A Study on the Influencing Factors of College Students' Online Learning Effectiveness Based on Peer Mutual Assessment

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Abstract: With the rapid advancement of internet technology, online learning has emerged as a vital avenue for university students to acquire knowledge. Peer assessment, recognized as an effective pedagogical strategy, is extensively implemented in online learning environments. This paper aims to explore the factors influencing the online learning outcomes of university students based on peer assessment. Firstly, it elucidates the definition and principles of peer assessment, analyzing its implementation process and advantages within the online learning context. Secondly, it examines the impact of peer assessment on university students' online learning outcomes from four perspectives: students' educational backgrounds, motivation for learning, the quality of peer assessment, and the guidance and support provided by educators. Subsequently, a research design is established, employing surveys and interviews to empirically analyze the relevant factors affecting the online learning efficacy of students engaged in peer assessment. Finally, the results of the study are used to provide strategic support for faculty online teaching evaluation, which is then used to provide targeted recommendations for online education practices in colleges and universities.

1. Introduction

With the rapid advancement of internet technology, online learning has emerged as a significant trend in the field of education. It transcends the traditional constraints of time and space, offering learners a more flexible and personalized approach to education. However, the issue of ensuring the quality of online learning has become increasingly prominent, representing a bottleneck to its development. Peer assessment, as an effective pedagogical strategy, has the potential to enhance learner engagement and outcomes. Yet, its efficacy in online learning environments is influenced by numerous factors. This study aims to investigate the factors affecting the effectiveness of online learning for university students based on peer assessment. By employing surveys and interviews, it seeks to conduct an empirical study of the relevant factors affecting peer assessment-based online learning, thereby providing theoretical foundations and practical guidance for improving the quality of online education for university students.

2. Overview of Peer Assessment

2.1 The Concept of Peer Assessment

PPeer assessment refers to the practice where students exchange their learning outcomes (such as essays or projects) during their educational journey and evaluate and provide feedback on each other's work, either orally or in writing. The essence of peer assessment lies in organizing students to judge the level, value, or quality of their peers' work [1]. Across both domestic and international research, various terms such as peer feedback, peer evaluation, peer assessment, peer interaction, and peer review are used to describe this process, which is extensively applied in second language teaching, particularly in writing instruction [2,3].

Peer assessment is a pedagogical strategy where students evaluate and provide feedback on their peers' learning outcomes, typically implemented in assignments, projects, or essays. Its aim is to enhance communication and understanding among students, helping them better recognize their strengths and weaknesses, thus improving their individual learning outcomes. Through peer assessment, students receive feedback from diverse perspectives, gaining a more comprehensive understanding of the course content and enhancing their critical thinking skills. Peer assessment fosters students' teamwork abilities and self-reflection skills, boosting their confidence and autonomy in learning. However, there are potential issues with peer assessment. For instance, in online learning environments, one significant factor affecting the validity and reliability of peer assessments is the reviewers' unclear understanding of the purpose and function of peer assessment, leading to biases [4]. Additionally, the subjectivity and biases in the evaluation process can impact the accuracy of feedback. Furthermore, some students may be reluctant to accept peer evaluations, resulting in less effective feedback.

2.2 Implementation Process for Peer Assessment

Peer evaluation serves as a vital mechanism to foster peer learning. Through peer evaluation, one can draw from the strengths of peers, identify one's own shortcomings, and extend encouragement and understanding towards peers' flaws and deficiencies[5]. The core aim of peer evaluation is to enhance students' self-awareness and awareness of others through interaction among peers, thereby promoting academic progress. The implementation process of peer evaluation is a dynamic and iterative process that requires collaborative efforts between teachers and students to achieve the desired outcomes. This process generally encompasses the following stages[6,7].

Stage 1: Preparation Phase. In this phase, the teacher must elucidate the objectives, procedures, and standards of peer evaluation to the students, ensuring that each student comprehends and embraces this evaluative method. Additionally, the teacher needs to provide the students with evaluation tools and methods, such as evaluation scales and criteria.

Stage 2: Implementation Phase. During this phase, students initially upload their learning outcomes or work online. These outcomes or works are then allocated to peers either automatically by the system or manually. Students begin conducting anonymous peer evaluations. To ensure the operability and effectiveness of the evaluation, teachers should provide evaluation samples in advance. The content of the evaluations can include aspects such as students' attitudes towards learning, methods, and outcomes.

Stage 3: Feedback Phase. In this phase, students promptly receive feedback from their peers. Students are expected to reflect on their learning outcomes and, based on the feedback and suggestions from peers, formulate their learning plans and improvement strategies. Concurrently, teachers should provide feedback on the evaluations, highlighting their strengths and weaknesses, and guide students towards deeper reflection.

Stage 4: Summary Phase. In this final phase, teachers need to reflect on and summarize the entire peer evaluation process, continuously optimizing the online peer evaluation mechanism in preparation for future peer evaluation activities.

2.3 Strengths and Weaknesses of Peer Assessment

Peer evaluation, as an effective pedagogical strategy, has been extensively implemented across various educational contexts, with three primary advantages. Firstly, during online peer evaluation, students are required not only to reflect upon and consolidate their own learning achievements but also to meticulously assess their peers' work, thereby stimulating their interest and initiative in learning. Secondly, peer evaluation fosters communication and collaboration among students, enabling them to better comprehend diverse viewpoints and ideas, which enhances their communication skills and teamwork abilities. Furthermore, through the peer evaluation process, students learn to appraise their peers' work objectively and fairly, which aids in developing their evaluative skills and critical thinking. Additionally, students can identify their own shortcomings through peer feedback, leading to improved and enhanced learning outcomes.

Nevertheless, peer evaluation also has its drawbacks. For instance, the quality of peer evaluation may be influenced by factors such as students' evaluative skills, negative perceptions, educational backgrounds, and personal biases, which can result in unfair assessment outcomes [8]. Moreover, there may be instances of negative and irresponsible behaviors during peer evaluation, such as malicious feedback or mutual flattery, which can adversely impact students' learning achievements and self-esteem.

3. Peer Assessment in an Online Learning Environment

3.1 Overview of Online Learning

Online learning is an educational modality facilitated through the internet and electronic devices, transcending traditional constraints of location and time, thus allowing learners to engage in education according to their personal needs and pace. Characterized by its flexibility, convenience, and interactivity, online learning is increasingly adopted by universities and institutions. Its primary forms include web-based courses, remote teaching, virtual laboratories, and online discussions. Web-based courses typically involve instructors uploading content such as videos, PowerPoint presentations, and texts to a learning platform, enabling students to access and study materials at their convenience. Remote teaching is conducted via video conferencing and live broadcasts, allowing real-time interaction between teachers and students. Virtual laboratories simulate experimental environments, enabling students to perform practical exercises in a virtual setting, thereby enhancing their hands-on skills. Online discussions provide a platform for students to express opinions, ask questions, and interact, fostering mutual engagement and collaboration.

Online learning offers an array of resources and diverse learning methods to cater to varied learner needs and interests. Learners can study according to their own pace and schedules, facilitating better acquisition of knowledge and skills. Additionally, online learning promotes interaction and collaboration among learners through discussions and group projects, enhancing educational outcomes. However, challenges exist, such as the need for strong self-discipline and autonomous learning capabilities to avoid distractions. Furthermore, a stable internet connection and adequate technical support are essential to prevent disruptions in the learning experience. Consequently, the design and implementation of online learning must thoroughly consider the learners' actual needs and cognitive conditions, providing a supportive learning environment and accessible tools.

3.2 The Practical Value of Peer Assessment in Online Learning

Peer assessment, as an effective pedagogical strategy, has been widely implemented in online learning environments, fostering student interaction, enhancing engagement and motivation, and offering both practical significance and theoretical value. Firstly, peer assessment enhances the interactivity of online learning. Due to the geographical distribution and temporal flexibility inherent in online education, face-to-face interactions among students are limited. Peer assessment provides a robust platform for students to exchange ideas, share knowledge, and resolve issues through evaluation and feedback, thereby contributing to the establishment of a learning community, and strengthening students' sense of belonging and collaborative skills. Secondly, through peer assessment, students receive timely feedback and guidance, identify their shortcomings, and make improvements, thereby enhancing the effectiveness of online learning. Additionally, by critically analyzing peer evaluations, students develop critical thinking and evaluative skills, which further contribute to improved learning outcomes. Moreover, active participation in online peer assessment requires students to manage their study time and tasks effectively, analyze and evaluate peer work meticulously, thus deepening their understanding and mastery of the learning content. Through engaging in peer assessment, students learn to self-reflect and adjust their learning strategies, improving their autonomous learning capabilities.

However, the application of peer assessment in online learning also faces certain challenges. For instance, due to the absence of face-to-face interaction, students might struggle to articulate their viewpoints accurately. The quality of peer assessments can be affected by students' evaluative skills and emotional biases, leading to issues such as suboptimal feedback quality and insufficient constructive feedback provision [9]. Therefore, it is crucial for educators to offer appropriate guidance and support to ensure the effectiveness and fairness of peer assessments [10].

3.3 Implementation Strategies for Peer Assessment in Online Learning

The implementation strategies for peer assessment in online learning primarily encompass the following aspects: (1) Establishing clear criteria for peer assessment. Evaluation criteria play a crucial role in the effectiveness of peer feedback. How to formulate evaluation standards that align with students' cognitive abilities, conduct training and guidance for peer assessment, and guide students to engage in peer evaluation actively and effectively has always been a focal point of research [11]. The criteria must closely align with and directly serve the learning objectives, comprehensively reflecting learners' academic achievements. They should not only focus on the quality of learning outcomes but also consider multiple dimensions such as learners' attitudes towards learning, collaborative spirit, and innovative capabilities. Evaluation criteria can also include guidelines for evaluators to follow, such as respecting the evaluated individuals and providing specific, constructive feedback. (2) Providing a convenient online peer assessment platform. The learning platform serves as the foundation for the implementation of online learning evaluation mechanisms, recording and providing a wealth of process data from learners' online activities, thereby creating a vast reservoir of online learning data to support multi-dimensional data information for monitoring and early warning [12]. To enhance the efficiency of peer assessment, it is essential to select or design an online learning platform with stable performance and ease of use, enabling students to conveniently submit assignments, view others' work, conduct evaluations, and provide feedback, thus meeting the needs of peer assessment. (3) Teachers guiding students to actively participate in peer assessment. Throughout the entire peer assessment process, teachers can lead students to understand the significance of peer evaluation by explaining its objectives, benefits, and providing successful peer assessment examples, thus encouraging active participation and stimulating enthusiasm for peer evaluation. (4) Teachers supervising the peer assessment process to

ensure every student participates and takes responsibility for the evaluation results. (5) Providing feedback and summarizing the results of peer assessment. After the peer assessment, teachers should summarize and provide feedback on students' performance, helping them to understand their strengths and areas for improvement, and refine their learning methods. Additionally, teachers should adjust teaching strategies based on the assessment results to enhance teaching quality. By implementing these strategies, the effectiveness of peer assessment in online learning can be improved, thereby enhancing the learning outcomes for university students [13].

4. Influencing Factors on the Effectiveness of Online Learning for College Students

4.1 Student's Learning Background

The learning background, encompassing factors such as age, gender, education level, professional background, and learning experience, is a significant determinant of the online learning efficacy of university students. Empirical studies conducted domestically have revealed that notable discrepancies exist in online learning outcomes based on gender [14]. Older students may exhibit a greater inclination towards traditional learning modalities, while their younger counterparts are likely to be more adept at online learning. Students of varying educational levels and professional backgrounds may demonstrate differences in their proficiency in information technology and capability to acquire online resources, potentially influencing their ability to access and process information in an online learning environment, thereby affecting their learning outcomes. Moreover, learning experience plays a crucial role in shaping the effectiveness of online education; students with extensive learning backgrounds are likely to possess a greater understanding of how to engage effectively in online learning, showcasing strengths in time management and self-motivation. In contrast, students with limited learning experience may require more guidance and support to enhance their online learning effectiveness. Therefore, educators and designers of online learning platforms ought to take into careful consideration the diverse learning backgrounds of students, providing tailored resources and support to optimize the online learning experience.

Furthermore, educational experiences may significantly influence students' learning outcomes. Students from varying educational levels exhibit differences in foundational knowledge, learning capabilities, and methodologies, which can impact the efficacy of peer evaluations. For instance, students with a robust foundation may be more proficient at identifying their peers' errors and offering valuable feedback, whereas those with weaker foundations may require additional guidance and support to engage effectively in peer assessments. Additionally, professional backgrounds may also play a role in the learning outcomes. Students from different disciplines may possess distinct understandings and perceptions of various types of learning content, which may affect the depth and quality of peer evaluations. For example, engineering students may provide more specialized assessments in technical courses, while humanities students might contribute deeper insights in social sciences courses. Furthermore, study habits constitute another aspect of the learning background, encompassing students' time management, learning strategies, and self-regulation. Variations in study habits can influence students' enthusiasm and efficiency in participating in peer evaluations. For instance, students with strong self-discipline are more likely to complete peer evaluation tasks punctually, whereas those with weaker self-discipline may necessitate greater oversight and motivation.

4.2 Students' Motivation for Learning

Motivation to learn is a pivotal factor influencing the efficacy of online learning for university students engaged in peer assessment. Learning motivation refers to the inclination that initiates and

sustains students' educational behaviors, directing them towards specific academic goals [15]. It is the intrinsic drive that propels individuals to engage in learning activities, fostering their interest and ensuring their sustained enthusiasm for the learning process. During peer assessment, students' learning motivation directly impacts their engagement and seriousness in the evaluation process.

Intrinsic motivation plays a significant role in enhancing students' online learning outcomes. Intrinsic motivation is characterized by the pursuit of activities for their inherent satisfaction, focusing on the enjoyment, interest, and sense of fulfillment derived from learning itself [16]. Students with high intrinsic motivation are likely to participate more actively in peer assessments, approach the evaluation process with greater diligence, and consequently improve online learning outcomes. However, in online learning environments, the absence of face-to-face interaction and supervision may lead some students to lack intrinsic motivation, resulting in suboptimal peer assessment outcomes. Extrinsic motivation can also affect students' online learning results. Extrinsic motivation is driven by external factors or goals beyond the activity itself, which is often more pronounced in adults [17]. In peer assessment, extrinsic motivation may manifest as a desire to receive positive feedback, improve grades, or fulfill course requirements. Although this motivation might encourage students to engage in evaluations, it could compromise the quality and depth of their assessments, thereby impacting online learning effectiveness. Additionally, students' learning motivation can be influenced by their peers. In the peer assessment process, positive interaction and support among peers can enhance students' motivation. Conversely, a lack of effective interaction or the presence of negative feedback can diminish students' motivation and affect the efficacy of peer assessments.

4.3 Quality of Peer Assessment

The quality of peer assessment can be reflected in various aspects such as the evaluation criteria, the assessment process, the content of the evaluation, the results of the evaluation, and the involvement and professionalism of the evaluators. In practical implementation, attention should be paid to a comprehensive consideration of these aspects to ensure the effectiveness and reliability of peer assessment. Peer assessment is a process of mutual evaluation and learning among students, and its quality directly impacts the students' learning outcomes [18]. Firstly, the quality of peer assessment is influenced by the students' evaluative abilities. During the assessment process, students need to possess a certain level of evaluative skill to accurately identify the strengths and weaknesses in their peers' work and provide constructive feedback. If students lack this capability, the effectiveness of the peer assessment will be significantly diminished. Secondly, the quality of peer assessment is also affected by the degree of student participation. In the peer assessment process, students need to engage actively and approach each evaluation with seriousness to ensure the quality of the assessment. If students' level of participation is low, the peer assessment will struggle to fulfill its intended role. Furthermore, the quality of peer assessment is influenced by the design of the assessment mechanism. The design should incentivize students to provide thoughtful evaluations while also safeguarding their self-esteem and enthusiasm for learning. Improperly designed peer assessment mechanisms may lead to resistance from students, thereby impacting the quality of the assessment [19].

4.4 Teacher Guidance and Support

The guidance and support provided by instructors are essential for enhancing the effectiveness of learners' online education environments [20]. In the peer assessment process of online learning, instructors assume roles as mentors, overseers, and collaborators. Firstly, instructors must clearly define the objectives and criteria of peer assessments, guide students in understanding the

significance of these evaluations, and ensure they conduct their assessments effectively. By offering specific evaluation examples and guidance, instructors help students develop a sound perspective on peer assessments, thereby avoiding subjective judgments and biases. Secondly, instructors need to monitor the entire peer assessment process to ensure fairness and objectivity. They can observe students' evaluative behavior, provide feedback, and address any issues that arise. Additionally, instructors should encourage communication and collaboration among students, fostering mutual learning and progress. Finally, instructors should actively participate in peer assessments alongside students, sharing their experiences and insights to offer additional support and guidance. The instructors' guidance and support can enhance the quality of peer assessments, promote active learning and deep thinking among students, and improve the overall effectiveness of online education.

5. Study Design and Implementation

5.1 Study Methods

The survey method aims to understand students' perceptions, emotions, and attitudes towards peer evaluation in online learning. Based on relevant domestic and international literature, a questionnaire was developed. The first section of the questionnaire is designed to gather basic information about students, such as gender and major. The second section includes questions on peer evaluation experiences (e.g., learning motivation, quality of peer evaluation), online learning environment (e.g., teacher guidance and support), and learning outcomes (e.g., satisfaction). The items related to factors influencing peer evaluation in online learning are measured using a 5-point Likert scale, with responses ranging from "Strongly Disagree (1)" to "Strongly Agree (5)."

The interview method allows for a more profound understanding of the practical application and influencing factors of peer evaluation in online learning among university students. This study invited 6 students who participated in the survey for in-depth interviews, including 4 females and 2 males. The interviews focused primarily on the implementation of peer evaluation in online learning, students' attitudes towards peer evaluation, and teachers' guidance and support for peer evaluation.

5.2 Study Objects

Pilot test subjects. This study selected sophomore students from our institution who have experience with peer-evaluated online learning as pilot test subjects. A total of 80 surveys were distributed, and after eliminating those with incomplete responses, 66 valid questionnaires were obtained, resulting in an effective response rate of 82.5%.

Formal test subjects. To ensure the representativeness and comprehensiveness of the sample, a stratified random sampling method was employed when selecting formal test subjects. This approach ensured that the final survey sample covered sophomore students from various majors as comprehensively as possible. A total of 300 surveys were distributed, 271 were returned, yielding a response rate of 90.3%, with 258 valid responses, leading to an effective response rate of 86.0%.

6. Findings and Discussion

6.1 The Influence of Learning Context on the Effectiveness of Online Learning Based on Peer Assessment

According to the statistics, out of 258 valid questionnaires, there were 107 male respondents, constituting 41.5% of the total, and 151 female respondents, accounting for 58.5%. Among the total

sample, students from computer-related fields such as Computer Network Technology, Digital Media Technology, and Software Technology numbered 90, representing 34.9% of the sample; students from non-computer-related fields such as Social Work, Ideological and Political Education, and English totaled 168, making up 65.1% of the overall sample.

The study reveals that students in computer-related fields generally have a higher level of acceptance of peer evaluation compared to their counterparts in non-computer-related fields, as these students believe that peer assessment enhances the effectiveness of online learning. The reasons for this may be as follows: (1) Professional characteristics and course requirements. Computer-related fields emphasize theoretical knowledge while also stressing practical operations. Peer evaluation in this context provides feedback more aligned with real-world projects, aiding students in continually improving and enhancing their practical skills. Computer-related courses often involve project collaboration and team work, necessitating strong cooperation and communication skills. Peer evaluation, as a simulated form of team collaboration, allows students to hone these abilities in practice. (2) Critical thinking and technical proficiency. When evaluating peers' work, students in computer-related fields must employ critical thinking to analyze issues such as system design, a process that enhances their critical thinking abilities, which is less commonly encountered by students in non-computer fields. Peer evaluation requires students to possess certain technical skills, such as the use of software tools. Students in computer-related fields generally start with a higher baseline and richer experience in these areas, thus benefiting more from this practice. (3) Learning motivation and interest. Students in computer-related fields often have a strong interest in technology, leading them to invest more time and effort into learning and exploration, thereby improving learning outcomes. (4) Timely feedback and rapid iteration. Peer evaluation in online learning offers prompt feedback, helping students quickly identify and rectify their shortcomings. In the computer field, rapid iteration is a common practice. Peer evaluation encourages students to continually revise and refine their work to meet new demands and challenges. This iterative process aids students in adapting swiftly to changes and enhancing their problem-solving capabilities.

There are significant differences between genders in the recognition of the effectiveness of peer review in online learning, with males exhibiting a higher overall appreciation compared to females. In other words, males are more inclined to acknowledge that peer review enhances online learning outcomes. This phenomenon may be influenced by several factors: (1) Gender differences and peer influence. In peer-reviewed online learning environments, males may be more readily motivated and influenced by their peers, leading to more active participation and improvement. A peer culture oriented towards learning may be more conducive to male engagement, with peer review serving as a means to stimulate their motivation for learning. (2) Critical thinking and feedback mechanisms. Peer review requires students to provide objective evaluations of their peers' work, which fosters critical thinking skills. Males may be more inclined to embrace and appreciate this evaluation method as it satisfies their need for logical analysis and judgment. (3) Learning styles and self-perception. Males might be more inclined towards competition and challenge, while females might emphasize cooperation and understanding. Peer review provides males with a platform to demonstrate their abilities and embrace challenges, thus they may recognize this method more positively. Peer review helps students gain a more objective understanding of their strengths and weaknesses. For males, this enhancement in self-awareness may be particularly significant as it aids in building confidence and clarifying their direction of effort.

6.2 The Effect of Motivation on Learning Outcomes

The investigation revealed that, among the 258 students who participated in the survey, only 89 expressed an interest in engaging in online peer assessment, accounting for 34.5% of the total.

These students believed that online peer assessment somewhat fostered their critical thinking development and that evaluating peers' learning outcomes also prompted them to reflect on their own, identifying strengths and weaknesses, which greatly enhanced their learning effectiveness. Conversely, 65.5% of the students, totaling 169 individuals, reported that their participation in online peer assessment was merely a requirement for course evaluation, with no genuine interest in the process. They felt that peer assessment imposed psychological pressure and had no positive impact on their online learning outcomes. This phenomenon might be attributed to several reasons: (1) Most university students are accustomed to receiving unidirectional evaluations and summative assessments from teachers within traditional educational models, while they find process-oriented evaluations and peer assessments—more dynamic and interactive methods—relatively unfamiliar. They may display a lack of confidence and resistance towards peer assessment. This psychological state not only restricts their self-reflection and growth during the learning process but also affects their collaboration and communication with peers, thereby impacting the overall learning effectiveness. Interviews with some students have corroborated this viewpoint. Therefore, relevant training and guidance are necessary to help them understand and adapt to peer assessment, thereby enhancing their enthusiasm and engagement in learning. (2) In online peer assessment, students with high internal learning motivation focus more on self-improvement and the satisfaction derived from the learning process, and are more inclined to derive a sense of achievement and self-worth from their learning experience. As a learning method, online peer assessment enables them to participate more actively and feel a greater sense of responsibility. Through peer assessment, they gain a more intuitive understanding of their learning status and receive valuable feedback and suggestions, which contribute to their self-improvement and satisfaction with the learning process. (3) Students with strong external motivation often focus on obtaining external rewards or recognition, such as grades or certificates, and perceive no direct connection between peer assessment and these external rewards, leading to lower regard for it. Such students may doubt the competence and fairness of their peers' evaluations, believing that peers without professional backgrounds or experience may not provide accurate or valuable feedback. Students with strong external motivation may also prefer to invest their time in learning activities that directly yield external rewards, viewing peer assessment as time-consuming and thus unwilling to engage actively. In some cases, students with strong external motivation might view peers as competitors rather than collaborators, which could lead to reluctance in sharing knowledge or experiences and accepting peer evaluations. In summary, due to shifts in focus, trust issues, time costs, and competitive attitudes, students with strong external motivation may consider peer assessment ineffective in improving online learning outcomes. For such students, appropriate guidance and incentive measures may be required to enhance their understanding of peer assessment.

6.3 The Effect of the Quality of Peer Assessment on Learning Outcomes

Survey results reveal that students have provided varied responses regarding the impact of peer assessment quality on learning outcomes. (1) 182 (70.5% of the total surveyed students) believe that clear and reasonable peer assessment criteria enhance their learning effectiveness during online peer evaluations. Indeed, a set of well-defined, specific, and actionable assessment criteria can delineate the content and dimensions of the evaluation, allowing students to assess accurately. Moreover, criteria that concretize teaching objectives and subject characteristics can thoroughly and objectively map out students' learning approaches. (2) 171 (66.3%) students think that an objective and impartial evaluation process can improve learning outcomes. This requires students to base their peer assessments on facts, maintaining an objective and neutral stance to avoid subjective assumptions and emotional biases that could affect the accuracy and reliability of the evaluation

results. Peer assessments should ensure that every student receives a fair evaluation opportunity, without bias or discrimination arising from personal preferences or relationships. (3) 123 (47.7%) students believe that comprehensive and multi-dimensional evaluation content can enhance online learning effectiveness. Peer assessments should cover various aspects, including students' learning achievements, attitudes, collaborative abilities, and innovative spirit, to reflect a comprehensive view of students' learning conditions and to understand their learning characteristics and emotional needs. (4) 218 (84.5%) students unanimously agree that timely and constructive feedback significantly stimulates interest in participating in peer evaluations and improves one's learning outcomes. Peer assessment results are generally provided promptly to the evaluated students, allowing them to understand their strengths and weaknesses and adjust their learning strategies and methods. Accompanied by encouragement and support, constructive feedback helps students build confidence and motivation. Constructive evaluations include specific improvement suggestions and development directions, guiding the evaluated students to identify their areas for improvement and strive for progress. (5) 196 (76.0%) students believe that the active participation and professionalism of peers in online learning peer assessments can enhance learning outcomes. Peer assessments require evaluators to take their evaluation tasks seriously, actively participate in the evaluation process, and trust their peers. Importantly, evaluators should possess a certain level of professional competence and evaluative ability, accurately understanding and applying assessment criteria to evaluate peer learning outcomes objectively and fairly. Additionally, evaluators should have good communication skills and a cooperative spirit to establish a positive interactive relationship with the evaluated peers.

6.4 The Effect of Teacher Guidance and Support on Learning Outcomes

In the realm of online learning, the guidance and support provided by instructors play a pivotal role in enhancing the effectiveness of peer evaluations among university students. Among the 258 students who participated in the survey, 237 (91.9%) affirmed the significant impact of instructors' guidance and support on the quality and efficacy of peer evaluations in online learning environments. The critical nature of instructors' roles in online peer evaluations manifests in several key aspects: (1) Clarifying the purpose and significance of peer evaluations, instructors must elucidate the objectives and value of peer assessments, helping students understand how these evaluations can enhance critical thinking, learn from others' strengths, and foster teamwork. By highlighting the positive effects of peer evaluations, instructors can stimulate students' enthusiasm and willingness to engage in these activities. (2) Establishing clear evaluation criteria, including aspects such as content, structure, and language, to ensure students have a definitive reference for their assessments; uniform evaluation standards reduce subjectivity and variability in the evaluation process, thus improving its objectivity and accuracy. (3) Providing necessary guidance and training, through demonstration of the evaluation process to offer students a tangible understanding of effective peer evaluations, including how to identify strengths, point out weaknesses, and propose improvements; this can be achieved through lectures, workshops, and other training forms to enhance peer evaluation skills. (4) Monitoring the progress of peer evaluations throughout the process, ensuring all students participate on time, and offering personalized support for any difficulties encountered during the evaluations. (5) Encouraging students to learn from and exchange with each other during the peer evaluation process, fostering a collaborative environment where students feel comfortable sharing their views and listening to feedback. (6) After the completion of peer evaluations, organizing reflection sessions to distill successful practices and areas for improvement; based on student feedback and analysis of evaluation outcomes, continually optimizing the peer evaluation mechanism to enhance its effectiveness and practical value.

7. Conclusions and Outlook of the Study

7.1 Findings of the Study

This study, by delving into the factors influencing the effectiveness of online learning through peer assessment among college students, reaches the following main conclusions: (1) The quality of peer assessment significantly impacts learning outcomes: high-quality peer assessments not only enhance student engagement and motivation but also effectively foster the development of critical thinking and improve learning results. Clear and reasonable evaluation criteria, an objective and fair assessment process, comprehensive and multi-dimensional evaluation content, and timely and constructive feedback all positively influence learning outcomes. (2) Learning motivation is a key factor affecting learning effectiveness: students with strong intrinsic motivation are more likely to gain a sense of achievement and self-improvement from peer assessments, whereas students with strong extrinsic motivation may be skeptical or reluctant due to distrust in peer assessments or considerations of time costs. Therefore, stimulating students' intrinsic motivation is crucial for enhancing the effectiveness of peer assessment. (3) Students' learning backgrounds moderate the effects of peer assessment: there are differences in the acceptance of peer assessment among students from different majors and genders. Students in computer-related fields, due to the practical nature of their studies, the need for teamwork, and critical thinking, are more inclined to recognize the benefits of peer assessment on learning outcomes. Additionally, male students exhibit higher levels of acceptance in peer assessment compared to female students, which may be related to factors such as gender role perceptions, critical thinking, and learning styles. (4) Teacher guidance and support play a significant role in the effectiveness of peer assessment: teachers' clear instructions, establishment of evaluation standards, provision of training, and monitoring of feedback significantly enhance the effectiveness and fairness of peer assessment, thereby promoting students' learning outcomes.

7.2 Follow-up Study Program

Based on the findings of this study, we propose the following plans for further research to deepen and expand the relevant field of study: (1) Refining the standards and assessment methods for peer evaluation quality: Further exploration into formulating more detailed and actionable evaluation criteria, as well as developing effective assessment tools to measure the quality of peer evaluations, providing a scientific basis for enhancing evaluation effectiveness. (2) Investigating the specific impact of different types of learning motivation on peer evaluation outcomes: Through longitudinal and experimental research, a thorough analysis of the differential effects of intrinsic versus extrinsic motivation on peer evaluation outcomes in various contexts, offering more targeted recommendations for educational practice. (3) Considering the multifaceted impact of learning background factors: Expanding the research sample to include students from diverse professional backgrounds and genders, further exploring the multifaceted moderating effects of learning background on peer evaluation outcomes, supporting personalized instruction. (4) Strengthening the effectiveness research of teacher support and guidance strategies: Evaluating through case studies and intervention experiments the practical effects of various teacher support strategies in enhancing peer evaluation outcomes, providing guidance for teacher professional development. (5) Introducing new technological means to optimize the peer evaluation process: Exploring how to utilize modern information technologies such as artificial intelligence and big data to refine the peer evaluation process, improving evaluation efficiency and accuracy, and offering more personalized learning feedback to students.

Acknowledgements

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