**Learning Critical Thinking Through Online Thesis Writing Courses: The Case of Undergraduate Students in a Chinese Public University**

**Abstract:** In order to write their graduation theses, Chinese undergraduate students used online learning to develop critical thinking skills, which are explored in this study. Understanding how students use critical thinking in this setting is essential given the growing popularity of online learning. With an emphasis on students attending Chinese public institutions, the study intends to explore their perspectives, difficulties, and experiences with developing critical thinking during thesis writing. The study collects comprehensive and detailed perspectives from informants through the use of qualitative research methodologies such as document analysis and in-depth interviews. The results indicate that a number of factors, including resource availability, peer and mentor contact, and the design of online learning environments, can affect students' ability to acquire critical thinking skills. This study suggests the improvement of online learning processes with the goal of strengthening undergraduate students' critical thinking skills, including investing in high-quality online resources, encouraging active instructor-student interaction, optimizing course design, and implementing effective feedback mechanisms. It also suggests integrating hands-on projects, group activities, and case studies to enhance critical thinking abilities. Institutional support and infrastructure improvements are also needed. Continuing professional development programmes are also recommended. The sample size was determined based on the principle of saturation, where data collection continued until no new themes or insights emerged. In total, 6 students were selected through purposive sampling.

*Keywords: China, Thesis Writing Course, Learning Critical Thinking, Online Learning, Undergraduate Students*

1. **Introduction**

The study found that student satisfaction with online learning is primarily influenced by students' expectations and course design, rather than the quality of teaching (Zhi & Hassan, 2023). The research emphasises the importance of triggering and sustaining interest in promoting deep learning, and well-designed online courses play a crucial role in engaging students and fostering critical thinking (Wong et al., 2023).In modern education, the supplementation and improvement of traditional teaching methods emphasise the enhancement of learning outcomes through technological means. The related study demonstrates that gamified teaching significantly improves students' abilities in literal, inferential, and critical reading comprehension (Abu Sa et al., 2020). The impact of online learning on mental health further emphasises the need to consider students' psychological needs and support mechanisms when designing and implementing online education courses(Welan & Zulkifli, 2023). Despite the Chinese government's efforts to promote the integration of technology in education through various policies, the actual implementation has not yet met expectations(Chenhui et al., 2024).With the rapid advancement of technology and the increasing popularity of online education, exploring the experiences of undergraduate students in learning critical thinking through online platforms has become imperative. This study delves into the unique context of Chinese public universities, focusing on the process of learning critical thinking during the writing of graduation theses. Online learning has revolutionised the landscape of education globally, offering flexibility and accessibility to students. In China, online education has gained significant traction, particularly in higher education institutions. However, while online platforms provide diverse resources and opportunities for learning, the effectiveness of cultivating critical thinking skills in this context remains underexplored. The importance of blended learning in higher education has been increasingly recognised, yet there remains a need for deeper exploration into its long-term effects and the optimal balance between online and offline components. Gouifrane et al. (2020) and Niu et al. (2023) have highlighted this need, underscoring the gaps in understanding how these hybrid models can be most effectively utilised over time. Furthermore, there are significant gaps in the application of didactical models and the validation of theoretical frameworks in online learning environments, as pointed out by Zimmermann, Dreisiebner, and Höfler (2017) and Jiang and Liang (2023).

Understanding how undergraduate students engage in critical thinking within the framework of online learning during the graduation thesis writing course is crucial for several reasons. Firstly, it sheds light on the efficacy of online education in promoting higher-order thinking skills, essential for academic and professional success. Secondly, it provides insights into the specific challenges and opportunities faced by students in the Chinese educational context, contributing to the enhancement of online learning practices in the country.

The public university where this study takes place is located in China and is known for its comprehensive approach to integrating online learning tools in its curriculum. The informants, all undergraduate students, were selected from those enrolled in the university's online thesis writing course. This course was specifically designed to incorporate critical thinking as a core component, with activities and assignments aimed at enhancing students' ability to analyse, evaluate, and synthesise information effectively. Through this course, students are encouraged to apply critical thinking in various stages of their thesis writing, from literature review to data analysis and interpretation.

The research focuses on undergraduate students enrolled in the university's graduation thesis course, a crucial component of their academic journey that demands the development of critical thinking skills. The primary objectives of this study are to understand the challenges these students face in developing critical thinking skills within an online learning environment, to examine their perceptions of the effectiveness of these environments in promoting critical thinking, and to identify the key factors influencing the development of such skills during the online thesis writing process. The research is guided by three central questions:

1. What challenges do undergraduate students encounter in developing critical thinking skills within the online learning environment while completing their graduation thesis?
2. How do these students perceive the effectiveness of online learning environments in fostering critical thinking during their thesis course?
3. What factors contribute to the development of critical thinking skills among students engaged in online learning for writing graduation theses?

By addressing these questions, the study aims to provide valuable insights into optimizing online learning strategies to better support critical thinking development in academic settings.

1. **Literature Review**

This literature review examines existing research on online learning and its impact on critical thinking. The integration of online learning in higher education has sparked considerable debate regarding its effectiveness in developing critical thinking and other academic skills.

* 1. **Online Learning**

Previous research emphasises the significance of understanding students' achievement emotions in online learning environments. Shao et al. (2023) found that perceived online teaching quality, along with appraisals of control and value, affects students' emotions in L2 learning during COVID-19. Data from 1503 Chinese undergraduates showed that effective teaching enhances enjoyment while reducing anxiety and boredom, mediated by perceptions of control and value. Conversely, chaotic teaching increases anxiety and boredom. Li and Che (2022) highlighted the negative impact of online learning on students' performance and well-being, especially for lower-grade students. Their survey across 30 Chinese provinces linked home or dormitory study environments to this decline, with students reporting physical discomfort and anxiety. Turnbull et al. (2021) outlined five challenges in transitioning to online learning, recommending strategies like e-learning training and blended learning. They proposed a Technology Enhanced Learning Hub but stressed the need for further research to evaluate its long-term effectiveness.

Educators should prioritise fostering in-depth discussions and critical thinking in online course design to optimise students' learning experiences.

* 1. **Online Learning and Critical Thinking**

Online learning has been recognised for its potential to enhance critical thinking skills among university students. It offers a broader spectrum of learning opportunities, facilitating the development of critical thinking abilities (Al-Husban, 2020). Research globally has delved into the impact of online learning on critical thinking. Studies have explored how online learning environments shape and support the development of critical thinking skills ( Chen et al., 2024). They have examined various aspects such as interactivity, access to resources, and task design within online platforms, highlighting their influence on students' critical thinking. However, there is a need for comparisons across different countries and regions to identify both commonalities and differences in how online learning environments impact critical thinking development. Comprehending these dynamics is crucial to optimise virtual learning environments and effectively promote critical thinking among undergraduate students.

* 1. **Definition and Measurement of Critical Thinking**

Critical thinking is a multifaceted concept that has been defined and understood in various ways across different contexts. Scholars have provided diverse definitions and interpretations of critical thinking, highlighting its importance in higher education and beyond (Altun & Yildirim, 2023; Skinner, n.d.; Tian & Low, 2011). Additionally, there are several assessment tools and methods commonly used to measure critical thinking skills among students (Liu et al., 2014; Yin et al., 2023). These instruments aim to evaluate students' abilities to analyse, evaluate, and synthesise information, as well as their capacity for logical reasoning and problem-solving.

However, accurately assessing and evaluating students' levels of critical thinking in research studies can pose challenges. Researchers often employ systematic literature reviews, qualitative and quantitative methods, including surveys, interviews, and performance tasks, to capture the complexity of critical thinking skills, instructional implementation, and assessment (Liu et al., 2014; Yin et al., 2023). For the purpose of analyzing critical thinking's evolution and effects in the context of online learning environments, especially when writing graduation theses for public universities in China, it is essential to comprehend the subtleties of defining and assessing critical thinking.

* 1. **Blended Learning and Critical Thinking**

Previous research highlights the short-term effectiveness of blended learning in enhancing clinical reasoning skills in nursing students but calls for further exploration of its long-term impact and effectiveness across different contexts (Gouifrane et al., 2020). Studies also propose innovative models for digital learning, such as the "Dr. Internet" MOOC, aimed at developing critical thinking skills rather than mere knowledge transmission, yet gaps remain in assessing their long-term effects (Zimmermann et al., 2017). Niu et al. (2023) found that blended learning improves cognitive, critical thinking, and mental health aspects in nursing education but noted the need for research on the optimal balance between online and offline components. Jiang and Liang (2023) explored factors influencing EFL students' engagement in SPOC-based environments, offering a theoretical model to improve participation but suggesting further validation across diverse contexts.

While studies call for further investigation into blended learning's long-term effects and optimal design (Gouifrane et al., 2020; Niu et al., 2023), our research addresses these gaps by exploring the influence of online environments on critical thinking in thesis writing.

* 1. **Undergraduate Thesis Course and Critical Thinking**

Several studies have identified challenges in thesis completion and strategies across different contexts. Azmat and Mater (2022) found issues with supervisor support, topic selection, and data collection among Pakistani students, highlighting a need for better support. Umam Al-Farrosi et al. (2023) emphasised obstacles like qualitative data analysis and advisor disagreements during COVID-19, suggesting improved academic support. Cacciuttolo et al. (2023) focused on ICTs and AI tools in engineering theses, but noted gaps in evaluating their long-term impact. Lin et al. (2024) explored barriers among Chinese nursing students, such as lack of research training, recommending better teacher support. Yamada (2022) examined Japanese students' socialization in thesis writing, but lacked insights into supervisory feedback's long-term effects.

Online learning has been proposed as a solution to enhance critical thinking through tools like virtual libraries and peer feedback (Putra, 2021; Al-Husban, 2020; Chen et al., 2024; Niu et al., 2023). However, there is a gap in comparative studies on different platforms' efficacy in fostering critical thinking, and the specific strategies educators use in online thesis courses. Further research should explore factors influencing student engagement, instructional strategies, and long-term critical thinking development in online environments. Cross-disciplinary comparisons could also highlight unique challenges and opportunities across fields.

1. **Methodology**

The methodology employed in this study is qualitative in nature, designed to capture the nuanced experiences and perceptions of undergraduate students regarding critical thinking in online learning environments. Data collection methods include in-depth interviews and document analysis, allowing for a comprehensive exploration of participants' perspectives. The sample comprises undergraduate students enrolled in public universities in China who are actively engaged in the process of writing their graduation theses. Through purposive sampling, participants with diverse backgrounds and experiences are selected to ensure the richness and depth of data collected. Data analysis involves thematic coding and interpretation, guided by the principles of qualitative research. The study ensures reliability through a carefully designed approach, employing in-depth interviews and text analysis to maintain accuracy and consistency. Data triangulation is used to mitigate bias and enhance credibility. Ethically, participants are fully informed and their consent is obtained, with confidentiality maintained. The research has been approved by the UPM Ethics Committee, ensuring respect for participants' rights and delivering trustworthy insights into the impact of online learning on critical thinking development.

* 1. **Informants**

The study employed purposive sampling to select participants who were most likely to provide rich, relevant, and diverse data regarding the development of critical thinking skills through online thesis writing courses. Purposive sampling was chosen because it allows for the intentional selection of individuals who possess specific characteristics or experiences relevant to the research objectives.In this study, the participants were undergraduate students at a Chinese public university who had recently completed an online thesis writing course. The selection criteria included students who had engaged actively in the course and demonstrated a range of academic performance levels. This ensured that the sample included both high-performing students and those who faced challenges in developing their critical thinking skills.The sample size was determined based on the principle of saturation, where data collection continued until no new themes or insights emerged. In total, 6 students were selected through purposive sampling, ensuring that the study captured a wide spectrum of experiences and perspectives relevant to the research questions.

In this study, in-depth semi-structured interviews were conducted to gather qualitative data on the informants' experiences with critical thinking during online thesis writing. A total of six interviews were conducted (N=6), each lasting approximately 60 minutes. The interviews were designed to explore various aspects of critical thinking as it pertains to the online learning environment. The questions asked during these sessions focused on informants' personal experiences, challenges, and strategies related to developing critical thinking skills while engaging in online thesis writing. These interviews provided rich, detailed insights that were crucial for understanding the impact of online learning platforms on the development of critical thinking skills.

Table 1 provides the demographic profile of the six informants. Male and female cover an equal proportion among the informants; all informants are between 20 to 23 years old; half of the informants are in their senior year, the other half are in their junior year; finally, they all study different majors, which include economics, literature, computer science, psychology, engineering, and history.

**Table 1.** Informants’ Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Informant | Gender | Age | Major | Year of Study |
| 1 | Female | 21 | Economics | Senior |
| 2 | Male | 22 | Literature | Junior |
| 3 | Female | 20 | Computer Science | Senior |
| 4 | Male | 23 | Psychology | Junior |
| 5 | Female | 21 | Engineering | Senior |
| 6 | Male | 22 | History | Junior |

* 1. **Data Collection, Analysis and Saturation**

Data collection for this study used semi-structured interviews and document analysis to explore undergraduate students' experiences of developing critical thinking through online learning during their thesis course. Interviews provided qualitative insights into students' perceptions and challenges, and were transcribed for analysis. Course materials and online discussions were also analysed to supplement the data.

The analysis involved coding interview transcripts and survey responses to identify recurring themes, which were refined through iterative review. Themes were then interpreted in relation to existing literature, offering insights into enhancing online education in Chinese public universities.

Data saturation was reached after six interviews, where no new themes emerged. Document analysis of thesis drafts and course materials further confirmed the findings, ensuring the data sufficiently addressed the research questions.

* 1. **Reliability and Ethical Considerations of the Study**

This study ensures the reliability of its results through a meticulously designed research process. To maintain reliability, the qualitative analysis is based on robust data collection methods, including in-depth interviews and text analysis. These methods are carefully implemented to ensure consistency and accuracy, thereby accurately capturing the impact of online learning on students' critical thinking development in their graduation thesis courses. Data triangulation is used to cross-verify findings, reducing bias and enhancing the credibility and validity of the research.

In terms of ethics, this study strictly adheres to ethical guidelines. Participants are fully informed about the study’s purpose, procedures, and potential impacts before providing their consent. All data is kept confidential, with personal identifiers removed to protect participants' privacy. Additionally, the research has received approval from the UPM University Ethics Review Committee, ensuring that all aspects of the study respect participants' rights and welfare. By integrating rigorous reliability measures and adhering to high ethical standards, this study aims to provide trustworthy and respectful insights into the role of online learning in developing critical thinking skills among undergraduate students.

1. **Research Results and Discussion**

The research findings shed light on the experiences of undergraduate students in learning critical thinking through online learning during their graduation thesis course in public universities in China. Through a combination of qualitative interviews and document analysis, several key themes emerged, providing valuable insights into the intersection of online learning and critical thinking development. Table 2 summarizes the themes and sub-themes identified in the study, including enhanced critical thinking skills, challenges and limitations, and recommendations for improvement.

**Table 2.** Themes and Sub-themes of the Finding

|  |  |
| --- | --- |
| Theme | Sub-theme |
| Enhanced Critical Thinking Skills | Diverse Learning Materials |
|  | Interactive Online Discussions |
|  | Flexibility and Autonomy |
|  | Integration of Theory and Practice |
| Interactive Learning Environment | Virtual Peer Interactions |
|  | Instructor Engagement and Guidance |
| Challenges and Limitations | Technical Challenges |
|  | Lack of Face-to-Face Interaction |
| Recommendations for Improvement | Enhancing Educational Resources |
|  | Increasing Instructor-Student Interaction |
|  | Optimizing Course Design |
|  | Implementing Effective Feedback Mechanisms |

* 1. **Enhanced Critical Thinking Skills**

The research revealed that the majority of students perceived online learning as beneficial for developing critical thinking skills, aligning with recent studies that highlight the positive impact of online environments on critical thinking .Yang et al. (2023) found that through online game-based escape room activities, students' problem-solving skills were enhanced and their critical thinking skills improved. Although students generally enjoyed the escape room activities, their specific feedback wasnot explored in detail. Our study shows that informants appreciated the diverse perspectives and resources available in the online environment, which encouraged them to engage in deeper analysis and reflection. These results underscore that online discussions and collaborative activities were particularly effective in stimulating critical thinking by encouraging students to evaluate different viewpoints and construct well-reasoned arguments.

* + 1. **Diverse Learning Materials**

The availability of diverse learning materials, including scholarly articles, multimedia resources, and interactive modules, facilitated students' critical thinking development by exposing them to multiple perspectives and sources of information.

*"The online platform gave us access to a wide range of resources, from academic journals to expert lectures, which really broadened my understanding of the topic and challenged me to think critically." [ Informant 1]*

*"I found the variety of learning materials provided online to be invaluable. Being able to explore different formats such as videos, articles, and interactive quizzes helped me grasp complex concepts from various angles." [ Informant 3]*

*"Having access to a wealth of resources online allowed me to delve deeper into topics of interest. I could compare different perspectives and evaluate the credibility of sources, enhancing my critical thinking skills." [Informant 4]*

The availability of a broad range of resources on online platforms, from scholarly journals to expert lectures, has expanded students' understanding of topics and challenged their ability to think critically. Students have found various formats, such as videos, articles, and interactive quizzes, to be particularly valuable in mastering complex concepts from different angles. Access to these rich online resources allows students to delve deeper into subjects of interest, compare different viewpoints, and assess the credibility of sources, thereby enhancing their critical thinking abilities.

* + 1. **Interactive Online Discussions**

Engaging in online discussions with peers and instructors provided students with opportunities to critically evaluate different viewpoints, challenge assumptions, and construct well-reasoned arguments.

*"Discussing topics with classmates from diverse backgrounds helped me see things from different angles and forced me to think critically before forming my opinions." [ Informant 3]*

*"The interactive nature of online discussions encouraged active participation and debate. It pushed me to question my own assumptions and consider alternative perspectives, fostering my critical thinking abilities." [Informant 4]*

*"Being part of online discussions allowed me to refine my critical thinking skills by articulating and defending my ideas in a collaborative setting. It also exposed me to new viewpoints that I hadn't considered before." [ Informant 5]*

Students reported that discussing topics with classmates from diverse backgrounds helps them view issues from multiple perspectives and encourages them to engage in deep critical thinking before forming their own opinions. The interactive nature of online discussions not only fosters active participation and debate but also prompts students to question their own assumptions and consider alternative viewpoints, which is crucial for developing critical thinking skills. Through these discussions, students can express and defend their ideas in a collaborative environment and encounter new perspectives they had not previously considered, thereby significantly enhancing their critical thinking abilities.

* + 1. **Flexibility and Autonomy**

The flexibility of online learning allowed students to explore topics at their own pace, pursue areas of interest, and engage in independent inquiry, which contributed to the development of their critical thinking skills.

*"Being able to study online gave me the freedom to delve deeper into topics that interested me the most. It encouraged me to think critically and explore different perspectives on my own terms." [ Informant 5]*

*"The autonomy provided by online learning empowered me to take ownership of my education. I could choose when and how to engage with course materials, which enhanced my critical thinking abilities and self-directed learning skills." [Informant 6]*

*"Having the flexibility to schedule my study sessions allowed me to approach the material with a fresh perspective each time. It challenged me to think critically about concepts and apply them in real-world contexts." [Informant 2]*

Students have reported that the freedom to delve deeply into subjects of personal interest encourages them to think critically and explore different perspectives in their own way. The autonomy provided by online learning enables students to control their educational experience, including the timing and approach to using course materials. This increased control enhances their critical thinking abilities and self-directed learning skills. Additionally, the ability to schedule learning around their own needs helps students approach materials from fresh perspectives, challenging them to think critically about concepts and apply them to real-world situations.

* + 1. **Integration of Theory and Practice**

Online learning platforms provided opportunities for students to apply theoretical concepts to practical situations, fostering critical thinking by enabling them to analyse real-world problems and propose viable solutions.

*"The online learning platform allowed me to apply what I learned in class to real-life scenarios through case studies and simulations. It helped me develop critical thinking skills by applying theory to practical situations." [Informant 6]*

*"Engaging in hands-on projects and practical exercises online allowed me to see how theoretical concepts could be applied in real-world contexts. It challenged me to think critically about the relevance and implications of what I was learning." [Informant 4]*

*"The integration of theory and practice in online learning activities helped me develop a deeper understanding of the subject matter and enhanced my critical thinking abilities. I could see the practical relevance of academic concepts, which motivated me to engage more deeply with the material." [ Informant 1]*

Students have found that engaging in case studies and simulations through these platforms enables them to apply classroom knowledge to real-life contexts, enhancing their critical thinking skills. The involvement in online practical projects and exercises allows students to see how theoretical concepts are applied in the real world, challenging them to critically assess the relevance and impact of what they have learned. The integration of theory and practice in online learning activities deepens students' understanding of the subject matter and improves their critical thinking abilities by demonstrating the practical significance of academic concepts, prompting a more engaged and reflective approach to the materials.

In summary, the development of critical thinking skills among undergraduate students during their online graduation thesis course can be attributed to several key factors. Diverse learning materials exposed students to multiple perspectives, while interactive discussions encouraged critical evaluation of different viewpoints. The flexibility of online learning fostered independent inquiry, and the integration of theory with practice allowed students to apply concepts to real-life scenarios. Together, these elements contributed to the enhancement of critical thinking skills.

* 1. **Interactive Learning Environment**

Students highlighted the importance of the interactive nature of online learning in fostering critical thinking，aligning with recent studies that highlight the importance of peer facilitation in promoting critical thinking through asynchronous online discussions (Xia & Xu, 2024). Our study deepens the finding by revealing that the opportunity to interact with peers and instructors in virtual settings facilitated discussions and enhanced their ability to think critically about course material. Moreover, our research provides new insights into how the asynchronous nature of online discussions allowed students sufficient time to reflect on complex issues and articulate their thoughts thoughtfully.

* + 1. **Virtual Peer Interactions**

Students emphasised the significance of interacting with peers in virtual settings, which facilitated discussions and provided diverse perspectives essential for critical thinking development.

*"The online platform allowed me to engage in discussions with classmates from different backgrounds and perspectives. Hearing their viewpoints challenged my own thinking and encouraged me to approach topics more critically." [Informant 2]*

*"Interacting with peers virtually provided me with valuable insights and alternative viewpoints that I hadn't considered before. It pushed me to critically evaluate my own opinions and broaden my perspective." [ Informant 4]*

*"Having the opportunity to discuss course material with peers online allowed me to explore different interpretations and analyses. It enhanced my critical thinking by exposing me to alternative viewpoints and encouraging me to question assumptions." [ Informant 5]*

Students highlighted that engaging with classmates from diverse backgrounds and viewpoints through the online platform challenged their own ideas and fostered a more critical approach to the topics discussed. This virtual interaction provided valuable insights and perspectives that they had not previously considered, prompting them to critically evaluate their own viewpoints and expand their understanding. Discussing course material online enabled students to explore various interpretations and analyses, exposing them to different viewpoints and encouraging them to question assumptions, which ultimately enhanced their critical thinking skills.

* + 1. **Instructor Engagement and Guidance**

Students appreciated the active engagement and guidance provided by instructors in online discussions, which fostered a supportive learning environment conducive to critical thinking.

*"The instructors' involvement in online discussions was crucial in guiding our critical thinking process. Their feedback and prompts encouraged deeper reflection and helped us navigate complex topics more effectively." [ Informant 1]*

*"Having instructors actively participate in online discussions added depth to our conversations and provided valuable insights. Their guidance challenged us to think critically and provided a framework for analyzing course material." [Informant 3]*

*"Instructors played a pivotal role in facilitating online discussions and encouraging critical thinking. Their expertise and guidance helped steer conversations toward deeper analysis and reflection."[Informant 6]*

Students emphasised that instructors' participation was essential in guiding their critical thinking processes. The feedback and prompts from instructors encouraged deeper reflection and helped students tackle complex topics more effectively. Active engagement by teachers enriched the discussions, providing valuable insights that challenged students' critical thinking and offered a structured framework for analyzing course materials. The expertise and guidance of instructors were pivotal in fostering reflection and deeper analysis during online discussions.

The interactive learning environment created through virtual peer interactions and instructor engagement proved instrumental in fostering critical thinking among students. Virtual peer interactions provided students with diverse perspectives and alternative viewpoints, prompting them to critically evaluate their own opinions and broaden their understanding of course material. Moreover, the active involvement of instructors in online discussions offered valuable guidance and insights, encouraging deeper reflection and providing a framework for critical analysis. Overall, the interactive nature of online learning facilitated exchanges and supported students' development of critical thinking skills.

* 1. **Challenges and Limitations**

Despite the benefits, students also encountered challenges in developing critical thinking through online learning. Technical issues, such as poor internet connectivity and platform usability, occasionally hindered their ability to fully engage in online activities. Additionally, some students expressed concerns about the lack of face-to-face interaction in the online environment, which they felt could limit the depth of their critical thinking development.

* + 1. **Technical Challenges**

Students faced technical issues such as poor internet connectivity and platform usability, which occasionally disrupted their engagement in online learning activities.

*"I encountered frequent internet disruptions during online discussions, which made it challenging to participate fully. It was frustrating because I often missed out on important points raised by my peers." [Informant 2]*

*"The online platform we used was not very user-friendly, which made navigating course materials and participating in discussions more difficult. It was a barrier to fully engaging in critical thinking activities." [ Informant 4]*

*"Technical glitches and slow internet connections often hindered my ability to contribute to group projects and discussions. It was disheartening to be unable to fully participate and keep up with the conversation." [Informant 6]*

Students frequently faced internet interruptions that hindered their ability to fully engage in discussions, causing frustration as they missed important points made by their peers. Additionally, the online platform's user-unfriendly design complicated navigation of course materials and participation in discussions, which created significant obstacles to effective engagement in critical thinking activities. These technical problems, including glitches and slow connections, also disrupted their involvement in group projects and discussions, making it challenging for them to stay aligned with ongoing conversations and diminishing their overall participation in the learning process.

* + 1. **Lack of Face-to-Face Interaction**

Some students expressed concerns about the absence of face-to-face interaction in the online learning environment, believing it could hinder the depth of their critical thinking development.

*"I missed the spontaneous discussions and exchanges that happen in face-to-face classes. It's harder to gauge reactions and engage deeply with course material in an online setting." [ Informant 1]*

*"Face-to-face interaction allows for more nuanced communication and deeper connections with classmates and instructors. The online environment lacks that personal touch, which can impact critical thinking development." [ Informant 3]*

*"Interacting with peers and instructors in person allows for more discussions and debates. Online discussions often feel more scripted and less spontaneous, limiting our critical thinking exploration." [ Informant 5]*

Students noted that they missed the spontaneous discussions and exchanges that typically occur in face-to-face classrooms. Engaging deeply with course materials and gauging responses in an online environment proved more challenging. The lack of personal interaction in online settings, compared to in-person interactions, diminished the opportunities for detailed communication and connection with peers and instructors. This absence of personal engagement affected the development of critical thinking, as online discussions often felt less spontaneous and more scripted, limiting the exploration of critical thinking skills.

The challenges and limitations identified in the study revolved around technical issues and the absence of face-to-face interaction in the online learning environment. Students encountered difficulties due to poor internet connectivity and platform usability, which hindered their full engagement in online activities and discussions. Additionally, the lack of face-to-face interaction was perceived as a barrier to deepening critical thinking development, as students missed the spontaneity and personal connection that physical classrooms offer. Unlike previous studies that focused on the challenges educators faced during the rapid shift to online teaching (Albloushi et al., 2024), our findings highlight the critical need to address technical issues and improve interpersonal engagement in online learning. These findings are crucial for supporting students' growth in critical thinking.

* 1. **Recommendations for Improvement**

Based on the research findings, several recommendations were proposed to enhance online learning practices and promote critical thinking among undergraduate students. These include improving the quality of online educational resources, enhancing instructor-student interaction, optimizing course design to incorporate more interactive and problem-solving activities, and implementing effective feedback mechanisms to support students' critical thinking development.

* + 1. **Enhancing Educational Resources**

Participants suggested improving the quality and accessibility of online educational resources to provide a more enriching learning experience.

*"Having access to high-quality resources such as e-books, academic journals, and multimedia lectures would greatly enhance our learning and critical thinking abilities." [Informant 2]*

*"There should be a greater variety of resources available online, including case studies, simulations, and interactive learning modules, to cater to different learning styles and promote critical thinking." [ Informant 4]*

*"Access to diverse educational materials like interactive tutorials and comprehensive databases would significantly improve our understanding and engagement in the subject matter." [Informant 5]*

Participants highlighted the importance of accessing high-quality materials, such as e-books, academic journals, and multimedia lectures, to enhance learning and critical thinking skills. They also recommended increasing the variety of resources available, including case studies, simulations, and interactive learning modules, to support diverse learning styles and promote critical thinking. These enhancements are anticipated to create a more enriching and effective learning environment.

* + 1. **Increasing Instructor-Student Interaction**

Students emphasised the importance of increased interaction with instructors to facilitate critical thinking development.

*"More active involvement from instructors in online discussions and assignments would provide valuable insights and guidance, fostering deeper critical thinking." [Informant 1]*

*"Regular feedback and personalized support from instructors are essential for refining our critical thinking skills. Increased interaction would help clarify doubts and stimulate further discussion." [Informant 3]*

Students highlighted the importance of increased interaction with instructors to support critical thinking development. They noted that more active engagement by teachers in online discussions and assignments provides valuable insights and guidance, which helps cultivate deeper critical thinking. Regular feedback and personalized support from instructors were also deemed crucial for improving critical thinking skills, as increased interaction clarifies doubts and encourages further discussion.

* + 1. **Optimizing Course Design**

Participants recommended optimizing course design to incorporate more interactive and problem-solving activities that promote critical thinking.

*“Incorporating project-based learning and real-world case studies can significantly improve students' critical thinking and problem-solving abilities.” [Informant 4]*

*"Courses should include more hands-on projects, group activities, and case studies to encourage critical thinking and practical application of knowledge." [Informant 5]*

*"Problem-based learning approaches, where we tackle real-world issues and apply theoretical concepts, would be highly effective in enhancing critical thinking skills." [Informant 6]*

Students recommended that courses should integrate more practical projects, group activities, and case studies to foster critical thinking and facilitate the practical application of knowledge. They suggested that a problem-based learning approach, where students address real-world issues and apply theoretical concepts, would be highly effective in enhancing critical thinking skills. Additionally,incorporating project-based learning and real-world case studies was seen as a way to significantly boost students' critical thinking and problem-solving abilities.

* + 1. **Implementing Effective Feedback Mechanisms**

Students highlighted the importance of timely and constructive feedback to support their critical thinking development.

*"Feedback on assignments and assessments should not only point out errors but also provide suggestions for improvement and encourage critical reflection." [Informant 2]*

*"Peer feedback mechanisms could also be implemented to encourage collaborative learning and enhance our ability to critically evaluate each other's work."* *[Informant 4]*

*"Feedback should guide us on how to improve and promote critical thinking, while peer reviews can offer diverse perspectives and enhance collaborative learning." [Informant 5]*

Students highlighted the importance of feedback on assignments and assessments not only in identifying errors but also in offering suggestions for improvement and fostering critical reflection. They suggested that feedback should guide students on how to enhance their work and encourage deeper critical thinking. Additionally, they emphasised the value of implementing peer feedback mechanisms, which can promote collaborative learning and improve students' ability to critically evaluate each other’s work. This approach allows for diverse perspectives and supports a more comprehensive learning experience.

The recommendations for improving online learning practices and promoting critical thinking among undergraduate students encompass enhancing educational resources, increasing instructor-student interaction, optimizing course design, and implementing effective feedback mechanisms. Participants emphasised the importance of high-quality and diverse resources, active involvement from instructors, interactive course activities, and timely feedback to foster critical thinking skills. These recommendations aim to create a more engaging and supportive online learning environment conducive to the development of students' critical thinking abilities. While other studies address various aspects of online learning system (Deng et al., 2023), these findings offer specific recommendations to enhance the educational experience. This study contributes to fostering critical thinking and proposes a comprehensive approach that covers resource quality, interaction, course design, and feedback. These actionable insights bridge theory and practice, improving online learning environments.

* 1. **Document Analysis**

The document analysis, which included reviewing students' thesis drafts, course materials, and feedback provided by instructors, further corroborated the interview findings. The analysis of thesis drafts showed a noticeable improvement in the depth of analysis and critical engagement over time, particularly in areas where students had received detailed feedback. The course materials were found to be consistent with best practices in online education, emphasising critical inquiry and reflective practices. Instructor feedback was identified as a key factor in guiding students toward more critical and independent thinking, often prompting revisions that led to more rigorous analysis in their final theses.

One example from the thesis drafts showed a student's initial attempt at analyzing their research data. The draft contained mostly descriptive content with limited critical engagement. However, after receiving detailed feedback from the instructor, the student revised their work to include a more thorough analysis, connecting their findings to broader theoretical frameworks. The instructor's feedback emphasised, “Consider how your findings challenge or support existing theories. This will help you move from description to critical analysis.” This resulted in a marked improvement in the depth of analysis in the student's final thesis, as they incorporated more critical perspectives and engaged more deeply with the literature.

In the online discussion forums, students often reflected on the challenges they faced in developing critical thinking skills. For instance, one student posted, “I find it difficult to question the sources because we’ve been taught to rely on authoritative texts. But now I realise I need to critically evaluate these sources too.” This comment was reflective of the broader struggle many students experienced, as observed in the interview data. The course materials were consistent with best practices in online education, with several modules dedicated to teaching critical inquiry and reflective practices. These materials included prompts such as, “How does this source align with or contradict existing research? What implications does this have for your thesis?” that were designed to foster critical thinking.

Furthermore, the instructor feedback was identified as a pivotal factor in guiding students toward more critical and independent thinking. For example, one instructor's comments on a draft highlighted, “Your argument is strong, but it would benefit from engaging with counterarguments. How might someone with a different perspective challenge your position?” This feedback often led students to revise their work, resulting in more rigorous analysis in their final theses.

By combining insights from both the interviews and the documents analysed, the study provides a richer, more nuanced understanding of how online thesis writing courses contribute to the development of critical thinking skills.

1. **Conclusion, Implications, Limitations, and Recommendations**

This research highlights the positive impact of online learning on undergraduate students' critical thinking development during their graduation thesis courses in Chinese public universities. By leveraging interactive platforms, online learning encourages deeper analysis, reflection, and collaboration. Despite challenges such as technical issues and limited face-to-face interaction, the overall effect on critical thinking remains positive. Key contributors include diverse learning materials, flexible course structures, and the integration of theory with practice.

The study suggests improvements, such as enhancing online resources, increasing instructor-student interaction, and optimizing course design with hands-on projects and group activities. Institutional support is also needed to address technical challenges and provide professional development for instructors. Limitations include the focus on a single university and the lack of comparison with traditional learning methods. Future research should involve multiple institutions and compare online learning with face-to-face learning to deepen understanding.

In summary, this study offers valuable insights into how well-designed online environments can promote critical thinking in thesis writing courses, providing practical recommendations for educators to improve student engagement and learning outcomes.

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