teamwork: PBL encourages students to collaborate in small groups to solve problems. Students need to work together to develop work plans, collaborate, communicate with each other, and critically evaluate their respective perspectives. This collaborative process promotes cognitive collision and debate among students, cultivating critical thinking and teamwork skills (Li, 2008).

Fourthly, reflection and evaluation: In PBL, students need to reflect on their learning process and results and conduct self-evaluation and peer evaluation. This process encourages students to reflect on the effectiveness of their decisions, solutions, and outcomes, and to propose suggestions for improvement. Through reflection and evaluation, students can develop critical thinking and self-reflection abilities (Chen et al., 2013).

The overall process of problem-based learning instructional model and the process of cultivating and improving critical thinking can be consistent and corresponding, and both emphasize the need to focus on learners. In Problem-Based Learning Instructional Model, learners are required to actively explore and solve problems, and the cultivation of critical thinking is even more so. Only when learners actively develop themselves can they truly develop, form or improve.

Therefore, the problem-based learning instructional model is a positive response to the tendency towards critical thinking. Based on this, this article aims to cultivate critical

thinking among college students and observe its impact on critical thinking tendencies based on the PBL teaching model.

As the founder, Barrows (1996) developed a 5-step PBL model to confirm the likelihood of improvements of critical thinking ability for students. He summarized six parts, namely: student-centered; Guided by teachers; Taking cooperation as the main form of learning; Focusing on problems as the focus of learning, as well as diversified ways of self-directed and cooperative learning, encourages students to obtain more information.

Based on previous research, Silver (2004) further refined the teaching process of PBL, viewing the entire teaching process as a cyclic process. He summarized the process of this cycle into seven steps, namely: problem scenario, identifying facts, problem hypotheses, identifying knowledge deficiencies, applying knowledge, summarizing, and evaluating. Teachers first need to present meaningful and continuously evolving problem scenarios to students. Then, students identify the facts in the scenario and start analyzing the problem, setting assumptions for solutions. Next, students enter the most important stage of "identifying knowledge deficiencies". When individuals identify the gap between the required content and existing reserves, the process of knowledge construction begins, Finally, reflect after the knowledge is resolved.

The PBL teaching model focuses on the process of thinking development, promoting the design of teaching activities not only to meet the needs of mastering subject knowledge and applying subject knowledge to solve problems, more importantly, it is important to focus on cultivating critical thinking patterns, ultimately forming teaching processes, and implementing them in specific teaching practices.

As the rationale shown above, the author realizes the importance of studying “Development of Problem-Based Learning Instructional Model to Improve Critical Thinking Ability for Undergraduate Students”.

Research Objective

1. To examine the factors enhancing critical thinking ability for undergraduate students.
2. To develop problem-based learning instructional model to improve critical thinking ability for undergraduate students.
3. To study the result of problem-based learning instructional model to improve critical thinking ability for undergraduate students.

Literature review

In the study of “Development of Problem-Based Learning Instructional Model to Improve Critical Thinking Ability for Undergraduate Students”, the researcher studied the documents concerning the following.

Development of Instructional Model

There are scholars to define the meaning of definition of Instructional Model as follows:

Joyce (2014) defined a teaching model as a paradigm that refers to a relatively stable, systematic, and theoretical teaching and learning activity based on certain pedagogical ideas and theories of teaching and learning.

Wu (1989) defined an instructional model as the basic structure of various types of instructional activities established in practice for the purpose of designing and organizing instruction under the guidance of a certain pedagogical ideology or theory.

Li (1991) defined a teaching model are relatively stable, systematic and theoretical teaching paradigm guided by a certain teaching ideology and centered on a certain theme in teaching activities.

He (1997) defined instructional model as a relatively stable framework of teaching activities and the synthesis of activity procedures established under certain teaching ideas and concepts and in a certain teaching environment.

From the above definition, it can be concluded that teaching mode refers to a series of teaching paradigms carried out by adopting certain teaching methods and strategies according to specific teaching objectives, teaching contents, teaching objects and teaching environment under the guidance of certain teaching ideas.

Components of Instructional Model

There are scholars to define the Components of Instructional Model as follows:

Li (1996) contends that instructional model should consist of four components, 1) theoretical basis, 2) functional goal, 3) realization conditions and activity, 4) procedure constitute.

Xu (2012), Joyce (2014), Ma (2004) contend that instructional model should consist of four components: 1) theoretical basis 2) teaching objectives 3) operating procedures 4) realization conditions or teaching means and strategies and 5) teaching evaluation.

(1) Theoretical basis. It refers to the relevant theories on which the teaching mode depends, which is the "brain" of the whole teaching, determines the direction of the teaching mode, and plays a guiding and leading role for other components.

(2) Teaching objectives. Refers to the expected effect of the teaching mode, but also the teacher in the teaching of students The prediction before the beginning of the movement is the core factor of the teaching mode, which plays a restrictive role in both the operation procedures and the realization conditions and is also the standard and scale of the teaching evaluation.

(3) Operating procedures. Refers to the specific procedures and measures taken by the teaching mode to achieve the results, including How teachers design, how to arrange teaching, how students to carry out learning, and so on, and this is also the most obvious difference between various teaching modes, with significant logic and relative stability.

(4) Implementation conditions. Refers to the teaching mode to achieve the teaching objectives, to ensure that the effective play of the function, on It is necessary to optimal combine various conditions, including teachers, students, teaching materials, teaching contents, teaching strategies, teaching methods, teaching management, teaching time and space, and so on.

(5) Teaching evaluation. Refers to the various criteria for judging the teaching mode.

Lou (2018) contends that instructional model consist of six components as follows: 1) teaching object 2) teaching concept 3) teaching objectives 4) selection of teaching materials 5) teaching methods and 6) teaching procedures. The six elements are closely linked and inseparable, and they restrict each other.

From the information above, the instructional model employed in the present study involves 5 components in line with the theories above i.e., principle and rationale, objectives, contents, methods of teaching & materials and evaluation.

Confirmatory model

To ensure the appropriateness of developed instructional model before implementation, the developed instructional model is confirmed depending on program evaluation standards in 4 aspects: 1) Utility standards, 2) Feasibility standards,3) Propriety standards and 4) Accuracy standards. (Stufflebeam, 2012)

Utility standards are intended to ensure that the developed instructional model will serve the information needs of intended users.

Feasibility standards are intended to ensure that the developed instructional model will be realistic, prudent, flexible, and frugal.

Propriety standards are intended to ensure that the developed instructional model will be conducted in conformity to teaching principles and provide positive results.

Accuracy standards are intended to ensure that the developed instructional model shows a measure of closeness to a true value.

Problem-Based Learning

Background

Problem-based learning (PBL) is a learner-centered instructional format requiring students to participate actively in their learning by researching and working through a series of real-life problems to arrive at the best solution (Kellah ,1996).

Problem-based learning was first designed for medical students at McMaster University based on the gaps of conventional medical training. However, in time, some other medical schools around the world began to adapt Problem-based learning (Barrows, 1986).

Problem-based learning is a teaching model based on constructivism. In the field of education, a relatively consistent concept has not yet been determined. However, most scholars agree with the following view: Problem-based learning emphasizes student orientation and should focus on real problem situations throughout the learning process (MCGRATH D,2003).

The definition of Problem-Based Learning

There are scholars to define the meaning of definition of Problem-Based Learning as follows:

Barrows (1996) defined that problem-based learning can provide students with more opportunities for problem-based collaboration and exploration, rather than simply using problem-based learning as a teaching model. Problem-Based Learning instructional model as six parts, namely: student-centered; guided by teachers; cooperation is the main form of learning; taking problems as the focus of learning and diversified ways of autonomous learning and cooperative learning promote students to obtain more information.

Barbara (1997) defined that problem-based learning is an auxiliary tool that can help teachers guide the classroom. Individuals can help them deal with practical situations through group collaboration and find solutions to cultivate their ability to learn, critical thinking, problem analysis, and information literacy, ultimately facing problems with a critical perspective and attitude.

Colliver (2000) proposed problem-based learning as a teaching approach that organizes students to learn based on actual problem situations. Students need to understand problems, analyze data, and solve problems under the guidance of teachers, and develop individual problem-solving and group collaboration abilities during this stage.

Trop and Sage (2002) defined that the problem-based learning model is characterized by: teachers need to prepare in advance, come up with "good" questions, and continue to encourage. In this way, it can individual not be afraid of discussion, and then actively carry out the preset process of identification, analysis and discussion; Teachers should learn to design problem situations in teaching, and guide students to discuss. At the same time, students must have their own position in the preset problem situation.

From the definition and views of other scholars above, Problem-Based Learning teaching model in this study refers to: put students in the context of a real problem, carry out daily learning in the way of group cooperation, and analyze, identify and evaluate problems in the process of exploring, so that students can not only understand knowledge-knowledge transfer-knowledge application, and achieve the purpose of forming critical thinking ability and thinking training, and form innovative talents.

Critical thinking ability

The definition of critical thinking ability

There are scholars to define the meaning of critical thinking ability as follows:

Peter (1990) defined that Dewey, the father of critical thinking teaching, the American Philosophical Association proposed the concept of critical thinking in 1910 includes two parts: emotional tendencies (critical spirit) and cognitive skills (critical skills)

Robert (2000) who is Canadian psychologist defined that critical thinking is the tendency or skill to engage in activities with a thoughtful attitude.

Bailin et al. (1999) defined that the process of critical thinking is essentially a problem-solving process, emphasizing the important role of real problem situations in the training process of critical thinking.

Michael (2000) defined that critical thinking is the skillful and dynamic interpretation and evaluation of observations, communication, information, and argumentation.

From the definition above, it can be concluded that critical thinking ability is an individual's attitude towards critical thinking, which is a purposeful and self-regulated process of judgment, including interpretation, analysis, evaluation, reasoning, and explanations of evidence, concepts, methods, standards, or all the situations on which judgment is based.

Research Methodology

This research used Mixed Method of Research. This research is divided into 3 phases.

Phase 1 was conducted to answer research objective 1: To examine the factors enhancing critical thinking ability for undergraduate students.

Phase 2 was conducted to answer research objective 2: To develop problem-based learning instructional model to improve critical thinking ability for undergraduate students.

Phase 3 was conducted to answer research objective 3: To study the result of problem-based learning instructional model to improve critical thinking ability for undergraduate students. The details are as follows.

Table 1 Factors affecting are internal and external factors to enhance critical thinking ability for undergraduate students in Guangxi Minzu University

Topics	Details
Research process	Analyzed the internal and external influencing factors from students and lecturers.
Research objective 1	To examine the factors enhancing critical thinking ability for undergraduate students.
Conduct research	Designing instrument 1 (The questionnaire for students) Designing instrument 2 (The interview for the lecturers) Assess the validity by 3 experts (List name from Appendix A)
Target group	1. The 150 students of Innovation Training course in the semester 1 academic year 2024 from 3 classes of English Major of Foreign Languages College in Guangxi Minzu University. 2. The lecturers who are teaching Innovation Training course from 3 colleges in Guangxi Minzu University.
Instrument	1. Questionnaire for students Part 1: Common data of the respondent in overall. (N=150) Part 2: About internal and External Factors. 6 items of internal factors / 6 items of external factors Part 3: Suggestion 2. Interview for the lecturers. Part 1: Common data of the respondent in overall. (N=3) Part 2: 10 questions. 5 questions for internal factors. / 5 questions for external factors. Part 3: Suggestions
Data analysis	1. Descriptive Statistics i.e., Frequency, Mean (μ) Standard Deviation (σ) for questionnaires. 2. Content analysis for interview.
Output	The result of the factors to enhance critical thinking ability of undergraduate students. The internal factors are consisted of students' positive emotion, positive learning behavior, positive teaching behavior, attitude, and physical health. The external factors are consisted of method of teaching, time, teaching environment and materials.

Table 2 Problem-based learning instructional model the appropriateness of which is confirmed by experts for further implementation

Topics	Details
Research process	Develop problem-based learning instructional model in terms of accuracy standards, propriety standards, feasibility standards, and utility standards.
Research objective 2	To develop problem-based learning instructional model to improve critical thinking ability for undergraduate students.
Research instrument	Designing instrument (the questionnaire for IOC). Designing instrument about the questionnaire on confirming the instructional. Assess the validity by 3 experts (List name in Appendix A).
Target group	3 experts through Item-Objective Congruence (IOC) according to the criteria.
Instrument	Questionnaires The handout for 3 experts through Item-Objective Congruence (IOC)
Data analysis	Descriptive analysis i.e. frequency and percentage. The acceptable items must not be less than 100%.
Output	The problem-based learning Instructional model the appropriateness of which is confirmed by experts for further implementation.

Table 3 The results of implementing problem-based learning instructional model will enhance critical thinking ability of undergraduate students at a level good ⩾80% according to rubric scoring criteria into their levels descriptor

Topics	Details
Research process	Conformity assessment form of lesson plans and rubric scoring in terms.
Research objective 3	To study the results of problem-based learning instructional model to enhance critical thinking ability of undergraduate students.
Conduct research	Design handouts and implement teaching in accordance with the principles and steps, goals and contents, teaching methods and evaluation of teaching based on problem-based learning instructional model
The sample group	1. The 50 students who enrolled in College Students' Career Guidance course from class section B are obtained by cluster sampling. 2. By 3 experts through Item-Objective Congruence (IOC) according to the criteria.
Instrument	1. Lesson plan for 3 experts through Item-Objective Congruence (IOC) 2. Rubric score form for 3 experts through Item-Objective Congruence (IOC)
Data collection	1. Ask for permission of data collection. 2. Collect students' performance by using rubric scoring before assessment by external raters.
Data analysis	Categorize students' performance according to rubric scoring criteria into their levels descriptor. Descriptive analysis i.e. frequency and percentage. The critical thinking ability of undergraduate students at a level good ≥80%.
Output	The suitability of Lesson plan and rubric scoring will be confirmed by experts and can be used for teaching experiments.

Research Results

The purpose of this chapter is to present the results of the study. In the study of "Development of Problem-Based Learning Instructional Model to Improve Critical Thinking Ability of Undergraduate Students", the researcher studied the documents concerning the following.

Objective 1: To examine the factors affecting critical thinking ability of undergraduate students.

Objective 2: To develop problem-based learning instructional model to improve critical thinking ability for undergraduate students.

Objective 3: To study the result of problem-based learning instructional model to improve critical thinking ability for undergraduate students.

Data Analysis Results

Part 1: Analysis results serving objective 1: To examine the factors affecting critical thinking ability of undergraduate students

Common data of the respondent in overall (N=150)

The results of the common data on gender and age for the respondents overall. It shows that the overall gender is mostly female, female accounting for 71% of the total. Male respondents accounted for 29% of the total. This is very consistent with the characteristics of more woman in English Major of Guangxi Minzu University. The age distribution of students is highest in the 18-20 year old age group at 88%, while the age of students in the 21-23 years old at only 12%. This is also very much in line with the age characteristics of second-year undergraduate students.

The result of questionnaire from students in overview (N=150)

The indicates that internal factors affecting the students' critical thinking ability for Guangxi Minzu University are found to be at a high level overall ($\mu = 4.41$). Considering each item individually, it was found that No.5 have the highest mean ($\mu = 4.63$), followed by No.4 ($\mu = 4.60$). and the lowest mean is No.2($\mu = 4.11$).

For external factors affecting the critical thinking, the overall level is also found to be at a high level ($\mu = 4.47$). Considering each item individually, it was found that No.4 has the highest mean ($\mu = 4.59$), followed by No.5 ($\mu = 4.55$) and the lowest mean are No.2 and No.3($\mu = 4.39$).

The Lecturers Interview analysis results

The interviews include three lecturers who taught the Innovation Training Course in Guangxi Minzu University in 1st semester of 2024 academic year. One lecturer is from Foreign Languages in Guangxi Minzu University, one lecturer is from Economics college in Guangxi Minzu University, one lecturer is from Innovation and Entrepreneurship College in Guangxi Minzu University

Common data of the respondent in Guangxi Minzu University. (N=3)

The common data of the lecturers shows that the most common gender is female, accounting for 66.70% of the respondents, while male accounting for 33.30%.

In terms of teaching experience, the most teaching experience falls in the range of above 9 years, making up 66.70%. In terms of the age of teachers, the most age is in the range of 35 -49 years old, making up 66.7%. In terms of professional title, associate professor accounting for 66.70% and lecturer accounting for 33.30%. It can also be seen that the interviewees are experienced and representative.

Interview Lecturers Results

After interviews with three lecturers, the factors that affect critical thinking ability of undergraduate students are summarized as follows.

Internal Factors

Students' positive emotion

Students' positive emotion factors include students' joy and eagerness for the course, and their ability to feel happy, satisfied, or eager during the course learning. The lecturers believe that positive emotions among students include their love and expectations for the course, and that they can feel happy, satisfied, or eager during course learning, which can stimulate their interest and motivation and have a positive impact on the improvement of their critical thinking.

Secondly, positive emotions of students also include their confidence in themselves. Students have confidence in their abilities and knowledge, believing that they can overcome difficulties and achieve good grades. This kind of confidence can help students overcome setbacks and maintain a positive state. Moreover, confident students are more willing to express their opinions and stimulate their creativity.

Thirdly, positive emotions of students also can control their emotions and behaviors, preventing themselves from being affected by emotional fluctuations. Students can control

their energy and attention, actively participate in classroom discussions and independent thinking, and avoid distractions and wasting time.

Positive learning behavior

The lecturers believe that positive learning behavior includes establishing trust relationships between lecturers, students, and families, as well as the positive thinking patterns. First, building trust with teachers and family during the learning process can make students feel confident. At the same time, maintaining good relationships with others enables students to respect others, be willing to help others, and cooperate with others. This kind of good interpersonal relationship can help students establish trust and common goals and improve learning and work efficiency. Moreover, students adopt a positive mindset to learn the course, focusing on the benefits rather than the drawbacks of the problem, and seeking ways to solve it. Students will not fall into negative thinking patterns but take positive actions.

Positive teaching behavior

The lecturers believe that when teachers have skills in communication, collaboration, adaptability, empathy, and patience, they will guide students to actively participate in classroom activities, actively engage in group discussions, and enable students to proactively identify and solve problems encountered in learning, thereby improving their critical thinking abilities. Secondly, teachers encourage interaction and cooperation among students, as well as exploring and challenging innovative thinking together, to find the best solutions. The lecturers stated that when teachers demonstrate skills in communication, collaboration, adaptability, empathy, and patience, students will also be more interested in learning the course and propose updated and more comprehensive perspectives, which will help improve their critical thinking abilities.

Attitude

Attitude includes two aspects; one is the positive attitude of students for learning course. The other one is the positive attitude of teachers for course teaching.

The lecturers believe that students have a positive attitude and interests for course learning, can make them willing to learn new knowledge, actively participate in group discussions, think actively, and solve problems. Students are not only willing to accept new knowledge and skills, but also adept at applying this knowledge to solve problems.

On the other hand, when teachers demonstrate positive personal enthusiasm and enthusiasm for teaching in the curriculum, they will guide students to pay attention to multiple aspects of the problem in a more vivid and interesting way, and propose deeper and more comprehensive perspectives, which will help improve students' critical thinking ability.

Physical health

Physical health includes students have well–being, brain and good health to study in course. Healthy students are better able to concentrate and maintain energy to study and think about problems. The lecturers said that when students have a good physical, mental, and health condition, they can better cope with challenges and fully unleash their potential. Students can improve their learning motivation and efficiency, actively learn and think about problems, which helps to enhance their critical thinking abilities.

External Factor

Method of teaching

In the interview, the lecturer mentioned that there have been continuous reforms in the teaching methods of Innovation Training Courses in recent years. Teachers pay attention to using various forms of teaching methods and begin to focus on student participation and teacher-student interaction. Using multimedia technology, they apply various interactive teaching methods such as case sharing, group discussion, case analysis, brainstorming, role-playing, and game experience to innovative training courses.

The lecturers mentioned that most teachers still adopt the traditional classroom teaching form, with the teacher as the center and self-directing and self-performing teaching content. Students passively receive theoretical knowledge, which is difficult to stimulate their

enthusiasm and interest in course learning, and difficult to improve their critical thinking and innovative thinking abilities.

Time

The lecturers consistently agreed that time is a key factor affecting students' critical thinking ability. If the students manage the time to study Innovation Training course both inside and outside the classroom can improve students' critical thinking ability. The lecturers believed that sufficient time is significantly important for the course of innovation training methods because it requires more time to practice which applying critical thinking to solve practical problems. Students need spend more time on practice and enhance critical thinking ability.

Teaching environment

In the Innovation Training course, an open, positive and interactive teaching environment is essential to improve students' critical thinking skills. In terms of class size, small class teaching should be adopted, with no more than 30 students in each class, to ensure that each student has more opportunities to participate in classroom discussions, and teachers can provide personalized teaching for students. At the same time, the classroom should have modern teaching equipment that can provide students with online learning and interaction with teachers, allowing teachers to receive timely teaching feedback and evaluations. A good classroom atmosphere can stimulate students' interest in learning, encourage them to think independently and actively.

Materials

In the interview, the lecturer mentioned that teachers tend to increase and optimize online course teaching resources, select some high-quality course online resources as part of theoretical teaching content, improve course learning effectiveness, and enrich students' learning experience. In addition to optimizing the current offline teaching content, teachers should increase online teaching content and students' online self-learning class hours, with offline teacher teaching as the focus and online student self-learning as a supplement for teaching activities.

The teaching materials commonly used by teachers, such as textbooks, corporate report, online innovation and entrepreneurship competitions, and entrepreneurship training simulations, help students apply critical thinking skills to conduct market research and analysis, write market research reports and business plans, and teach students how to discover, analyze, and solve problems, preparing them for future employment.

These factors collectively contribute to improving critical thinking skills among undergraduate students at Guangxi Minzu University.

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