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Barriers and Enablers to Adopting Virtual Reality in Lower Secondary STEAM Curricula

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Abstract

This study investigates the barriers and enablers to VR integration in middle school STEAM curricula, addressing a notable gap in the existing literature. A systematic literature review and qualitative synthesis were conducted, supported by bibliometric analysis, to examine key concepts, including technological barriers, teacher training needs, and policy interventions. Data were extracted and coded to ensure a comprehensive analysis of academic publications, emphasizing VR-driven educational outcomes and systemic challenges. Findings reveal that technological limitations, such as high costs and infrastructure deficits, alongside insufficient teacher training and institutional resistance, are significant barriers. Enabling factors include targeted professional development, collaborative platforms, and policy reforms that enhance accessibility and scalability. Case studies highlight VR's potential to transform STEAM education when supported by inclusive strategies and cost-effective technologies. This study underscores the importance of aligning policy, training, and infrastructure to ensure sustainable VR integration.

Keywords: Virtual reality (VR), STEAM education, educational technology, student engagement, teacher training, and interdisciplinary learning

1. Introduction

Virtual Reality (VR) has emerged as a revolutionary educational tool, especially in the STEAM (science, technology, engineering, arts, and mathematics) fields. Through its immersive and interactive learning environments, virtual reality (VR) encourages more engagement and makes it easier to understand complicated concepts. For instance, Vázquez & Palencia (2024) showed how VR improves spatial reasoning and geometry problem-solving abilities. Lin et al. (2024) emphasized how technology might help kids with learning impairments by giving abstract ideas a concrete form. Despite these advantages, a number of contextual and systemic issues have prevented VR from being widely used in lower secondary STEAM curricula. Expensive equipment prices, inadequate technology infrastructure, and a lack of teacher preparation hamper adoption of VR. Institutional reluctance and challenges in integrating VR content with current curricula exacerbate these barriers, according to studies like Wang (2024) and Ravichandran & Mahapatra (2023). These difficulties are further compounded by ethical considerations like the digital divide and health issues like VR sickness (Ozgun & Sadık, 2023; Chalkiadakis et al., 2024).

A multifaceted strategy including legislation changes, technology improvements, and systemic support for educators is needed to overcome these obstacles. On the other hand, facilitating elements like focused professional development, sophisticated writing tools, and encouraging legislative frameworks play a crucial role in encouraging VR integration. For example, Tafazoli (2024) emphasizes how professional development helps teachers become more confident and have better skill sets, while partnerships and collaborative platforms facilitate resource sharing and innovation (Oubahssi et al., 2024). Furthermore, Shankar et al.'s (2023) investigation of transdisciplinary VR applications shows how it might promote critical thinking and creativity in STEAM education.

This study aims to identify and evaluate the obstacles and facilitators to VR adoption in lower secondary STEAM curricula. To overcome these obstacles and promote fair, efficient, and long-lasting VR integration in international educational contexts, it attempts to synthesize results from case studies and current research.

This study aims to investigate the primary barriers hindering the adoption of Virtual Reality (VR) in lower secondary STEAM curricula, focusing on technological, institutional, and teacher-related challenges. It explores enabling factors such as teacher training, policy reforms, and technological advancements that support VR integration. Additionally, the study examines successful case studies of VR implementation to identify best practices for addressing systemic challenges. By synthesizing these insights, the research seeks to develop actionable recommendations to promote equitable and sustainable VR use in STEAM education, fostering broader accessibility and effectiveness in middle school learning environments.

This study seeks to answer key questions: What are the primary barriers to adopting VR in lower secondary STEAM curricula? What enabling factors support its integration? How can successful case studies inform strategies for overcoming challenges? Finally, what policy, training, and technological interventions are needed to foster equitable and sustainable access to VR in STEAM education?

2. Theoretical Framework

The theoretical framework for this study is grounded in the Technology Acceptance Model (TAM) (Su & Li, 2021), Constructivist Learning Theory (Shah, 2019; Bada, 2015), and Diffusion of Innovations Theory (Dearing & Cox, 2018; García-Avilés, 2020). Together, these theories provide a comprehensive lens to understand the barriers and enablers of adopting Virtual Reality (VR) in lower secondary STEAM curricula. Based on VR's promise to improve engagement, comprehension, and collaboration, the Technology Acceptance Model (TAM) emphasizes how perceived utility, technical support, user training, and simplicity of use affect teachers' and students' desire to accept the technology. Constructivist learning theory, which emphasizes active knowledge production through experiential learning and lets students explore and work together in interactive environments, is in line with virtual reality's immersive qualities. Lastly, the Diffusion of Innovations Theory provides techniques to overcome opposition and expedite implementation, explaining that institutional preparation, governmental backing, and professional development are necessary for VR acceptance.

3. Literature Gap and Significance

An important turning point in a student's academic career is middle school. Students start to establish their interests and goals throughout this time of major cognitive and social growth (Yun, 2023). These early years are greatly influenced by STEAM education. STEAM courses give students the critical thinking, problem-solving, creativity, and teamwork abilities they need to succeed in the workforce of the twenty-first century (MacCallum, 2021; Hawkinson, 2024). Virtual reality (VR) has the potential to greatly improve the learning process in middle school STEAM programs, making these disciplines more interesting and available to a larger group of pupils (Hawkinson, 2024). Virtual Reality (VR) adoption in lower secondary STEAM curricula faces significant unexplored barriers. Existing research often overlooks systemic issues like institutional resistance, teacher training deficits, and curriculum misalignment. Moreover, enabling factors such as professional development and policy reforms lack comprehensive frameworks addressing these challenges holistically. This study fills the gap by analyzing barriers and enablers, focusing on middle school STEAM education. It offers actionable strategies and

replicable best practices for policymakers and educators, contributing to equitable and sustainable VR integration globally.

4. Research Hypotheses

This study examines factors influencing the adoption of virtual reality (VR) in lower secondary STEAM education. It hypothesizes that institutional barriers, including high costs and limited infrastructure (H1), and teacher-related issues like inadequate professional development and resistance to technology (H2), hinder VR integration. Conversely, enabling factors such as targeted teacher training, collaborative platforms, and supportive policies (H3) are expected to facilitate successful adoption. Additionally, advancements in affordable technologies and equitable policy reforms are proposed to enhance VR accessibility and sustainability (H4). Together, these hypotheses explore challenges and opportunities for incorporating VR into STEAM curricula effectively.

5. Methodology

5.1 Conceptual Framework Development

A conceptual framework was developed using literature analysis and concept mapping to refine key aspects of VR integration, such as infrastructure, teacher training, and policy alignment. Relationships between barriers and enablers were analyzed to overcome challenges and enhance STEAM education. A systematic literature review and qualitative synthesis examined VR's impact on engagement, critical thinking, and interdisciplinary learning. Bibliometric analysis highlighted trends, enablers, and challenges, showcasing VR's transformative potential while addressing constraints like technology, teacher readiness, and policy alignment.

5.2 Evaluation of VR Integration in STEAM Curricula

The evaluation process involved a systematic review conducted in adherence to PRISMA criteria across multiple academic databases, including Google Scholar, PubMed, Scopus, Web of Science, JSTOR, and ProQuest. Boolean search terms and targeted keywords such as "Virtual Reality," "STEAM education," "barriers," and "enablers" were used to identify relevant studies published between 2013 and 2024. The review prioritized original research and recent studies exploring VR's role in enhancing critical thinking, problem-solving, and student engagement in STEAM contexts. The findings emphasized VR's potential to create inclusive, interdisciplinary educational frameworks aligned with modern pedagogical and technological advancements.

5.3 Inclusion Criteria for Qualitative Synthesis

The qualitative synthesis focused on original research articles published in English in reputable journals or conference proceedings, excluding theses, and dissertations. Selected studies explored VR integration in middle school STEAM education, highlighting its impact on fostering engagement, critical thinking, and interdisciplinary collaboration. Additionally, studies that examined enabling factors like teacher training, technological infrastructure, and policy alignment were included to ensure a comprehensive analysis of barriers and enablers. This approach ensured that the synthesis provided actionable insights into creating equitable and sustainable educational practices leveraging VR technology.

5.4 Article Selection Process

A total of 1350 documents were found from several databases, and their relevancy was assessed using title and keyword in the first stage. A number of 250 articles remained after 650 duplicates and 450 ineligible records were removed. The abstracts of these papers were examined for relevant information related to the topic to vet them further. Item failure to meet the predefined inclusion criteria was eliminated during the final screening. 67 articles were chosen and evaluated for qualitative synthesis because of this stepwise selection procedure, as shown in Figure 1.

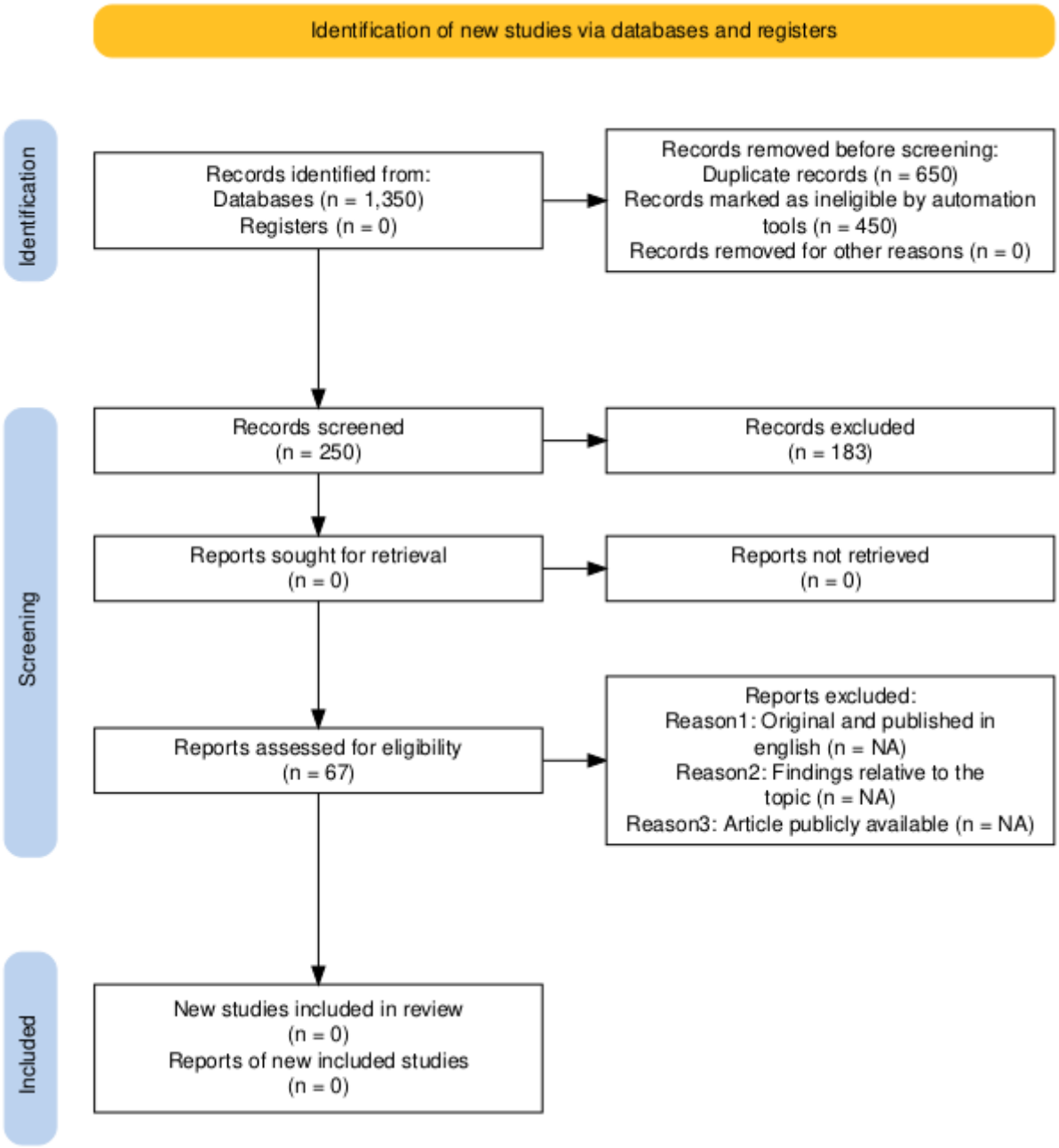

Figure 1. Identification of new studies via databases and registers (PRISMA diagram) (Haddaway et al., 2020)

5.5 Data Extraction and Data Analysis

A systematic data extraction process was employed to examine the integration of virtual reality (VR) in lower secondary STEAM curricula. Relevant information, including authorship, theoretical frameworks, research methods, findings, and limitations, was documented using a structured Excel sheet for reliability and comprehensiveness. A mixed-methods approach combined regression analysis to evaluate VR's impact on academic achievement, engagement, and accessibility with co-occurrence analysis to identify research trends. Thematic and content analyses explored barriers like infrastructure and teacher training while addressing ethical concerns like the digital divide. These analyses provided actionable insights to overcome systemic challenges and promote VR adoption.

5.6 Ethical Considerations

Throughout the study, ethical considerations were rigorously upheld. Data privacy was ensured by anonymizing personal information, and all sources were appropriately credited in

adherence to copyright laws (Ducato, 2020; Hornuf et al., 2023). The research followed ethical guidelines for implementing VR in education, critically evaluating potential biases, risks, and accessibility concerns associated with immersive technologies. These measures ensured a responsible approach to addressing systemic barriers while fostering equitable and sustainable VR integration in STEAM curricula.

6. Findings

6.1 Article Publishing Trends Between 2013 and 2024

Figure 2 shows the annual distribution of publications from 2013 to 2024, highlighting an increasing trend in research activity. The field saw minimal contributions in its early years, with only one publication each in 2013, 2018, and 2019. A noticeable rise began in 2020 with seven publications, followed by consistent growth, peaking at 15 in 2023. This surge reflects heightened interest, likely driven by advancements in technology and educational practices. A slight decline to 11 publications in 2024 suggests stabilization in the field. Overall, the figure demonstrates the evolving nature of research in this area, emphasizing its growing relevance (Figure 2).

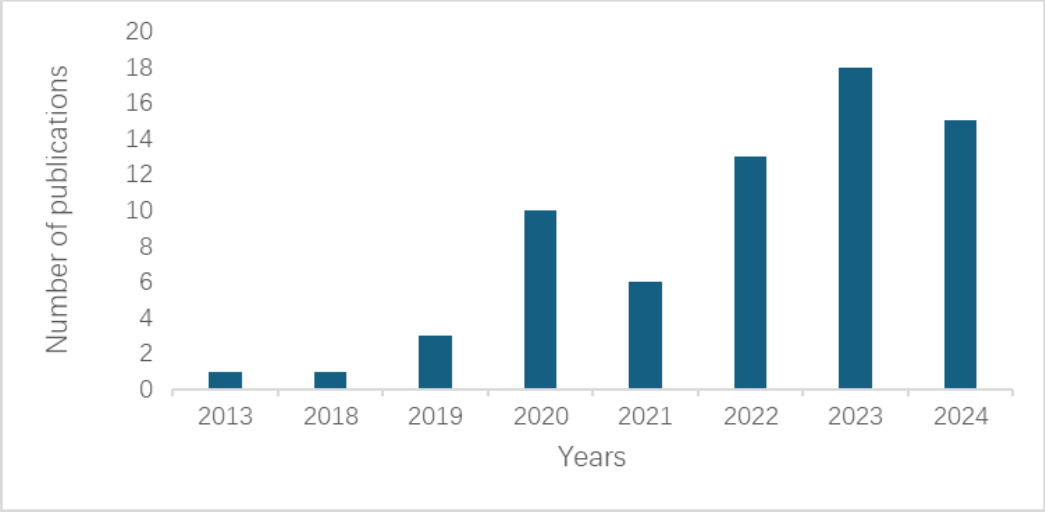

Figure 2. Trends in Publications on Sustainable Education and Youth Entrepreneurship (2013-2024)

6.2 Citation Frequency of Key Studies in VR and STEAM Research

The contributions of different authors are highlighted in Figure 3, which displays a broad variety of publication or citation numbers. With more than 2,000 citations, Merchant et al. (2014) stands out as having had a substantial impact on the field. Notable contributions with comparatively large citation counts are also displayed by other writers, such Zingraff (2020) and Maas & Hughes (2020), demonstrating their significance in furthering the field of study. However, most authors have fewer citations, which suggests that their work is either new or specialized. This distribution highlights the diversity and increasing engagement in this developing discipline, while also highlighting the importance of foundational studies.

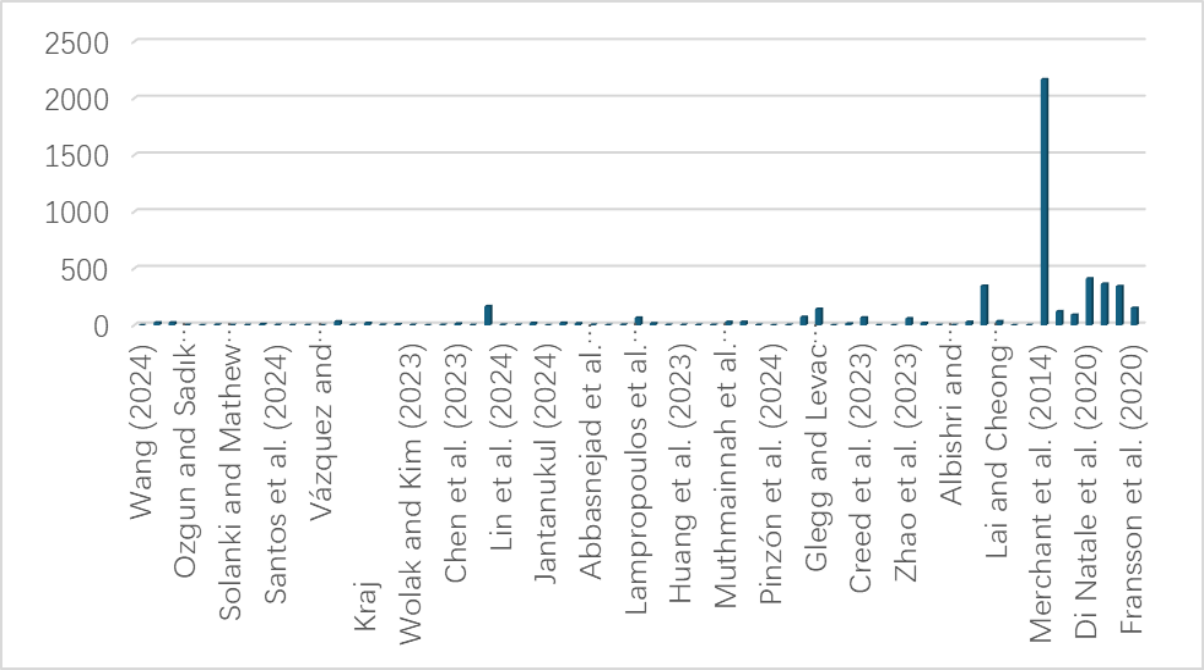

Figure 3. Author Contributions and Citation Impact in VR and STEAM Research

6.3 Exploring Barriers and Enablers to Virtual Reality Adoption in STEAM Education: A Methodological Perspective

Research on Virtual Reality (VR) in education employs diverse methodologies to investigate its adoption and impacts. Like those by Al-Oudat & Altamimi (2022), quantitative studies utilize frameworks such as the Technology Acceptance Model (TAM) to examine adoption factors. Mixed-methods approach, seen in Wang (2024), integrate surveys and interviews to explore educator perceptions and infrastructure needs. Systematic reviews, like Pirker and Dengel (2021), synthesize trends and barriers, while experimental designs, such as Abbasnejad et al. (2022), assess VR's effectiveness in STEAM education. These methodologies underscore the importance of policies, teacher training, and robust technological infrastructure for successful VR integration.

6.4 Key Findings in Adopting Virtual Reality in Lower Secondary STEAM Curricula: A Comprehensive Overview

6.4.1 Impact on Student Engagement and Learning Outcomes

Studies such as Wang (2024) and Vázquez & Palencia (2024) demonstrate that VR significantly enhances student engagement, motivation, and comprehension of complex concepts. VR environments promote cognitive, affective, and behavioral engagement by making abstract concepts tangible and encouraging critical thinking and problem-solving. Applications in subjects like geometry and STEM highlight VR's ability to bridge theoretical and practical knowledge, improving academic performance and essential skills development. The immersive nature of VR fosters deeper learning and helps students connect to content more meaningfully.

6.4.2 Barriers to VR Adoption in STEAM Education

Significant challenges hinder VR integration in STEAM classrooms. High costs of equipment and content development, insufficient teacher training, and limited technical infrastructure remain major barriers, as noted in studies such as Al-Oudat & Altamimi (2022) and Lin et al. (2024). Other concerns include health risks like VR sickness, reduced student-teacher interaction, and challenges aligning VR content with established curricula (Ozgun & Sadık, 2023). Organizational resistance and insufficient administrative support further complicate adoption. These issues are particularly pronounced in under-resourced and developing regions.

6.4.3 Technological and Design Aspects of VR

Studies like Baek (2020) and Jantanukul (2024) emphasize that VR's immersive, interactive, and

realistic design features significantly influence user perceptions. Positive attributes such as realism and interactivity foster motivation, while concerns about usability, performance, and adaptability raise challenges. Effective VR design requires careful consideration of both engagement factors and potential drawbacks, including issues like immersion-related anxiety or cognitive overload.

6.4.4 Teacher Autonomy and Professional Development

Teacher autonomy and training are pivotal for successful VR adoption. Du et al. (2022) and Oubahssi et al. (2024) emphasize the need for tailored training programs that foster teacher confidence and equip them with the skills to integrate VR into lessons effectively. Advanced authoring tools and resources that streamline VR content creation are critical to empowering educators and supporting adoption in diverse classroom contexts.

6.4.5 Ethical and Equity Considerations

Chalkiadakis et al. (2024) and Creed et al. (2023) highlight the ethical and equity concerns surrounding VR adoption. Issues like the digital divide, unequal access to resources, and privacy risks need to be addressed to ensure equitable adoption. Accessibility barriers for students with disabilities and underserved populations are particularly pressing, underscoring the need for inclusive design and policy measures.

6.4.6 Navigating Health, Safety, and Interdisciplinary Opportunities in VR Adoption

Virtual Reality (VR) adoption in education faces significant health and ethical challenges. Prolonged use can cause VR sickness, especially in younger students, as highlighted by Ozgun & Sadık (2023). Ethical concerns such as data privacy, algorithmic bias, and the digital divide further complicate integration. Clear guidelines for safe use, equitable access, and inclusive design are vital for sustainable implementation. Additionally, VR's interdisciplinary potential, particularly when combined with Augmented Reality (AR) and Mixed Reality (MR), fosters collaborative learning. Shankar et al. (2023) highlights how such integration enhances STEM education, promoting teamwork, creativity, and critical thinking.

6.4.7 Context-Specific Challenges and Opportunities

Regional factors, such as those discussed by Pinzón et al. (2024) and Swargiary (2023), play a crucial role in shaping VR adoption. In resource-constrained settings, challenges like limited infrastructure, inadequate funding, and cultural resistance to new technologies are significant. However, tailored solutions, such as localized VR content and affordable hardware, present opportunities to overcome these barriers and ensure wider adoption.

6.4.8 Policy and Strategic Implications

Successful VR integration requires systemic approaches involving collaboration between educators, policymakers, and technologists. Tailored strategies addressing cost, accessibility, and training gaps are critical for maximizing VR's transformative potential in STEAM education. Policies that support infrastructure development, professional training, and inclusive practices can help VR revolutionize teaching and learning, equipping students with essential skills for 21st-century challenges.

6.5 Addressing Barriers to Virtual Reality Integration in STEAM Education

The research studies of adoption of Virtual Reality (VR) in STEAM education faces multiple challenges that limit its transformative potential. Contextual and methodological constraints, such as geographic specificity and reliance on cross-sectional designs, restrict the generalizability of findings. Studies like Wang (2024) and Du et al. (2022) emphasize the need for longitudinal and multi-contextual research to assess VR's adaptability across diverse settings. Technological and design challenges, including high costs, limited infrastructure, and usability issues, further hinder integration, as noted by Lin et al. (2024). The lack of teacher training and professional development programs is another persistent barrier, with studies advocating for advanced tools and structured frameworks to empower educators. Ethical concerns, such as privacy, inclusivity, and health risks like VR sickness, require urgent attention. Future directions emphasize interdisciplinary collaboration, policy reform, and cost-effective solutions to overcome these barriers. Addressing these challenges is essential to unlocking VR's potential for innovation and inclusivity in education.

7. Discussion

7.1 Trends and Methodological Challenges in Virtual Reality Research

The integration of Virtual Reality (VR) into lower secondary STEAM education has gained significant scholarly attention, as reflected in the increasing number of studies exploring its pedagogical impact. However, research in this field often encounters methodological challenges, such as limited geographic and cultural contexts, small sample sizes, and reliance on cross-sectional data. Studies like Wang (2024) and Du et al. (2022) demonstrate promising outcomes but are constrained by single-region scopes, limiting generalizability. Future research should prioritize longitudinal designs and cross-cultural investigations to evaluate VR's sustained impacts and adaptability in diverse educational environments.

7.2 Technological and Design Limitations

Technological barriers remain a significant challenge for VR adoption. High equipment costs, limited infrastructure, and usability concerns hinder widespread implementation. As noted by Ravichandran and Mahapatra (2023) and Lin et al. (2024), scalability and cost-effective solutions are critical to overcoming these obstacles. Furthermore, VR systems often lack accessibility and adaptability, which impacts their effectiveness in meeting diverse student needs. Addressing these limitations through innovative system designs and technical improvements is essential to ensure VR's broader integration in STEAM curricula.

7.3 Teacher Training, Professional Development, and Individual Barriers

The role of teacher training in successful VR integration cannot be overstated. Studies such as those by Baek (2020) and Oubahssi et al. (2024) highlight the lack of structured professional development programs and advanced authoring tools for educators. Tafazoli (2024) further underscores the challenge of individual teacher resistance, insufficient technological proficiency, and systemic institutional constraints as barriers to adopting computer-assisted technologies, including CALL in Iran. While professional development opportunities enhance teacher confidence and skillsets, they alone cannot address broader contextual barriers. These findings highlight the critical need for multi-level interventions, including institutional support and systemic policy changes, to empower teachers with the tools and motivation needed to integrate VR effectively into their teaching.

7.4 Navigating Health, Safety, and Interdisciplinary Opportunities in VR Adoption

Virtual Reality (VR) adoption in education faces significant health and ethical challenges. Prolonged use can cause VR sickness, especially in younger students, as highlighted by Ozgun & Sadık (2023). Ethical concerns such as data privacy, algorithmic bias, and the digital divide further complicate integration. Clear guidelines for safe use, equitable access, and inclusive design are vital for sustainable implementation. Additionally, VR's interdisciplinary potential, particularly when combined with Augmented Reality (AR) and Mixed Reality (MR), fosters collaborative learning. Shankar et al. (2023) highlights how such integration enhances STEM education, promoting teamwork, creativity, and critical thinking.

7.5 Transformative Potential of Virtual Reality in Enhancing Educational Engagement and Learning Outcomes (Case Studies)

Virtual Reality (VR) has demonstrated immense potential in educational settings, as illustrated by notable case studies. It has proven transformative in educational settings, enhancing engagement, comprehension, and interdisciplinary learning across various disciplines. Leong et al. (2024) illustrated the impact of VR through Google Expeditions, which enabled students to take virtual field trips, such as exploring ancient Rome, fostering a deeper understanding of historical and cultural contexts. Mondly VR transformed language learning by immersing students in virtual environments, improving motivation and fluency. Similarly, VR-based physics simulations allowed students to visualize abstract concepts, significantly boosting their interest and comprehension in STEM education. These cases underscore the interactive and inclusive nature of VR in fostering critical thinking. Kluge et al. (2022) highlighted the University of Newcastle's use of extended reality (XR) in disciplines like procedural training and criminology. Despite challenges such as infrastructure limitations and cost constraints, the initiative demonstrated VR's capacity for hands-on, safe learning experiences. Interdisciplinary collaboration and iterative software development proved crucial for successful implementation. Zakaria et al. (2020) further emphasized VR's role in primary science education in Malaysia, using immersive tools

like Google Expeditions to improve concept retention and engagement. Similarly, McGrath et al. (2010) demonstrated VR's ability to simplify complex physics concepts. Together, these examples showcase VR's potential to revolutionize education through innovative, scalable approaches.

7.6 Policy Implications and Strategic Directions

Policy barriers, including insufficient institutional support and misaligned curricula, further restrict VR adoption. Studies like Lin et al. (2024) and Santos et al. (2024) emphasize the need for strategic collaborations among policymakers, educators, and technologists. Tafazoli (2024) reinforces the importance of multi-level interventions, particularly in addressing systemic country-level challenges and institutional constraints, which are critical for the successful integration of educational technologies. Policies should address infrastructure gaps, funding models, and equitable access to ensure VR can be adopted at scale. The role of public-private partnerships in driving innovation and accessibility is also critical to realizing VR's potential in STEAM education.

8. Implications of this Study

8.1 Theoretical Implications

By analyzing systemic obstacles like teacher opposition and infrastructure deficiencies with facilitators like professional development and supportive policies, this study contributes to the theoretical understanding of VR integration in lower secondary STEAM education. Future educational research will be guided by the framework it offers for tackling accessibility issues and the digital divide while promoting participation, critical thinking, and interdisciplinary learning.

8.2 Practical Implications

Through scalable teacher training, equitable access programs, and affordable infrastructure, this study addresses systemic constraints and offers practical ways for incorporating VR into STEAM education (Baek, 2020; Ravichandran & Mahapatra, 2023). Policymakers, educators, and technologists can find useful solutions to promote the sustainable and equitable adoption of VR by aligning VR technologies with curricula, which creates engaging and effective learning environments (Huang et al., 2023; Lin et al., 2024).

9. Conclusion

The revolutionary potential of virtual reality (VR) in lower secondary STEAM education is examined in this study, with a focus on how it might improve interdisciplinary learning, engagement, and critical thinking. It draws attention to the significance of professional development, policy alignment, and equal resource access by tackling obstacles including technical restrictions and teacher-related difficulties. The study fills in holes in the literature by concentrating on STEAM instruction in middle schools, which is frequently disregarded in VR research. Actionable tactics for long-term VR integration are provided by the useful suggestions from case studies. To ensure that VR's potential for inclusive and future-ready education is realized, future research should investigate creative frameworks to address systemic issues.

10. Limitations and Future Research Directions

This study is constrained by its dependence on prior research, which may cause it to miss recent advancements or regional differences in VR usage. Other academic levels and fields are left out of the middle school STEAM education focus. Subsequent investigations ought to delve into the enduring effects of virtual reality on educational results in various settings, with a focus on reasonably priced technology, educator preparation, and legislative structures for fair and sustainable incorporation (Merchant et al., 2013; Campos et al., 2022).

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Ethics Statement

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to. No ethical approval was required as this is a systematic review article with no new data collection on site, on animals or human beings.

Conflict of Interest

There is no conflict of interest with me about this review article. The study is self-funded, and all sources of financial support have been disclosed.

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The Perceived Role of Teachers in Resolving Conflicts Between Students: Reflections on Effectiveness and Intervention

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Abstract

This article proposes a reflection on the perceived role of teachers in managing conflicts between adolescents in the school context. The central focus is on how educators perceive and interpret conflicts between students, and how this perception influences their resolution strategies and the effectiveness of interventions. Through a theoretical review, the nature of conflict in the school environment is explored, addressing the different types and levels of conflict (intrapersonal, interpersonal, intragroup, and intergroup) and their causes, such as social, emotional, and cultural factors. Furthermore, conflict resolution strategies based on existing theories are discussed, with an emphasis on the active role of teachers in mediation, prevention, and resolution of disputes. The reflection also includes an analysis of the consequences of unresolved conflicts, both for the students involved and for the school environment in general. Based on teachers' perception of conflict and their role in mediation dynamics, the article argues that a conscious and informed approach can increase the effectiveness of pedagogical intervention. The article concludes with recommendations on how to improve teacher training in conflict management, aiming to promote a more harmonious and inclusive school environment. This reflection seeks to contribute to a deeper understanding of the interaction between teachers, students, and conflict in the educational context.

Keywords: conflict management, teachers' perception, adolescents, conflict resolution, school mediation, educational environment

1. Introduction

The increasing complexity of school environments, characterized by cultural diversity, socio-economic disparities, and the varied personal experiences of students, has contributed to the emergence and intensification of conflicts among adolescents. In the current context, conflicts arise not only as a reflection of the tensions inherent in social relationships but also as opportunities for the development of emotional and social skills (Souza & Guilherme, 2024).

The intervention of teachers, in this sense, proves to be fundamental, as they act as mediators and facilitators of a harmonious learning environment. The way in which

teachers perceive and respond to conflicts can significantly influence both the emotional well-being of students and the school climate (Spilt et al., 2012; Valente & Lourenço, 2022). The goal is to provide more effective and tailored strategies for supporting learning, taking into account the idiosyncrasies of each student and the challenges that arise in the school context as a whole (Landim, 2025).

In schools, conflicts among adolescents can manifest in various forms, ranging from interpersonal misunderstandings to tensions that develop between groups. These conflicts can have various origins, including identity issues, cultural differences, and value conflicts, and, if not properly managed, they can evolve into situations of bullying, isolation, and sometimes violence (Ferreira et al., 2024).

The role of teachers, therefore, goes beyond the traditional teaching of curriculum content, requiring an integrated approach that includes conflict mediation and the promotion of a culture of peace. Recent studies highlight that positive and collaborative school environments are crucial for the academic and personal development of students, and that effective teacher intervention is one of the key factors contributing to such an environment (Chrispino & Chrispino, 2023; Sebaje et al., 2019; Valente & Lourenço, 2022).

Despite the recognized importance of teachers as mediators, the perception they have of their own role in conflict management is not always optimized or valued in the training process. Many teachers face significant challenges when trying to identify early signs of conflict and apply resolution strategies that address the needs of students (Ribeiro de Lima, 2024; Zee & Koomen, 2016). The lack of continuous training and institutional support can lead to a sense of helplessness, which in turn compromises the effectiveness of interventions. Additionally, the pressure to maintain order and academic performance can limit teachers' availability to empathetically address conflicts, resulting in reactive rather than preventive approaches (Silva et al., 2022). Thus, the question arises: how does the perception teachers have of their competencies and their mediating role influence conflict resolution? And what strategies can be adopted to strengthen this perception and, consequently, improve the school climate?

This article analyzes the role of teachers in resolving conflicts between students and how this perception influences intervention strategies and the school environment. The main objectives of the study are: to explore the nature of conflicts among adolescents, from intrapersonal manifestations to intergroup dynamics, identifying the underlying causes; to assess how teachers interpret their role as mediators and how this perception translates into effective pedagogical practices; to review contemporary theories and practices of mediation and conflict resolution in the school context, emphasizing approaches that promote dialogue and inclusion; and to identify gaps and challenges in teacher training, pointing to the need for continuous professional development that allows them to enhance their mediation and intervention skills.

This study aims to highlight the importance of recognizing teachers not only as knowledge transmitters but also as agents of social transformation. Based on a theoretical review grounded in contemporary authors, the article emphasizes the urgency of promoting training that includes socio-emotional skills and conflict resolution (Alves et al., 2023; Maia et al., 2021; Santos et al., 2025). By identifying and discussing teachers' perceptions, the study aims to contribute to the creation of intervention strategies applicable in various school contexts, improving the quality of the educational environment and promoting the holistic development of students.

The article is structured into four main sections. The first, a theoretical review, analyzes in detail the main theories on conflicts and their resolutions, addressing dimensions such as intrapersonal, interpersonal, intragroup, and intergroup, as well as their causes. This section underpins the study, contextualizing the pedagogical interventions within a solid theoretical framework, with references to both classical and contemporary authors.

In the second section, the role of teachers as mediators, the perception of teachers regarding their competencies in conflict management and how it influences the strategies adopted are explored. Mediation and intervention practices are analyzed, highlighting the challenges and potentialities of the teaching role, based on empirical studies and critical analyses of recent literature.

The third section, discussion of results,

integrates the theoretical knowledge from the research with pedagogical practice. It reflects on the implications of unresolved conflicts in the school environment and discusses the best practices that can be implemented to improve the effectiveness of teachers' interventions. This analysis offers a critical and constructive perspective, emphasizing the importance of continuous training for teachers.

Finally, the fourth section, conclusions, synthesizes the main findings of the research, highlighting the practical implications for teacher training and intervention in conflict resolution. Recommendations are made for future research and for improving pedagogical practices, aiming to promote more inclusive and harmonious school environments.

In summary, the article proposes a comprehensive and critical reflection on the importance of teachers' perceptions in resolving conflicts between students. It argues for the need for pedagogical intervention based on effective mediation strategies and continuous training that prepares teachers for the challenges of the current school context (Chrispino & Chrispino, 2023; Deutsch et al., 2011). Based on recent literature and empirical studies, the aim is to contribute to the debate on the transformative role of teachers, encouraging practices that promote cohesion and well-being in the educational environment.

2. Theoretical Review

2.1 Conflict: An Overview

Conflict is a phenomenon inherent to human relationships and manifests in various forms in social and institutional contexts. In the school environment, particularly among adolescents, conflicts emerge as part of the emotional, social, and cognitive development process of students (Gusmão & Almeida, 2024). To understand its dynamics, it is essential to analyses its definitions, characteristics, and impacts on learning and the school climate.

Conflict can be defined as a disagreement or incompatibility of interests, values, needs, or expectations between individuals or groups (Deutsch, 2011; Rahim et al., 2018). In the school environment, it can manifest in various ways, including interpersonal conflicts between students, tensions between social groups, or even disagreements between teachers and students. According to several studies (Gusmão & Almeida, 2024; Pereira, 2021; Silva, 2018), conflicts can be classified into four main types: intrapersonal, when an individual experiences doubts or internal contradictions, reflected in school behavior; interpersonal, when it occurs between two or more students, arising from misunderstandings, rivalries, or misperceptions; intragroup, when conflicts arise within the same group, such as a class or work team; and intergroup, between different groups, which may involve cultural, social, or institutional issues.

In the context of adolescence, a phase marked by the construction of identity and the development of autonomy, conflicts become frequent due to the search for self-assertion and emotional and social changes (Levisky, 2025; Ramírez et al., 2024). According to Galvão et al. (2016), the school environment should be a space for building socio-emotional skills, promoting preventive strategies for conflicts.

Conflicts are inherent in human interaction and can be seen both as challenges and as opportunities for growth. According to Deutsch (2011), conflicts can be functional when they promote dialogue and the development of creative solutions, or dysfunctional when they result in aggression, prolonged misunderstandings, and social exclusion. Among the main characteristics of school conflicts, the following stand out: multidimensionality, which involves emotional, social, cultural, and psychological factors; interdependence, where one individual's actions directly affect the responses and perceptions of others; and dynamism, which causes conflicts to evolve over time, potentially being resolved, intensified, or transformed into new forms of interaction.

Effective conflict management in the school context depends on the teachers' ability to identify early signs of tension and apply appropriate pedagogical strategies. According to Alves et al. (2023), mediation and teaching conflict resolution skills can minimize negative impacts and create a more collaborative environment.

The way conflicts are managed can have a significant impact on the school environment. Poorly resolved conflicts can generate a climate of tension, fear, and insecurity, affecting students' well-being and their motivation to learn (Spilt et al., 2012). Studies indicate that schools with high levels of conflict experience

higher rates of absenteeism, decreased academic performance, and difficulties in relationships among students (Valente & Lourenço, 2022).

On the other hand, when properly managed, conflicts can be opportunities for the development of socioemotional skills, such as empathy, active listening, and problem-solving. Conflict mediation by teachers plays a key role in promoting a more collaborative and inclusive learning environment (Sebaje et al., 2019). According to Valente and Lourenço (2022), investing in teacher training for conflict management can contribute to a more harmonious and productive environment.

Thus, understanding the dynamics of conflict in the school context is essential for developing effective mediation and intervention strategies, ensuring a more harmonious and conducive learning environment.

2.2 Theoretical Perspective

The study of conflicts in the school environment requires an integrated understanding of various theoretical approaches from psychology, sociology, and pedagogy. These disciplines offer complementary insights that enrich the management and resolution of conflicts among adolescents.

In psychology, conflict is often analyzed through psychoanalytic theory, which emphasizes intrapsychic conflicts and the influence of the unconscious on human behavior (Canavêz & Oliveira, 2014). Social conflict theory, originating from sociology, focuses on structural inequalities and tensions between social groups (Adorno et al., 2021). Sociology, in turn, examines how social and cultural factors influence conflict dynamics among students, highlighting the need for educational policies that promote equity and inclusion. Pedagogy emphasizes mediation as an essential tool in conflict resolution, proposing methods that transform disputes into opportunities for learning and personal development, fostering socioemotional skills and building a more collaborative school environment (Amorim et al., 2022).

Integrating these theoretical perspectives is fundamental for effective management of school conflicts. Psychology provides tools to understand and regulate the emotions involved in conflicts. Sociology offers a critical view of social structures that may perpetuate conflicts, while pedagogy proposes educational practices that turn conflicts into learning experiences. This integrated approach allows educators to identify the multiple dimensions of conflicts and implement more holistic and effective resolution strategies.

2.3 Theories Related to Adolescent Conflict

Understanding conflicts among adolescents in the school environment requires an in-depth analysis of the theories that elucidate their causes and dynamics. These theories provide insights into the individual and contextual factors that influence the occurrence and escalation of youth conflicts. Various theoretical approaches aim to explain the origins and mechanisms of conflicts among adolescents.

Hirschi's Social Control Theory (1969) suggests that juvenile delinquency results from weakened social bonds. The author identifies four key elements that influence young people's behavior: Attachment, which relates to the emotional bond with parents, teachers, and peers. Adolescents with strong emotional ties tend to respect social norms and avoid deviant behaviors; Commitment, which is associated with investment in conventional activities, such as education and career goals. A high level of commitment acts as a deterrent to delinquency; Involvement, which involves participation in legitimate activities that occupy time and reduce opportunities for deviant behaviors; and Belief, which refers to the acceptance of social norms and values. When adolescents internalize these beliefs, they are less likely to engage in conflicts or delinquent behavior.

This conceptualization is useful for understanding observations about the family and school characteristics of adolescents with disruptive behavior. It is often observed that these young people do not maintain good relationships with parents who are inadequate educators — passive, inconsistent, and disinterested — and are unaware of their children's activities (Monteiro et al., 2019).

The Realistic Conflict Theory (Sherif, 1961) postulates that intergroup conflicts arise from competition for limited resources and incompatible goals. In the school context, groups of adolescents may come into conflict due to competition for social recognition, access to resources, or privileges. Sherif's "Robbers Cave" experiment illustrated how competition can lead to hostility between groups and how common goals can reduce these tensions. His studies were groundbreaking in introducing the first

steps toward understanding intergroup conflicts in social psychology (Fernandes & Pereira, 2018).

Erikson's Psychosocial Development Theory (1968) proposes eight stages that span the human life cycle, from childhood to advanced adulthood. In each stage, individuals face conflicts that influence the formation of personality: Trust vs. Mistrust (0-1 year): basic trust is established when needs are consistently met; Autonomy vs. Shame and Doubt (1-3 years): the child develops autonomy by exploring and asserting themselves, while a lack of support can lead to doubt; Initiative vs. Guilt (3-6 years): initiative is nurtured by encouraging exploration and creativity; excessive criticism can result in guilt; Industry vs. Inferiority (6-12 years): developing skills and competencies is crucial; lack of success can cause feelings of inferiority; Identity vs. Identity Confusion (12-18 years): adolescence is marked by the search for identity; lack of clarity can lead to confusion; Intimacy vs. Isolation (young adulthood): establishing intimate relationships is fundamental; failure to do so can result in isolation; Generativity vs. Stagnation (middle adulthood): contributing to society through work and family is central; lack of involvement can cause stagnation; Ego Integrity vs. Despair (old age): reflecting on life with satisfaction leads to integrity; regrets may result in despair.

The successful resolution of each conflict results in virtues that influence subsequent development, contributing to a balanced personality throughout life (McLeod, 2018).

In summary, the theories presented illustrate how social and cultural contexts influence both the origin and the evolution of conflicts among adolescents, being fundamental to understanding the escalation of these conflicts. Sociocultural theories highlight the role of the social and cultural environment in shaping individual behavior (Coling et al., 2024). The social context, such as socioeconomic status, family environment, and exposure to violence, can increase adolescents' propensity to engage in conflicts (Dantas & Furlan, 2024). Disadvantaged environments tend to exacerbate stress and limit access to support resources, intensifying conflict. Additionally, cultural norms and values, such as expectations related to masculinity, honor, or respect, can promote aggressive responses, especially in contexts where assertiveness is valued (Ferreira et al., 2024). Thus, social modeling shows that adolescents tend to observe and imitate behaviors from significant figures in their environment, such as parents, celebrities, or community leaders. If these role models handle conflicts aggressively, it is more likely that young people will adopt similar behaviors.

Understanding these theories is essential for educators to develop effective conflict mediation and resolution strategies. Strengthening the bonds between students and teachers, fostering positive relationships, can increase students' attachment and commitment to school, reducing behaviors that lead to conflicts. Promoting collaborative activities, such as projects that require cooperation, can reduce harmful competition and foster empathy among students (Monteiro et al., 2019). Furthermore, socioemotional education, by teaching emotional management and peaceful conflict resolution skills, empowers adolescents to deal constructively with differences. By integrating these theoretical approaches, schools can create more inclusive environments conducive to the healthy development of adolescents, minimizing the occurrence and escalation of conflicts.

2.4 Theories Related to Conflict Resolution Strategies

Conflict resolution in the school context has been widely studied from different theoretical perspectives, which provide insights into the most effective ways to mediate disputes between students. School mediation and proactive approaches to conflict management are essential for building a positive educational environment. In this sense, two main theoretical approaches that underpin conflict resolution strategies are highlighted: the Harvard Negotiation Theory, Transformative Mediation, and Social Control Theory.

The Harvard Negotiation Theory (Fisher & Ury, 1981) proposes a principle-based approach, emphasizing the importance of effective communication and seeking mutually beneficial solutions (win-win). In the school context, this theory suggests that teachers can act as facilitators by helping students identify common interests and find creative alternatives to resolve their conflicts (Ramírez et al., 2024). One of the main strategies advocated by this approach is the separation of people from the problems, allowing students to focus on resolving the dispute without compromising interpersonal relationships.

Transformative Mediation, proposed by Bush and Folger (2005), emphasizes the need to promote empowerment and mutual recognition between the parties in conflict. This approach not only focuses on the immediate resolution of the problem but also on developing the socioemotional skills of the involved parties, promoting empathy and self-regulation. In the school environment, transformative mediation is especially relevant as it encourages students to understand each other's perspectives and take responsibility for their actions (Silva, 2024).

In addition to these approaches, several conflict management models have been applied in the school context. Deutsch's (2011) Conflict Resolution Model classifies conflicts as productive and destructive, suggesting that the outcome of a conflict depends on how it is managed. Cooperation, rather than competition, is a determining factor in achieving positive resolutions. The Dual Concern Model of Conflict Resolution (Rahim, 2002) identifies five main conflict management styles: competition, accommodation, avoidance, compromise, and collaboration. The choice of the most appropriate strategy depends on the nature of the conflict and the characteristics of those involved.

The application of these theories and models to school mediation highlights the crucial role of teachers as facilitators in conflict resolution. Recent research indicates that continuous training programs for teachers, focused on the development of mediation and conflict management skills, can significantly improve the school environment and reduce incidents of violence and bullying (Alves et al., 2023; Santos et al., 2025). Therefore, integrating approaches based on negotiation, transformative mediation, and the strengthening of social bonds can contribute to a more harmonious and inclusive educational environment.

3. The Perceived Role of Teachers in Conflict Management

The perception that teachers have of their role in conflict management influences how they intervene and the effectiveness of the strategies adopted (Zee & Koomen, 2016). This perception is shaped by factors such as the training received, professional experience, and institutional support. Teachers who feel responsible for mediation tend to adopt more proactive approaches, while others may resort to punitive strategies or avoid intervening (Silva et al., 2022).

Teachers perceive conflict mediation in different ways. Many recognize it as an essential part of their educational role, while others feel unprepared to handle complex situations (Ribeiro de Lima, 2024). The lack of specific training can lead to the adoption of less effective strategies, such as imposing sanctions without mediation, which can escalate conflicts (Ferreira et al., 2024). On the other hand, teachers with training in conflict management tend to use more constructive approaches, such as non-violent communication and active listening (Valente et al., 2024).

Teacher self-efficacy refers to the belief in their ability to resolve conflicts. Studies show that teachers with high self-efficacy approach disputes with more confidence and flexibility, promoting a positive school environment (Dias, 2017; Zee & Koomen, 2016). Those who doubt their ability may avoid conflicts or apply rigid disciplinary measures, increasing tensions (Silva et al., 2022).

Strengthening teacher self-efficacy can be achieved through continuous training and institutional support. Training programs that teach mediation strategies and communication skills increase teachers' confidence in conflict management (Maia et al., 2021). Additionally, schools that encourage collaboration among teachers promote the exchange of experiences and the implementation of effective practices (Valente & Lourenço, 2022).

Research shows that teachers who are confident in their ability to manage conflicts contribute to a more inclusive and safe environment. This reduces the frequency of confrontations and improves the school dynamics, benefiting both academic performance and the socio-emotional development of students (Santos et al., 2025). Therefore, investing in teacher training and creating a collaborative environment supports effective conflict resolution strategies and a more positive school climate.

3.1 Theoretical Framework for Conflict Management among Adolescents: The Conflict Process

The conflict process among adolescents in the school environment can be broken down into five essential phases: identification, escalation, intervention, resolution, and follow-up, each requiring a specific approach to ensure effective resolution.

In the identification phase of the conflict, teachers play a crucial role in recognizing early signs of tension, such as changes in behavior or verbal and physical aggression (Alves et al., 2023; Spilt et al., 2012). Timely recognition is key to preventing the situation from worsening, as according to Deutsch (2011), the lack of intervention can lead to the intensification of the conflict, creating a cycle that is difficult to break. The teacher must be attentive to these early signs to identify the problem before it escalates.

The escalation of the conflict occurs when the dispute between students grows, involving more people or becoming more aggressive. Here, educators need to intervene quickly to prevent the problem from intensifying (Alves et al., 2023). Early intervention can be decisive in containing violence and reducing harm to the school community. It is essential that teachers act assertively, without allowing the situation to escalate further (Fisher & Ury, 1981).

In the intervention phase, educators act as mediators, using mediation techniques to help students express their emotions and find a solution to the conflict (Bush & Folger, 2005; Sebaje et al., 2019). Mediation requires the teacher to be impartial and capable of guiding students in constructing solutions that meet the needs of both parties. Studies highlight the importance of negotiation, where the parties involved seek to reach a mutual agreement, with the mediator helping to foster constructive dialogue (Ribeiro de Lima, 2024; Silva, 2024).

The resolution phase occurs when students reach an agreed solution. The teacher's role is to help students recognize their responsibilities and understand the commitments made during the mediation process. The goal is to restore relationships and establish a new understanding (Souza & Guilherme, 2024). Effective resolution depends on the students' willingness to collaborate and reflect on what caused the conflict and how to avoid it in the future.

Finally, follow-up is essential to ensure that the solution is lasting. The teacher should continue to monitor the situation to prevent new conflicts, promoting reflection sessions or adjusting school coexistence norms. Constant follow-up ensures that the school environment remains positive and inclusive, helping students apply the lessons learned (Alves et al., 2023; Gusmão & Almeida, 2024).

3.2 Types and Levels of Conflict

Conflicts are natural phenomena in human interactions, and in the school context, they manifest in various forms and intensities. Understanding the types and levels of conflict — intrapersonal, interpersonal, intra-group, and inter-group — is essential for promoting a healthy and collaborative environment. Analyzing these conflicts allows us to identify their causes and find effective solutions for their management.

Intrapersonal conflict occurs when an individual faces internal dilemmas, such as insecurity, social pressure, and identity issues. During adolescence, a phase of intense identity construction, these emotional conflicts can affect behavior and social interaction (Levisky, 2025). The perception of one's own self-efficacy influences the ability to deal with emotional and social challenges, impacting academic performance and interpersonal relationships (Dias, 2017). Additionally, difficulties related to self-esteem and social acceptance can hinder communication and the sense of belonging to groups (Coling et al., 2024; Spilt et al., 2012).

Interpersonal conflicts occur between individuals and can arise from misunderstandings, rivalries, or differences in values and opinions. In the school context, they affect peer relationships and can result in bullying or social exclusion (Ferreira et al., 2024). Effective mediation by teachers can transform these conflicts into opportunities for social and emotional learning (Souza & Guilherme, 2024), with emotional intelligence and communication skills being essential to fostering a more collaborative environment (Valente & Lourenço, 2022).

Intra-group conflict refers to tensions within a specific group, such as a class or a circle of friends, and can arise from competition for status, differences of opinion, or changes in the group's dynamics (Canavêz & Oliveira, 2014). In the school context, these disputes influence the construction of adolescents' identities (Amorim et al., 2022; Levisky, 2025). However, when well-managed, they can strengthen bonds and develop skills such as empathy and negotiation (Galvão, Shultz & Guimarães-Iosif, 2016).

Finally, inter-group conflicts involve disputes between different groups within the school, often driven by social, cultural, or ideological differences (Fernandes & Pereira, 2018). These conflicts are influenced by social identity

processes, in which individuals tend to value their own group over others, potentially leading to rivalries and polarization, with a negative impact on the school climate (Ribeiro de Lima, 2024). Strategies such as mediation and the promotion of collaborative activities between groups are essential for reducing tensions and encouraging a culture of respect and cooperation (Sebaje et al., 2019).

4. Discussion and Theoretical-Practical Integration

This chapter aims to integrate the information and results obtained throughout the research, reflecting on the practical and theoretical implications of conflict management among adolescents in the school environment. The analysis of the conflict, the strategies adopted by teachers, and the consequences perceived by them will help clarify the impact of these situations on the school dynamics and the development of the students.

4.1 Causes of Conflict Among Adolescents

Conflicts among adolescents in the school environment can be triggered by a variety of emotional, social, and cultural factors. Adolescence is a phase of significant changes, both physically and psychologically, which can increase vulnerability to conflicts (Levisky, 2025). Issues of identity, self-esteem, and the need for social acceptance are often at the root of many misunderstandings (Coling et al., 2024). Additionally, the school environment, which involves interactions with a diversity of groups, can amplify tensions and create rivalries, especially when there are disputes over status or power (Canavêz & Oliveira, 2014).

School norms, often represented by rigid rules and hierarchical structure, also influence the emergence of conflicts. The perception of inequality or injustice in the norms can lead to defiant attitudes among students. According to research by Silva et al. (2022), the improper management of norms and the lack of a collaborative approach to resolving disputes aggravate conflict, directly affecting the school climate.

Teachers, as central figures in mediation and conflict management, play a crucial role in early identification and intervention. Their perception of the factors contributing to conflicts is decisive in the choice of strategies to be adopted (Chrispino & Chrispino, 2023). Many teachers identify factors such as bullying, rivalry between groups, and a lack of conflict resolution skills as the main causes of misunderstandings among students (Ferreira et al., 2024). The ability of teachers to recognize these factors is essential for effective intervention and promoting a more harmonious environment.

4.2 Conflict Resolution Strategies: Teachers' Perspective

Teachers use a variety of approaches to manage conflicts in the classroom. The strategies adopted vary depending on the training received, personal experience, and the school context. According to Maia et al. (2021), many teachers and educators choose mediation strategies that involve active listening and dialogue between the parties, seeking collaborative solutions that meet the needs of everyone involved.

Mediation and negotiation approaches are fundamental to restoring harmony among students. The mediation process, when well-conducted, can transform a conflict into an opportunity for learning and the development of social skills (Chrispino & Chrispino, 2023; Ribeiro de Lima, 2024). However, it is important that teachers are adequately prepared to manage these situations, particularly regarding impartiality and promoting non-violent communication.

In addition, many schools adopt preventive strategies, such as the implementation of socio-emotional education programs aimed at empowering students to handle their emotions and conflicts constructively. Teacher training is a crucial factor in this process, as teachers with specific training in conflict management and mediation tend to be more successful in resolving disputes (Valente & Lourenço, 2022).

4.3 Consequences of Conflict: Impacts Perceived by Teachers

Unresolved conflicts have serious repercussions in the school environment, affecting both the school climate and students' academic performance. Teachers' perceptions of these consequences are essential to understanding the impact of conflicts on the school community. Unmanaged conflicts can lead to a deterioration of relationships among students, increasing tension and, in extreme cases, resulting in bullying or social exclusion (Ferreira et al., 2024).

According to Santos et al. (2025), in terms of academic performance, students involved in

frequent conflicts may experience a decline in motivation, concentration, and participation in school activities. Furthermore, students' emotional health may also be affected, leading to an increase in cases of anxiety, depression, and other emotional disorders.

Institutional support for teachers, such as training programs and involvement of the school community, is crucial to mitigate the negative impacts of conflicts. Creating a collaborative environment, in which teachers feel supported, is essential to ensure they can implement effective conflict mediation and resolution strategies (Chrispino & Chrispino, 2023).

4.4 Existing Knowledge and Gaps in Knowledge

The literature on conflict management among adolescents in the school context is already quite extensive, but there are some gaps that need to be explored. Most of the research focuses on mediation strategies and teacher training, but there is still limited investigation into the impact of institutional norms and school culture on the origin and escalation of conflicts. Furthermore, there is a need to deepen the understanding of how teachers' perceptions of self-efficacy influence their choice of conflict resolution strategies and how this affects the overall school climate (Zee & Koomen, 2016).

The relevance of this study is justified by the fact that, by addressing existing gaps, it contributes to a better understanding of conflict dynamics and provides practical insights for improving the management of these conflicts in the school environment. Additionally, by integrating theory and practice, this study can serve as a basis for the development of continuous training programs for teachers and the creation of more inclusive and positive school environments.

Conflict management among adolescents is an ongoing challenge in the school environment, and the role of teachers is crucial in resolving and mitigating these situations. Understanding the causes, resolution strategies, and consequences of conflicts is fundamental to promoting a school culture of respect and collaboration. By integrating theory with practice, it is possible to refine the approaches adopted by educators, ensuring a safer and healthier environment for all involved.

5. Conclusions and Recommendations

5.1 Summary of Key Points

This research examined teachers' perceptions of conflict management in the school environment, highlighting their influence on the strategies adopted and the effectiveness of mediation. The results demonstrate that teachers play a central role in conflict mediation, with this role being influenced by their training, experience, and institutional support (Silva et al., 2022).

The theoretical review revealed that conflicts among adolescents are natural and multifaceted processes, arising from emotional, social, and cultural factors (Erikson, 1968; Canavêz & Oliveira, 2014). Different types and levels of conflict were addressed, from intrapersonal to intergroup, with the adoption of strategies promoting active listening, nonviolent communication, and negotiation being essential to minimize their negative effects (Bush & Folger, 2005; Valente & Lourenço, 2022).

The analysis of teachers' perceptions revealed a variety of approaches, ranging from mediatory practices to punitive or avoidant strategies. Studies indicate that teacher self-efficacy is a determining factor in the choice of strategies, as teachers with greater confidence in their abilities tend to adopt more constructive approaches (Dias, 2017; Santos et al., 2025). Continuous training and institutional support emerge as key elements in empowering teachers and promoting a more positive school environment (Maia et al., 2021).

5.2 Reflections on Pedagogical Practice

Teachers' perceptions of conflict management directly influence how they handle everyday school situations. When teachers view mediation as an integral part of their educational role, they tend to foster a more collaborative and inclusive environment, minimizing the recurrence of conflicts (Ribeiro de Lima, 2024). However, the lack of specific training may lead to the adoption of reactive approaches, such as direct punishment or omission, which can exacerbate interpersonal problems between students (Ferreira et al., 2024).

Pedagogical practice can be enhanced through the implementation of continuous training programs focused on developing socio-emotional skills and effective mediation strategies (Alves et al., 2023). Additionally, the support of school institutions in promoting spaces for dialogue and collaboration among teachers can strengthen teachers' confidence and encourage the exchange of experiences (Valente

& Lourenço, 2022).

5.3 Recommendations and Future Perspectives

Based on the results of this research, some recommendations are proposed to improve conflict management in the school environment:

1) Development of continuous training programs for teachers, focused on conflict management, nonviolent communication, and school mediation. Studies indicate that such initiatives increase teacher self-efficacy and improve the school climate (Maia et al., 2021; Santos et al., 2025);

2) Creation of school mediation spaces, where teachers and students can engage in dialogue and resolve conflicts constructively. Models like those presented by Bush and Folger (2005) show that mediation promotes a more harmonious environment and reduces conflict recurrence;

3) Encouragement of collaboration among teachers, through pedagogical meetings and the exchange of best practices, strengthening cohesion and institutional support for conflict management (Valente & Lourenço, 2022);

4) Ongoing research on teachers' perceptions and the effectiveness of adopted strategies, with the goal of developing more effective methodologies for conflict resolution in the school environment (Sebaje et al., 2019);

5) Promotion of a school culture based on respect and empathy, with the implementation of activities that encourage cooperation and mutual understanding among students from different social groups (Fernandes & Pereira, 2018).

Finally, future perspectives point to the need for an integrated approach, involving teachers, students, families, and the school community in building a more inclusive and collaborative environment. Research on the impact of teacher training and institutional policies on conflict management could significantly contribute to the improvement of educational practices and student well-being. In this sense, strengthening educators' capacity and promoting a culture of dialogue and mediation are essential steps to turn school conflicts into opportunities for growth and learning. Only through a concerted and sustained effort will it be possible to consolidate an educational model that values harmonious coexistence, peaceful resolution of differences, and the strengthening of interpersonal relationships, promoting a truly democratic and equitable school.

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Multimedia Learning and UDL in UK Higher Education

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Abstract

The integration of multimedia learning and Universal Design for Learning (UDL) in UK higher education has significantly enhanced student engagement, accessibility, and learning outcomes in asynchronous digital environments. Video lectures, interactive simulations, and AI-driven adaptive learning have improved knowledge retention and participation, yet challenges such as faculty preparedness, technological infrastructure, and accessibility disparities persist. This study examines the role of interactive content, gamification, and virtual reality (VR) in promoting active learning while addressing barriers related to the digital divide, institutional policies, and faculty training. Research indicates that students using adaptive learning technologies achieve higher retention and completion rates, while gamified learning environments foster greater motivation and participation. However, equitable access to digital resources and ethical AI governance remain critical concerns. Future strategies should focus on AI-driven personalization, immersive learning experiences, and expanded faculty development initiatives to ensure scalable and inclusive digital education. By leveraging emerging technologies, data-driven learning analytics, and open educational resources (OERs), UK universities can create more effective, accessible, and engaging learning experiences for diverse student populations.

Keywords: multimedia learning, Universal Design for Learning (UDL), adaptive learning, AI-driven education, virtual reality (VR), gamification

1. Introduction

Multimedia learning has transformed asynchronous education in UK higher education by offering greater flexibility, engagement, and inclusivity. The integration of video lectures, interactive simulations, and gamified tools has improved student retention and motivation, catering to diverse learning preferences. According to JISC (2021), 72% of students prefer courses integrating multimedia elements, and Universities UK (2022) found that retention rates were 25% higher in such courses compared to text-based instruction.

Cognitive Load Theory (CLT) suggests that well-structured multimedia reduces cognitive overload, enhancing knowledge retention. A University of Edinburgh study (2020) found that students using narrated video lectures with visuals achieved 40% better comprehension than those relying on text alone. Similarly, Universal Design for Learning (UDL) ensures accessibility for diverse learners, with features like captions

and interactive transcripts improving student satisfaction by 35% (OfS, 2021).

However, challenges remain, including digital accessibility issues, as 15% of UK students lack stable internet access (UK Department for Education, 2020). Passive learning is another concern, requiring interactive elements like embedded quizzes and discussion prompts to enhance engagement. Universities must invest in faculty training and AI-driven adaptive learning technologies to optimize multimedia use. Emerging innovations such as VR and AI-driven personalization offer exciting opportunities to improve knowledge retention, as shown by Imperial College London's 2022 study, which found that VR-enhanced learning improved retention rates by 45%.

To fully realize the potential of multimedia in asynchronous learning, universities must prioritize accessibility, instructional design, and technological innovation, ensuring high-quality, engaging educational experiences for all students.

2. Theoretical Perspectives on Multimedia and UDL

Multimedia learning in asynchronous higher education is grounded in Cognitive Theory of Multimedia Learning (CTML) and Universal Design for Learning (UDL). CTML, developed by Richard Mayer, asserts that learning is most effective when verbal and visual information are presented together, optimizing cognitive load and enhancing retention. A 2020 University of Edinburgh study found that students using structured video lectures retained 40% more information than those relying solely on text. However, CTML warns against cognitive overload, emphasizing short, interactive, and well-structured multimedia design to maintain engagement.

UDL, developed by Meyer and Rose (2002), ensures learning environments are inclusive and flexible, accommodating diverse learners through multiple means of representation, engagement, and assessment. A 2021 UK Office for Students (OfS) report found that institutions adopting UDL-aligned multimedia strategies saw a 35% increase in student satisfaction and a 20% improvement in accessibility for students with disabilities. Features such as closed captions, interactive transcripts, and text-to-speech tools have been instrumental in supporting neurodiverse and second-language learners.

The integration of CTML and UDL in UK higher education has led to AI-driven adaptive learning systems, gamified learning experiences, and virtual reality (VR) modules, significantly improving student engagement and knowledge retention. A 2022 Universities UK report found that students using AI-powered personalized learning had 26% higher course completion rates. However, faculty preparedness and the digital divide remain challenges. A 2022 JISC survey reported that only 45% of faculty felt confident in designing multimedia-based courses, while 15% of students from low-income backgrounds struggle with internet access (UK Department for Education, 2021).

Future strategies should focus on faculty training, investment in AI-driven learning analytics, and enhanced accessibility policies to ensure inclusive and engaging asynchronous education. By integrating evidence-based instructional strategies, UK universities can further improve student engagement, accessibility, and learning outcomes in digital education.

3. Impact of Video Lectures on Student Engagement

Video lectures have become a central component of asynchronous learning in UK higher education, offering students the flexibility to engage with course content at their own pace. The shift toward digital education, accelerated by the COVID-19 pandemic, has positioned video-based instruction as an essential tool for maintaining student engagement in virtual learning environments. However, the effectiveness of video lectures in fostering engagement depends on multiple factors, including instructional design, interactivity, cognitive processing, and accessibility. Research indicates that while well-structured video lectures can enhance motivation and learning outcomes, passive video consumption may lead to disengagement if not complemented by active learning strategies.

One of the primary advantages of video lectures is their ability to provide multimodal learning experiences that cater to different student preferences. Unlike traditional text-based resources, video lectures integrate visual, auditory, and textual components, which align with the dual-channel processing model of the Cognitive Theory of Multimedia Learning

(CTML). This approach helps students process and retain information more effectively by reducing cognitive overload and reinforcing key concepts through multiple representations. A 2021 study conducted by the Higher Education Policy Institute (HEPI) found that students enrolled in courses with high-quality video lectures demonstrated a 22% increase in content retention and exam performance compared to those relying solely on lecture notes.

In addition to improving knowledge retention, video lectures enhance student autonomy and self-regulated learning. The ability to pause, rewind, and replay content allows students to control their learning pace, which is particularly beneficial for those who require additional time to process complex concepts. A 2022 survey conducted by JISC revealed that 74% of UK university students preferred video-based lectures over live-streamed sessions, citing the flexibility to revisit difficult topics and structure their study time effectively. This level of control supports active learning behaviors, as students can engage with the material in a way that aligns with their individual cognitive needs.

However, while video lectures offer greater flexibility, they also present challenges in maintaining sustained student engagement. Passive video consumption—where students watch recorded lectures without actively interacting with the content—can lead to reduced attention spans and lower retention rates. Research suggests that student engagement in video lectures declines after 6–12 minutes, with longer videos resulting in higher dropout rates. A 2020 study by the University of Manchester found that students watching lectures longer than 15 minutes showed a 30% decrease in attentiveness, reinforcing the importance of concise, well-structured video segments to maintain focus.

To address this issue, UK universities have begun implementing interactive video features that encourage active participation and cognitive engagement. Techniques such as embedded quizzes, reflection prompts, and clickable annotations transform passive viewing into an interactive learning experience. A 2022 report by Universities UK found that students who engaged with interactive video lectures scored 28% higher on comprehension tests compared to those who watched standard pre-recorded lectures. Platforms like Panopto, Kaltura, and Echo360 have been widely adopted in UK institutions to provide interactive video functionalities, real-time analytics, and engagement tracking, allowing educators to monitor student progress and adapt instructional strategies accordingly.

Another key factor influencing student engagement is the presence of the instructor within the video lecture. Research suggests that videos featuring instructor visibility, eye contact, and expressive gestures foster a greater sense of connection and engagement among students. A 2021 study published in the British Journal of Educational Technology found that students were 35% more engaged with video lectures where instructors appeared on-screen, compared to voice-over slides alone. This effect can be attributed to social presence theory, which emphasizes the importance of human interaction in digital learning environments. In response, many universities have encouraged educators to incorporate personalized video messages, discussion-based recordings, and virtual office hours to enhance student-instructor interaction in asynchronous courses.

Incorporating captions, transcripts, and playback customization options further enhances engagement and accessibility, particularly for students with hearing impairments, neurodivergent learning styles, or non-native English speakers. A 2021 study conducted by the UK Office for Students (OfS) found that courses implementing closed captioning and interactive transcripts experienced a 20% improvement in student satisfaction and engagement levels. These accessibility features not only support inclusive learning environments but also improve comprehension and retention for all students by allowing them to review key points more effectively.

Despite these advancements, there are still challenges in optimizing video lectures for engagement. A significant barrier is the digital divide, where students from low-income backgrounds may lack access to high-speed internet or reliable devices, limiting their ability to stream high-quality video content. A 2020 report by the UK Department for Education highlighted that 15% of university students faced digital accessibility issues that affected their ability to engage with online learning materials. Universities must address these disparities by offering offline-accessible video

content, lower-bandwidth streaming options, and downloadable resources to ensure equitable access.

Additionally, faculty readiness and instructional design skills play a crucial role in the effectiveness of video lectures. Many educators lack formal training in multimedia pedagogy, leading to variability in video quality, clarity, and engagement strategies. A 2022 report by JISC found that only 47% of UK faculty members felt confident in designing effective video-based instruction, emphasizing the need for professional development in digital content creation, video editing, and learner analytics. Universities must invest in faculty training workshops, instructional design support, and centralized multimedia production resources to ensure that video lectures meet high educational standards.

Looking forward, the future of video lectures in UK higher education will likely be shaped by emerging technologies such as artificial intelligence (AI), virtual reality (VR), and adaptive learning analytics. AI-powered auto-captioning, sentiment analysis, and engagement tracking can help educators identify student learning patterns and adjust content delivery based on real-time feedback. VR-based lectures, currently being piloted at institutions like Imperial College London, offer immersive learning experiences that go beyond traditional video formats. As technology continues to evolve, universities will need to explore more interactive, personalized, and immersive approaches to video-based learning to further enhance student engagement.

Video lectures have become a cornerstone of asynchronous learning in UK higher education, offering flexibility, accessibility, and multimodal engagement. While well-designed video lectures improve retention, comprehension, and student autonomy, passive video consumption remains a challenge that must be addressed through interactive elements, active learning strategies, and instructor presence. By leveraging UDL principles, instructional design best practices, and emerging technologies, universities can further optimize video-based learning to ensure maximum engagement and effectiveness in asynchronous education.

4. Enhancing Learning Through Interactive Content

4.1 Enhancing Active Learning Through Interactive Content

Interactive content plays a crucial role in promoting active learning and student engagement in asynchronous higher education. Traditional video lectures, while informative, often lead to passive learning, where students consume content without actively processing or applying it. By integrating quizzes, simulations, branching scenarios, and gamification elements, UK universities have made digital learning more dynamic and engaging. Research indicates that interactive learning strategies significantly improve retention, motivation, and comprehension, making them essential for asynchronous education.

According to constructivist learning theory, students learn best when they actively engage with course material, rather than passively absorbing information. Interactive tools allow students to test their understanding, apply concepts in simulated environments, and receive immediate feedback on their progress. A 2021 JISC study found that students who engaged with interactive quizzes and knowledge checks demonstrated a 30% higher retention rate compared to those who only consumed static content. Similarly, a University of Birmingham (2022) study found that students who participated in interactive case studies and problem-solving exercises developed stronger critical thinking skills, highlighting the importance of application-based learning.

Gamification has emerged as a particularly effective strategy for increasing student motivation in asynchronous courses. By incorporating game-like elements such as leaderboards, achievement badges, and progress tracking, students are encouraged to engage with course materials in a structured yet enjoyable manner. A 2021 University of Edinburgh study found that students in gamified courses completed 40% more learning activities than those in traditional courses, suggesting that competitive and reward-based learning fosters higher participation and engagement. Interactive modules that incorporate scenario-based decision-making also allow students to apply theoretical knowledge to real-world problems, reinforcing learning in a practical context.

Discussion forums and collaborative digital spaces also contribute significantly to student engagement. Unlike traditional lecture-based

instruction, interactive discussion boards encourage peer learning and idea exchange. Research from the Higher Education Academy (2022) found that structured discussion activities increased engagement by 35%, leading to deeper comprehension and improved learning outcomes. Platforms such as Padlet, Perusall, and Piazza provide students with opportunities to collaborate asynchronously, annotate texts, and engage in multimedia discussions, making online learning more interactive and socially engaging.

4.2 The Role of Emerging Technologies in Interactive Learning

Advancements in artificial intelligence (AI), virtual reality (VR), and adaptive learning platforms have expanded the possibilities for interactive learning in asynchronous higher education. These technologies enhance engagement, personalize learning pathways, and provide immersive educational experiences, ensuring that students remain motivated and actively involved in their coursework.

AI-driven adaptive learning platforms, such as Century Tech and Smart Sparrow, analyze student responses and engagement patterns in real time, adjusting content delivery to meet individual needs. A 2022 Universities UK report found that students using AI-driven interactive learning systems were 25% more likely to achieve higher assessment scores, as they received personalized feedback and adaptive scaffolding. These platforms ensure that students are neither overwhelmed by complex material nor disengaged by content that is too simple, making learning experiences more tailored and effective.

The integration of virtual reality (VR) and augmented reality (AR) has further enhanced interactive learning by providing students with immersive, hands-on experiences. UK universities have incorporated VR-based lab simulations for science courses, virtual patient interactions for medical training, and historical reconstructions for humanities students. A 2022 pilot study at Imperial College London found that students who engaged in VR-based lab experiments retained 50% more information than those who only reviewed traditional instructional videos, highlighting the potential of immersive learning in enhancing retention and comprehension.

Despite the clear benefits of interactive content, challenges remain in implementation, including faculty readiness, technological infrastructure, and accessibility concerns. Many educators lack training in instructional design and digital pedagogy, making it difficult to create and integrate high-quality interactive materials. A 2022 JISC survey reported that only 48% of UK faculty members felt confident in designing interactive digital content, emphasizing the need for professional development and institutional support. Additionally, the digital divide remains a concern, as some students lack access to high-speed internet and advanced devices, limiting their ability to engage with high-tech learning tools such as VR and AI-driven platforms.

To fully optimize interactive content in asynchronous learning, UK universities must invest in faculty training, digital infrastructure, and accessibility initiatives. Providing educators with user-friendly authoring tools such as H5P, Articulate Storyline, and Adobe Captivate can facilitate the creation of engaging and interactive learning materials. Additionally, institutions should prioritize universal accessibility standards, ensuring that interactive content is compatible with assistive technologies and designed to accommodate diverse learners.

Interactive content has proven to be a transformative force in asynchronous higher education, offering students engaging, personalized, and immersive learning experiences. By integrating AI, gamification, and VR/AR technologies, universities can create dynamic and interactive digital learning environments that enhance retention, critical thinking, and student motivation. However, addressing faculty readiness, technological infrastructure, and accessibility barriers will be key to ensuring that all students benefit from high-quality, interactive digital education.

5. Barriers to Implementing Multimedia and UDL

Despite the benefits of multimedia learning and Universal Design for Learning (UDL) in UK higher education, several challenges hinder their effective implementation. Technological limitations, faculty preparedness, institutional constraints, accessibility issues, and financial concerns all impact the scalability and sustainability of these strategies. Addressing these barriers is crucial to ensuring that multimedia-based learning remains inclusive,

engaging, and effective.

One of the main obstacles is technological infrastructure. While universities have adopted learning management systems (LMS) like Moodle, Blackboard, and Canvas, not all institutions have the resources to integrate AI-driven adaptive learning, high-resolution video lectures, or virtual simulations. Many multimedia tools require significant bandwidth, storage capacity, and stable internet access, making them less accessible for students facing digital divide issues. A 2021 UK Department for Education report found that 15% of university students from low-income backgrounds struggle with internet connectivity, limiting their engagement with high-bandwidth content. Without device loan schemes, subsidized internet access, and offline-compatible course materials, some students risk exclusion from multimedia-enhanced education.

Another key challenge is faculty readiness and instructional design expertise. Many educators lack formal training in digital pedagogy, interactive content creation, and accessibility-focused course design. A 2022 JISC survey found that only 47% of UK faculty members felt confident in designing multimedia-rich learning experiences, citing time constraints and insufficient institutional support. Without comprehensive faculty training programs and instructional design assistance, many educators default to traditional lecture formats, reducing the effectiveness of multimedia learning.

Institutional policies and incentives also impact the adoption of UDL-aligned multimedia learning. While 82% of UK universities recognize UDL as an essential framework for accessibility (OfS, 2021), only 46% have policies enforcing its integration. This leads to inconsistencies in captioning, transcript availability, and alternative learning pathways for students with disabilities. Additionally, student engagement varies significantly based on course design. A 2022 University of Manchester study found that students in courses with non-interactive video lectures were 27% more likely to disengage compared to those using quizzes, discussion prompts, and adaptive feedback mechanisms. Simply adding multimedia does not guarantee higher engagement—pedagogical strategies must emphasize active learning.

Financial constraints present another significant barrier. High-quality multimedia content requires investment in professional production teams, AI-driven content creation tools, and accessibility compliance measures. A 2021 Higher Education Academy (HEA) study found that faculty members developing multimedia-rich courses reported a 25–30% increase in preparation time, adding pressure to their existing workloads. Without funding for faculty support grants or centralized multimedia production teams, universities may struggle to maintain high standards for digital content.

Security and data privacy concerns also pose challenges, particularly with AI-driven adaptive learning and learning analytics. As universities increasingly track student engagement and performance through digital platforms, ethical concerns regarding data collection, privacy, and algorithmic bias must be addressed. A 2022 UK Information Commissioner's Office (ICO) report emphasized the need for clear policies on AI use in education, ensuring that learning analytics protect student autonomy and prevent discriminatory outcomes.

Despite these challenges, UK universities are making progress by investing in faculty development, digital accessibility initiatives, and AI-driven learning platforms. Addressing barriers related to infrastructure, faculty preparedness, financial constraints, and ethical concerns will be essential for scaling multimedia learning and ensuring inclusive digital education. By prioritizing UDL-aligned multimedia strategies, improving accessibility policies, and expanding professional development, UK higher education can enhance the sustainability and effectiveness of multimedia-based learning for all students.

6. Future Strategies for Digital Learning Development

The expansion of digital learning in UK higher education presents opportunities to enhance student engagement, accessibility, and learning outcomes. Future strategies must focus on personalization, faculty training, technological infrastructure, and ethical considerations to create an inclusive and scalable digital learning ecosystem.

One of the most promising advancements is AI-driven adaptive learning, which tailors content to students' cognitive abilities and progress. A 2022 Universities UK report found

that students using adaptive learning platforms had 26% higher completion rates. AI-powered recommendation engines, personalized quizzes, and dynamic content adjustments will further improve learner autonomy and retention.

Immersive learning experiences through Virtual Reality (VR) and Augmented Reality (AR) will also play a key role. UK universities such as Imperial College London and the University of Edinburgh have piloted VR-enhanced medical and engineering courses, showing a 45% increase in engagement and knowledge retention. Expanding VR/AR across disciplines can help bridge theoretical learning with practical application.

Faculty training and digital pedagogy development remain essential. A 2022 JISC survey found that only 47% of UK faculty felt confident in integrating digital learning tools. Professional development programs, digital teaching certifications, and instructional design teams will support educators in creating engaging online courses.

Ensuring equitable access is another critical focus. A 2021 UK Department for Education report revealed that 15% of students struggle with internet access, exacerbating learning inequalities. Solutions such as device loan programs, mobile-optimized content, and AI-driven accessibility tools (speech-to-text and real-time captioning) will enhance digital inclusion.

Data-driven learning analytics and ethical AI governance must be prioritized to maintain student privacy and prevent algorithmic bias. A 2022 UK Information Commissioner's Office (ICO) report emphasized the need for transparent data governance policies, ensuring that student learning data remains secure and anonymous.

The expansion of Open Educational Resources (OERs) and collaborative learning platforms will further reduce financial barriers and encourage peer collaboration. Platforms like PeerWise, Padlet, and Perusall enable co-creation of content and active learning, fostering global learning communities.

Gamification will continue to drive engagement. A 2021 University of Leeds study found that students in gamified courses completed 40% more activities and reported higher motivation. Features like achievement badges, progression tracking, and interactive leaderboards will enhance continuous participation.

Collaboration between universities, EdTech companies, and policymakers is crucial to accelerating digital education advancements. Investment in faculty training, digital equity, and AI-driven learning solutions will ensure UK universities remain leaders in high-quality digital education. By leveraging emerging technologies, evidence-based instructional design, and policy-driven strategies, the future of digital learning will be more inclusive, engaging, and impactful for all students.

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When Capital Conceal Harassment: Explaining Sexual Harassment in American Colleges and Universities Through the Lens of Cultural Capital Theory

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Abstract

This paper examines the issue of sexual harassment in U.S. colleges and universities through the framework of cultural capital theory. It argues that professors' cultural capital — comprising academic prestige, research accomplishments, and social networks — empowers them to commit sexual harassment with minimal repercussions. The hierarchical relationship between professors and students, particularly at the graduate level, creates an environment where students depend on professors for academic and career advancement, making them vulnerable to harassment and less likely to report it. The paper highlights the role of gender inequality and the academic power structure in normalizing harassment and silencing victims. Through case studies at institutions like Caltech and Dartmouth College, the paper illustrates how professors' cultural capital allowed them to evade accountability, while students were pressured into silence. By applying Bourdieu's theory of cultural capital, the paper concludes that the unequal distribution of cultural capital in higher education contributes significantly to the concealment of sexual harassment and suggests that reforming university monitoring systems may offer a potential solution to address these issues.

Keywords: sexual harassment, cultural capital, academic power, gender inequality, higher education

1. Introduction

In the U.S. and around the world, higher education institutions have a long history of frequent incidents of sexual harassment and assault by professors. The Western media and social organizations have formed scale of resistance in some degrees (e.g., collective marches and other activities) and required universities to openly tackle the assaults of professors and to make their management systems visible, but more important questions are: What dares aggressors to act and allows them to escape punishment, and what prevents victims from reporting. Data show that only 7% of a sample of female students in U.S. colleges and universities who responded to sexual harassment chose to report it to the institution (Hill & Silva, 2005). A significant contributing reason for students not being proactive in publicizing their encounters are students' lack of trust in the institution and the feeling that they will not receive effective feedback and supports for their requests for help (Cantor et al., 2015).

Sexual harassment is a type of behavior that

obscures personal boundary, which intent to be violent and controlling, and is viewed as potentially emotionally charged such as humiliating, scaring and intimidating to an individual (United Nations, 2008). In general, sexual harassment should be legally sanctioned or morally condemned by the person. However, in the special public space of colleges and universities, because of the interests and unequal power relations between students and professors, and because of the impact that their behavior can have on the social prestige and status of educational institutions, a portion of voices that choose to report sexual harassment to the public are silenced by power. In addition, many more victims choose to keep quiet voluntarily due to the strong personal networks and power of professors.

The important reason behind this phenomenon — the ability of extensive and profound cultural capital to empower or translate into the power of professors to commit assaults against students without suffering reputation losses, and to use it as a means of controlling public opinion in institutions and evading due punishment, and the students being compelled to compromise because of their need for their own cultural capital, this is the viewpoint which be highlighted and analyzed in this paper.

2. Statement of the Problem

In U.S. institutions of higher education, the professor-student relationship involves strong links of benefits: a student's academic resources, relationships and social networks, and career growth are connected with his or her supervising professor. This leads to a hierarchy and a specific academic social structure that guides an unequal allocation of power, thereby creating a risk environment supportive of harassment and victimization, and may have contributed to a cultural environment in which sexual harassment is normalized (Zara et al., 2024). Students who are victimized often feel embarrassed and emotionally uncomfortable. Researches has proved that the adverse consequences of sexual harassment include academic setbacks or failures, reduced trust in relationships, lowered self-confidence, and physical and mental illnesses (Li, 2014). Yet symbolic pressure or coercion from professors makes it difficult for students to protect their rights and interests due to fear of revenge and blame; furthermore, gender inequality brought about by societal role expectations increases the risk of stigmatization for victimized female students, and also makes it easier to distort their victim status or rumor violence. This makes it harder for a significant proportion of female students in higher education to open up about their experiences, especially in male-dominated academic areas (Estrich, 1986).

3. Propose of Study

The purpose of this paper is to validate that social and personal cultural capital has a positive impact on the power of professors and the validation of sexual harassment in the context of American higher education, focusing on clarifying the following three points: a) what is cultural capital; b) the expression of cultural capital in the American society and its impact on the higher education environment; and c) the translation of cultural capital to the power of professors, as well as the tolerance and the conceal of their aggression by universities. This paper will also introduce the concrete case based on this social issue and continue to discuss:

Are graduate students more likely to be victimized than undergraduates?

Why do aggressor professors choose sexual harassment and aggression among the many means (e.g., money, delayed graduation, verbal violence) by which they can pressure and control students?

What are some of the sociocultural factors that can influence these choices?

4. Theoretical Framework

In this paper, we use the framework of cultural capital theory to analyze the issues raised above based on the context of higher education in the US.

Cultural capital theory (Bourdieu, 1986) defines cultural capital as a social resource that can be acquired through academic education, interpersonal socialization, and social customs and norms. This social resource, through social media or public relations, impacts the social reputation of an organization or individual and therefore determines their opportunities and options. Based on this theory, cultural capital is sort of three main forms:

1) Specific cultural capital, which refers to the reserves of knowledge, talents, and skills that an individual absorbs and internalizes during the process of acquired skills training and socialization.

In the group of professors in colleges and universities, it shows up as rich research experience, subject knowledge, results published in academic journals, and receiving honors, etc. (Bourdieu, 1986), which accumulates personal connections and reputations for them, but actually expands invisible power as well.

2) Objective cultural capital, which refers to items reflected in concrete with objective value, such as money, luxury goods, etc., which can serve to show the subject's wealth and power.

In the college environment, according to the psychology of showing off, people tend to pay more respect and obey professors' power because of the material things they show.

3) Internalized cultural capital, which refers to the social norms, cultural customs and general values that individuals develop through education. Research in the context of sexual harassment is most typical of the "male-dominated society" in the US and medias that are prejudiced and hostile to women. More than the former two, they are not the capital directly held by the aggressor, but by influencing and shaping the thinking, behavioral patterns and perceptions of the general public, they lead them to indulge in the aggressor's expansion and abuse of power, which makes it easier for the aggressor to commit wrongful acts and go unpunished.

In summary, with the support of cultural capital theory perspective, the following points can roughly explain the problem of sexual harassment in American higher education:

1) The cultural capital possessed by professors is beneficial to the external reputation of educational institutions and the development of academic cooperation, thus prompting institutions to embrace their behavior;

2) The personal prestige and power transformed by cultural capital suppresses student resistance;

3) Capital holders who conform to the prevailing social ideology of the day are able to use their symbolic power or material benefits (e.g., money, etc.) to maneuver public view in the social media, thereby removing accusations or condemnations.

5. Methodology & Cases Statement

The research method used in this paper is the documentary survey method combined with cases study. In this research, this paper selects 2 real cases from American education organizations:

1) The sexual harassment of a professor at the California Institute of Technology that occurred in 2015. In this case, Prof. Ott, as a famous astrophysics lecturer in this university, was suspended because he was accused of "sexual harassment" by two female students. He had fallen in love with a female postgraduate student and verbally harassed her on a number of occasions over the course of his teaching career, but dismissed the student out of fear that she would take unfair advantage of his affections and not take her work seriously, while at the same time he maintained an affair with another female student and professed his love for her over a period of 21 months. The two intolerant students chose to report the incident to the university, but all Caltech did was suspend Prof. Ott's salary for nine months and require him to receive "reinstatement training" when he returned to campus. They did not even take away his research rights. According to the investigation, Prof. Ott is a senior member of the Caltech faculty, with independent research rights, and was granted his tenure at the age of 38. The students were dissatisfied with the sanction because it meant that Prof. Ott would continue to work with students.

2) In 2018, seven female students at Dartmouth College jointly reported three professors for sexual harassment. The three professors sent indecent photos to students without their permission, as well as inviting them for drinks and subsequently sexually assaulting them. However, these behaviors were ignored and concealed by Dartmouth College. Back between 2002 and 2017, at least 27 students had already given feedback to officials about the professor's improper behavior. In addition, many more victims have been forced to accept the victimization and choose to remain silent due to the professor's control over a large amount of academic resource and his ability to intervene in social opinion about them. In response to public pressure, the university eventually removed or retired the three professors.

According to the research, in a study on the correlation between the academic level of medical students and the probability of suffering sexual harassment, 52% of medical students, 31% of hospitalists, and 25% of faculty members in the total sample had been sexually harassed in 2018 (Hsiao et al., 2021). Additionally, another study showed public

information about faculty members committing sexual attack, 8% of the perpetrators were assistant professors, 13% were associate professors, and 51% were professors (Espinoza et al., 2020). This suggests that an increase in academic hierarchy promotes sexual harassment by giving individuals more invisible power; similarly, individuals with higher academic status or more resources are less likely to be sexually assaulted.

6. Discussion & Limitations

The cases above all illustrated that the academic hierarchy and accumulation of knowledge owned by an individual translates into cultural capital, and is internalized as an advantage that facilitates avoidance of punishment for sexual assault, victimization, or control of the victim's actions. In the social context of the US, where education has become a core social sector, individuals with mature academic resume and educational backgrounds often have more opportunities for higher-paying jobs (DiMaggio, 1982). Consequently, this has led to the fact that in American higher education, academic resources have become a condition to control students.

In the case of Professor Ott, it can be seen that because he was a celebrity professor at the college with independent research rights, he was able to obtain significant social influence and prestige for the institution, becoming an authoritative symbol of the educational institution and maintaining the school's internalized capital, which led the school to choose to continue to employ him; and in the case of Dartmouth College, the school's attitude of harboring the aggressor and the professor's academic. In the case of Dartmouth College, the school's attitude of hiding the aggressor and the professor's academic oppression combined to prevent the victims from resisting, but the support of society and public opinions could create a positive awareness and help them to defend their rights.

Combined with the cases and literature analysis, it is not difficult to find that most of the sexual harassment by professors in America occurs at the graduate level. A survey shows that graduate students are more likely to be sexually harassed than undergraduate students (Zara et al., 2024). At the undergraduate level, the power of professors over students is confined to course grades, organization of activities outside the classroom, etc., and the number of students they face makes it hard for them to have isolated social activities with specific students; however, at the graduate level, there is a clear dependence between students and their professors, and not only is the development of their careers related to their professors' opinions, but also they need to inherit their professors' academic networks and study resources (Li, 2014). Students who are subject to "Apprenticeship" have to accept harassment in order to gain their own cultural capital.

The fact that the aggressor professor chose sexual harassment among the many means of applying unequal power can be attributed to the vague legal system of the US and the inequality of the traditional social concepts of gender from the perspective of cultural capital. Issues such as monetary coercion and physical harm have clear legal boundaries, and students' cries for help will not be obscured by the social culture; while the existing legal system lacks a clear definition of sexual harassment and punishment rules, which makes the evaluation of the harm blurred; meanwhile, a study found that sexual harassment in academia is also the result of the concept of "gender roles overflow" in the social and cultural capital, i.e., irrelevant to academics and inappropriate gender role expectations, which lead professors to treat students in a female role rather than a mentor-apprentice relationship (Li, 2014).

Up to now, the research in this paper still has some limitations: since many students remain silent about the issue of sexual harassment, the cases found in the reported literature are based on what has been reported in the media, and their description and analysis are inevitably subjective; in addition, the concepts of cultural capital and academic resources are inherently obscure and abstract, and are affected by factors such as personal wealth, academic subjects, positions, etc., which make them difficult to be defined in concrete terms.

7. Conclusion

This paper focuses on the issue of sexual harassment of students by professors in US and analyzes it using Bourdieu's theory of cultural capital. It argues that, under this perspective, the problem of sexual harassment where the perpetrators dare to act, and the victims are afraid to report can be attributed to the fact that "cultural capital has become the power of

professors and the necessity of students". The cultural capital possessed by professors is not only effective in controlling the actions of students, but also in shifting university administration and public opinion in their favorable direction. In addition, patriarchal and male dominated notions of academic organization, gender and power inequalities, and the still imperfect nature of the relevant systems make it challenging for students to gain widespread support in the college environment. Due to the fact that cultural capital is necessary for the functioning of society and an important factor of social perceptions, it is difficult for us to essentially remedy this situation. In the future, adjustments to the monitoring system of universities and the graduate school system may become feasible ways forward.

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Research on the Cooperative Mechanism of Administrative Law Enforcement and Supervision in the Stage of Compulsory Education

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Abstract

Against the backdrop of the Chinese government's advocacy for establishing a collaborative mechanism between educational administrative law enforcement and educational supervision, this article examines the current state of these two domains. The study identifies several issues, including ambiguous responsibilities, mutual buck-passing, and a lack of coordination. The author argues that it is essential to clarify the concepts of educational administrative law enforcement and educational supervision at the compulsory education stage and to delineate the relationship between them. This clarity is crucial for constructing an effective collaborative mechanism for educational administrative law enforcement and supervision at the basic education stage.

Keywords: educational administrative law enforcement, educational supervision, coordination mechanism

1. Introduction

This research primarily focuses on administrative law enforcement and supervision in education during the compulsory education stage, a focus driven by China's unique national context. China implements a nine-year compulsory education system, which distinguishes this stage of education from higher education or vocational education. The mandatory nature of compulsory education underscores the critical role of administrative law enforcement in education and enhances the feasibility of establishing a collaborative working mechanism between educational administrative law enforcement and supervision.

Regarding the development of a collaborative mechanism between educational supervision and administrative law enforcement at the compulsory education stage, existing research primarily addresses the following aspects:

Connotation and Theoretical Foundation: Studies have clarified the functional roles of educational supervision and administrative law enforcement, emphasizing that the core of the collaborative mechanism lies in resource integration and the formation of a unified effort. The theoretical underpinnings include collaborative governance theory and public

management theory.

Necessity and Practical Significance: Research highlights that the collaborative mechanism is essential for addressing the issue of "fragmented governance" in educational supervision and administrative law enforcement. It also contributes to improving the efficiency of educational governance and ensuring equity and quality in education.

Current Challenges and Issues: Studies reveal that the current collaborative mechanism faces several challenges, including unclear responsibilities, ineffective communication, limited information sharing, and inadequately defined laws, regulations, and operational frameworks.

Pathways and Strategies for Improvement: Research proposes several strategies, such as enhancing laws and regulations, optimizing organizational structures, promoting information sharing, strengthening professional development, and fostering innovative collaborative approaches. Additionally, it explores new models, such as joint law enforcement initiatives and specialized supervision programs.

Case Studies and Practical Insights: By analyzing both domestic and international case studies, the research identifies successful practices within collaborative mechanisms, offering valuable insights for practical implementation.

In summary, existing research provides a solid theoretical foundation and practical guidance for constructing an effective collaborative mechanism. However, further advancements are needed in areas such as legal frameworks, mechanism innovation, and capacity building to address existing gaps and enhance overall effectiveness.

2. Review of Relevant Research

Regarding the construction of a coordination mechanism between educational supervision and administrative law enforcement at the basic education stage, existing research primarily focuses on the following aspects:

Connotation and Theoretical Basis: Research clarifies the functional roles of educational supervision and administrative law enforcement, emphasizing that the core of the coordination mechanism lies in integrating resources and forming a unified effort. The theoretical foundations include collaborative governance theory and public management theory.

Necessity and Practical Significance: Studies highlight that the coordination mechanism is essential for addressing the issue of "fragmented governance" between educational supervision and administrative law enforcement. It also contributes to improving the efficiency of educational governance and ensuring equity and quality in education.

Current Status and Challenges: Research reveals that the current coordination mechanism faces challenges such as unclear responsibilities, ineffective communication, insufficient information sharing, and inadequately defined laws, regulations, and operational frameworks.

Pathways and Strategies for Improvement: Research proposes strategies such as improving laws and regulations, optimizing organizational structures, enhancing information sharing, strengthening team capacity, and innovating collaborative approaches. Additionally, it explores new models, including joint law enforcement initiatives and specialized supervision programs.

Case Studies and Practical Insights: By analyzing domestic and international case studies, research summarizes successful practices of coordination mechanisms, providing valuable references for practical implementation.

In summary, existing research offers theoretical support and practical guidance for constructing an effective coordination mechanism. However, further advancements are needed in areas such as legal frameworks, mechanism innovation, and capacity building to address existing gaps and enhance overall effectiveness.

3. Significance of the Study

Theoretical significance: Educational supervision is an important part of educational management and one of the basic educational systems stipulated in the Education Law of the People's Republic of China. However, the educational supervision system in China has a short history and its development is relatively backward. The function of educational supervision in supervising the implementation of educational policies and improving the quality of education and teaching has not been effectively played. The authority of educational supervision is not enough, and the results are

not fully used, which can not fully adapt to the requirements of educational reform and development in the new era. In recent years, the domestic research on the administrative enforcement of basic education and educational supervision mainly focuses on their respective functional positioning, role playing and other aspects, and the research on the synergistic mechanism of the two is relatively few. This study can make up for this deficiency to some extent.

Practical significance: The research on the cooperative mechanism of educational supervision and educational administrative law enforcement is an innovative exploration to deepen the reform of educational administrative law enforcement and educational supervision system, and is of great significance to the realization of governing education according to law. First, it is conducive to deepening the modernization of education governance system and governance capacity. Through the construction of collaborative mechanism, we can effectively integrate educational resources, improve the efficiency and effect of educational management, and promote the sustainable and healthy development of education. Second, it is beneficial to optimize the allocation of educational resources and improve the quality of education. Through the collaborative mechanism, the problems in education can be found and solved in time, the improvement and innovation of education and teaching can be promoted, and the quality and efficiency of education can be improved. Third, it is conducive to promoting the process of the rule of law in education and ensuring the fairness of education.

4. Definition of Core Concepts and Analysis of the Relationship Between Them

4.1 Education Administrative Law Enforcement

Basic education administrative law enforcement: From a broad point of view, educational administrative law enforcement generally refers to all educational administrative activities. Educational supervision refers to the activities of supervisory bodies and supervisory personnel to implement and enforce educational laws and regulations in accordance with legal authority and procedures. From this perspective, educational supervision can be incorporated into the broad concept of educational administrative law enforcement. Therefore, the educational administrative law enforcement discussed in this paper is the narrow sense of educational administrative law enforcement. That is, the administrative fact behavior, specifically refers to the state administrative organs and their staff in the field of basic education, according to law, the supervision and management of educational activities, administrative punishment and other administrative law enforcement behavior.

4.2 Educational Supervision

Educational supervision refers to the activities of people's governments at or above the county level and their educational supervision institutions to supervise, inspect, evaluate and guide the educational work of people's governments at lower levels, educational administrative departments and schools. Therefore, the basic functions of educational supervision can be summarized into two aspects, namely supervision and guidance.

4.3 Coordination Mechanism

Coordination mechanism refers to a coordination and cooperation working mechanism established between different subjects to achieve common goals. In the field of basic education, the coordination mechanism mainly involves the coordination and cooperation between administrative law enforcement and educational supervision.

4.4 Collaborative Governance Theory

This theory emphasizes coordination and cooperation among different subjects to achieve common goals. This study will draw on the theory of cooperative governance to explore the cooperative mechanism between administrative enforcement and educational supervision in basic education. Education policy implementation theory: This theory focuses on how education policies are effectively implemented, including policy formulation, policy implementation, policy evaluation and other links. This study will use the theory of educational policy implementation to analyze the role of basic education administrative law enforcement and educational supervision in policy implementation and their collaborative mechanism. Rule of law education theory: This theory emphasizes the rule of law, standardization and specialization of education, and requires legal conduct and administration in educational activities. Based on the theory of rule of law education, this study will explore the

role of basic education administrative enforcement and education supervision in the process of promoting the rule of law of education and their collaborative mechanism.

At present, the education administrative departments of various provinces and cities in China have published lists of administrative powers, which specify what the government should and should not do according to the rule of law concept of "not authorized by the law, legal duties must be done, and anything prohibited by the law can be done". The author believes that the construction of educational supervision and educational administrative law enforcement coordination mechanism can be carried out based on the list of administrative powers. Educational administrative law enforcement is in accordance with the list of powers, the use of compulsory, punishment and other "rigid" management measures, law enforcement focuses on the post-incident supervision, law enforcement agencies in schools and other educational institutions after the problem with "rigid" law enforcement measures to solve. The supervision focuses on the prevention and discovery of problems in advance, and adopts more "soft" measures such as consulting, explanation, investigation and suggestion. Through the daily supervision and professional guidance of the supervised units through education and supervision, a normal risk prevention mechanism is established, the threshold of risk prevention and control is moved forward, and the problems arising in the supervision process are "early detection, early warning and early treatment".

5. Establish a Coordination Mechanism Between Educational Supervision and Educational Administrative Law Enforcement

To construct the coordination mechanism of educational supervision and educational administrative law enforcement in the stage of basic education, we can start from the following aspects:

5.1 Analysis Based on the Division of Responsibilities Perspective

Laws and regulations on compulsory education should be further improved, and the legal basis for supervision and administrative law enforcement should be clarified. Formulate specific operational norms for collaborative work to ensure that there are rules to follow. Now the government has published a list of administrative law enforcement powers at the compulsory education stage on its official website. This list helps to clarify the division of responsibilities in the enforcement and supervision of education administration. Education supervision is mainly responsible for monitoring, evaluating and guiding the quality of education and teaching in schools to ensure the implementation of education policies. Education administrative law enforcement is mainly responsible for investigating and dealing with illegal acts in the field of education according to law and maintaining education order. The two should clarify the boundaries of their respective responsibilities and avoid overlapping or gaps in their functions.

5.2 Analysis Based on Information Sharing Perspective

A unified information sharing platform can be built. The platform facilitates the timely exchange of supervisory and enforcement information, ensuring that both sides are up-to-date. The problems found by the supervision can be timely fed back to the law enforcement department through the platform, and the results of the law enforcement department should also be fed back to the supervision organization, so as to facilitate the supervision workers to urge the later rectification. A system of regular joint meetings may be established. This system facilitates enhanced work communication, regular discussion of major issues, and coordinated action. Joint working groups may be set up to address complex issues in a coordinated manner. Administrative law enforcement completes the rigid enforcement and punishment of violations, while educational supervision completes the flexible actions of "assessment", "feedback", "supervision" and "guidance". A monitoring and evaluation mechanism can be established to regularly check the implementation of the coordination mechanism. Ensure the effectiveness and fairness of the coordination mechanism through third-party evaluation. Digital supervision platforms can be established, and technological means such as big data and artificial intelligence can be used to enhance the efficiency of supervision and law enforcement. Through data analysis, we can provide early warning of potential problems before they happen.

5.3 Analysis Based on Joint Meeting System Perspective

A regular joint meeting system can be established to strengthen work communication, regularly discuss major issues and coordinate actions. Joint working groups may be set up to address complex issues in a coordinated manner. Administrative law enforcement completes the rigid enforcement and punishment of violations, while educational supervision completes the flexible actions of "assessment", "feedback", "supervision" and "guidance".

5.4 Analysis Based on Social Participation Perspective

From the perspective of social participation. Staff organizational ability training should be regularly conducted to enhance the professional ability of supervision and law enforcement personnel, and to help workers further understand the legal nature of cooperation between education supervision and education administrative law enforcement. Training should cover educational policies, laws and regulations, and collaborative work processes. Social forces such as parents and communities should be encouraged to participate in supervision and provide feedback in a timely manner. The necessary administrative powers can establish a reporting mechanism to facilitate timely handling of problems reported by the public. At the same time, the media should strengthen the publicity of the collaborative work mode of education supervision and education administrative law enforcement to enhance public awareness. Regular work reports will be issued to enhance transparency and enhance credibility.

6. Conclusion

Educational supervision and educational administrative law enforcement bear their respective responsibilities, and both have independent existence value, and they can neither replace each other nor combine into one. In the stage of compulsory education, the coordination between educational supervision and administrative law enforcement can be based on specific administrative law enforcement powers. Through information sharing, joint law enforcement, strengthening supervision and other means to establish a collaborative work mechanism to reduce unnecessary administrative interference on law enforcement targets. Through education and supervision, non-compulsory means such as guidance, suggestion and advice are adopted to innovate administrative law enforcement methods and help administrative counterparts to actively abide by the law. Use the "rigidity" of law enforcement to guarantee the "flexibility" of educational supervision.

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Exploring and Implementing a Cross-Disciplinary Innovation Talent Cultivation Model for Professional Master's Programs in Civil and Hydraulic Engineering

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Abstract

With the rapid development of social economy, the demand for professionals in civil and hydraulic engineering is increasing daily. The traditional model for cultivating professional master's talents is no longer meet the diverse requirements of the market. This paper explores the implementation of a cross-disciplinary innovation Guidance model in the master's education of civil and hydraulic engineering. By analyzing the current challenges in talent cultivation, the paper outlines objectives for talent development, curriculum design, practical teaching methodologies, and strategies for fostering innovative capabilities within the context of Cross-disciplinary innovation Guidance. Additionally, it provides recommendations for effectively implementing this model, aiming to serve as a reference for nurturing high-quality, innovative talents equipped with practical skills.

Keywords: cross-disciplinary innovation, civil and hydraulic engineering, professional master's, talent cultivation model, practical teaching

1. Introduction

In the context of the new era, the high-quality development of China's economic and social increasingly demands high-level interdisciplinary innovative talents. Traditional master's cultivation models in civil and hydraulic engineering primarily emphasize professional knowledge and skills, often neglecting the cultivation of innovation awareness and cross-disciplinary innovation competencies. As the trend of interdisciplinary integration becomes more prominent, Cross-disciplinary innovation talent cultivation models are emerging as a new approach for developing talent in universities. This paper systematically explores and analyzes the civil and hydraulic engineering master's cultivation model under Cross-disciplinary innovation Guidance, aiming to provide insights for enhancing master's students' innovation capabilities and practical levels.

2. Current Problems in Civil and Hydraulic Engineering Master's Talent Cultivation

2.1 Disconnection Between Theoretical Learning and Practical

In the current training process for master's students in civil and hydraulic engineering, the

first-year curriculum predominantly emphasizes theoretical foundation courses. However, the teaching approach often prioritizes knowledge acquisition over the development of practical skills and quality, favoring lecture-based instruction over hands-on training. This results in students gaining knowledge in an abstract manner, which diverges from the objectives of practicality-oriented training. Additionally, the instruction of fundamental professional knowledge lacks integration, systematic organization, and relevance to practical training, real-world industry challenges, and thesis work. Consequently, students struggle to apply theoretical concepts to engineering practice and fail to effectively develop their abilities to identify and solve problems in complex engineering projects (Lin Ke, 2020).

2.2 Misalignment Between Cultivation Objectives and Market Demands

The cultivation objectives in current civil and hydraulic engineering master's programs still emphasize singular professional domains, failing to promote the development of cross-disciplinary innovation competencies. As engineering construction continues to evolve, the demand for interdisciplinary talents is growing rapidly. Traditional cultivation models struggle to adapt to this increasing market demand for high-level, versatile professionals.

2.3 Weak Innovation Awareness and Ability Development

Traditional civil and hydraulic engineering master's cultivation models prioritize knowledge transmission over effective innovation awareness and capability development. The curriculum often lacks modules on innovation and entrepreneurship, while practical segments rarely include innovative practice activities. Consequently, students demonstrate weak innovation awareness and capabilities, which contradicts society's urgent need for high-quality innovative talents.

3. Training Objectives of Master's Degree Students in Civil and Hydraulic Engineering Under the Orientation of Interdisciplinary Innovation

Guided by the principles of cross-disciplinary innovation, the training objectives for master's students in Civil and Hydraulic Engineering emphasize the development of a comprehensive competency framework. This framework is built upon a multidisciplinary knowledge base, with interdisciplinary integration as its core and innovative thinking as the driving force (Song Kezhi & Yuan Hongxian, 2024).

By integrating expertise in Civil and Hydraulic Engineering with related fields such as management, economics, and environmental science, the program fosters an interdisciplinary knowledge system that equips students with the necessary foundation to tackle complex engineering challenges. Building upon this foundation, the program prioritizes the cultivation of students' interdisciplinary integration capabilities, enabling them to systematically apply knowledge from multiple domains to formulate effective engineering solutions.

Moreover, the program places a strong emphasis on fostering innovative thinking. Moving beyond the limitations of traditional training models, it nurtures students' creativity by enhancing their problem-solving skills, refining their analytical thinking, and strengthening their practical competencies. Through targeted training in innovation awareness, cognitive approaches, and hands-on experience, the program stimulates students' intrinsic motivation for proactive innovation in engineering practice. Ultimately, it aims to cultivate high-level professionals with cross-disciplinary expertise and sustained innovative capacity, thereby providing essential talent support for the industry's transformation and advancement.

4. Training Path for Interdisciplinary Innovative Master's Degree Students in Civil and Hydraulic Engineering

4.1 Curriculum System Construction

To cultivate interdisciplinary innovative master's students in Civil and Hydraulic Engineering, a three-tier curriculum framework—Basic Layer, Interdisciplinary Layer, and Frontier Layer—can be established to form a progressive and integrative knowledge system.

The Basic Layer aims to strengthen students' foundational knowledge by integrating fundamental natural science courses with core professional courses. Additionally, interdisciplinary general education courses, such as environmental science, materials science, and information technology, are incorporated to build a dual-dimensional knowledge base of "professional expertise + interdisciplinary

expansion."

The Interdisciplinary Layer focuses on the convergence of disciplines, offering specialized courses such as intelligent construction and BIM technology, ecological restoration in hydraulic engineering, and engineering-environment system analysis. Furthermore, management-related courses, including engineering economics and project management, are embedded to cultivate students' multidisciplinary collaborative thinking.

The Frontier Layer aligns with the evolving industry landscape, featuring cutting-edge courses such as "Lifecycle Management of Green Buildings," "Artificial Intelligence in Structural Monitoring," and "Hydraulic Engineering under Dual-Carbon Goals." Elective modules in economics, law, and data science further enrich the curriculum, forming a "core-rigidity + flexible-expansion" course structure.

A dynamic course update mechanism is implemented through a dual optimization approach of "interdisciplinary integration + industry-driven demand." Traditional courses are infused with interdisciplinary elements; for instance, intelligent sensor data analysis is incorporated into mechanics courses, while ecological red-line assessments are embedded in water resources planning. To ensure real-time industry alignment, a "Curriculum Update Committee" is jointly established with enterprises and research institutes. This committee transforms cutting-edge technologies—such as digital twins and low-carbon construction—into teaching resources through annual industry white paper analysis and an evolving engineering case library (e.g., resilient urban sponge systems, nearly zero-energy buildings).

A hybrid teaching model combining "theoretical instruction + project-based discussions" is promoted. Leveraging an intelligent construction virtual simulation platform co-developed with industry partners, interdisciplinary course design is conducted to facilitate the deep integration of knowledge dissemination and competency development.

This structured curriculum system systematically supports the cultivation of composite engineering professionals with systems thinking and innovation capabilities, ensuring a progressive learning pathway from fundamental knowledge reinforcement to interdisciplinary innovation and frontier expansion, all while maintaining a dynamic discipline-industry synergy.

4.2 Practical Teaching Component

The construction of the practical teaching system emphasizes progressive competency development through modular design, platform-based support, and innovative methodologies, establishing a continuous capability-building framework throughout the training process. The system follows a "four-stage progressive" model, advancing from fundamental experimental skills to pioneering innovation (Yu Boting, Yang Nan, Teng Yongfu et al., 2023):

- The Basic Training Layer focuses on standardized experiments such as concrete performance testing and mechanical simulation analysis, consolidating students' proficiency in instrument operation and data interpretation.
- The Professional Application Layer builds upon this foundation, incorporating specialized practices such as structural parametric design and BIM modeling, strengthening students' proficiency in professional software and comprehension of engineering standards.
- The Cross-boundary Integration Layer engages students in interdisciplinary projects, such as collaborative building design and lifecycle management, fostering their ability to integrate knowledge across disciplines and apply systematic thinking.
- The Innovation Breakthrough Layer introduces open-ended topics such as algorithm development and novel material synthesis, driving the transition of innovative concepts into functional prototypes.

A dual-element collaborative structure within the practical training platform provides comprehensive capability development support. On-campus, digital twin laboratories for intelligent construction and virtual simulation centers are established, integrating advanced monitoring and modeling technologies to create high-fidelity engineering simulation environments. Off-campus, "on-site engineering classrooms" are jointly developed with leading

enterprises (Luo Yunju, Xie Qiang & Liu Lijuan, 2022), incorporating key project milestones to establish a real-world training mechanism based on "construction cycle tracking + key technology breakthroughs." This setup enables students to refine their decision-making abilities in real engineering scenarios.

Innovative teaching methodologies transcend traditional practice boundaries, forming a multi-dimensional learning enhancement model: Project-based teaching leverages real-world engineering projects, guiding students through the entire process—from requirement analysis and solution selection to construction simulation (Yang Xiujuan, Fan Henghui & Wang Ning, 2021). Case-immersion teaching develops an interdisciplinary case library, allowing students to integrate technical, economic, and legal knowledge through role-playing and scenario-based learning. Virtual-real integration teaching utilizes mixed reality (MR) technology to construct an "intelligent construction site sandbox," enabling students to dynamically validate construction plans through virtual simulation and real-world implementation, overcoming spatial and temporal constraints to enhance learning efficiency.

This practical teaching system effectively integrates modular progression, platform synergy, and iterative methodologies to establish a seamless competency development pathway from basic skills → professional application → system integration → innovation breakthroughs. It fosters deep integration between engineering practice and interdisciplinary learning, providing a systematic training framework that bridges theory and practice for solving complex engineering challenges. Ultimately, it significantly enhances the alignment between talent cultivation and industry demands.

4.3 Innovation Capability Development

The cultivation of innovation capability should be closely integrated with curriculum design and practical training to provide students with a comprehensive and structured learning experience.

5. Curriculum Design

To systematically develop students' innovation and entrepreneurship skills, the curriculum should incorporate the following components:

- Fundamental Courses on Innovation and Entrepreneurship: Courses such as "Innovative Thinking and Methods" and "Fundamentals and Practice of Entrepreneurship" should be offered to equip students with a solid theoretical foundation in innovation and entrepreneurship.
- Specialized Courses for Civil and Hydraulic Engineering: Tailored to the discipline, courses like "Case Studies in Innovation and Entrepreneurship for Civil and Hydraulic Engineering" should be introduced to enhance students' ability to apply innovative solutions in their field.
- Practice-Oriented Innovation Courses: Students should be encouraged to participate in experiential learning activities, such as the "Internet Plus" Innovation and Entrepreneurship Competition, where they can develop practical problem-solving skills and entrepreneurial mindset through hands-on projects.

6. Practical Training

To complement the theoretical curriculum, a robust practical training system should be established:

Innovation and Entrepreneurship Practice Bases: On-campus, universities should set up dedicated innovation and entrepreneurship practice bases, offering structured training, mentoring, and project incubation. Off-campus, collaborations with leading enterprises and research institutions should provide students with real-world exposure and industry-driven learning experiences.

Dual-Mentor System: A mentorship program should be introduced, comprising experienced faculty members, industry experts, and successful entrepreneurs, to offer comprehensive guidance in innovation and entrepreneurship.

Innovation Incentive Mechanisms: Innovation and entrepreneurship scholarships and project funding programs should be established to reward students' achievements and encourage participation. Innovation and entrepreneurship practice should be integrated into the academic credit system, motivating students to actively engage in related activities.

By implementing these measures, students will

cultivate innovative thinking and entrepreneurial capabilities, enabling them to address the challenges of modern engineering practices. Ultimately, this approach will foster highly skilled professionals who can drive the sustainable development of the civil and hydraulic engineering industry.

7. Conclusion

The exploration and implementation of an advanced training model for master's students in Civil and Hydraulic Engineering represent a critical educational reform aimed at addressing the increasing complexity of modern engineering challenges. This initiative also aligns with national strategic priorities, including the "Dual-Carbon" strategy and the development of new-type urbanization. By establishing an integrated "three-in-one" training framework—comprising curriculum restructuring, practice-driven learning, and innovation empowerment—a dynamic, interdisciplinary training model is developed, with innovation at its core and industry demand as its guiding principle. This approach effectively bridges the gaps between theoretical knowledge and practical application in engineering education, deep specialization and interdisciplinary integration, as well as technological innovation and industrial implementation. Ultimately, this model ensures that talent cultivation remains aligned with major national strategic objectives, while also providing a sustained impetus for the green, digital, and intelligent transformation of the industry.

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The Role of '1+X' Certification in Curriculum Reform and Competency-Based Education in China's Vocational Colleges

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Abstract

The '1+X' certification system is a major reform in China's vocational education, designed to integrate competency-based learning with traditional academic programs. By allowing students to obtain industry-recognized certifications alongside their diplomas, the system aims to enhance workforce readiness, bridge skills gaps, and improve employment prospects. This paper examines the development, implementation, and challenges of the '1+X' system, assessing its impact on curriculum integration, skill development, and industry collaboration. Findings suggest that the system has successfully expanded vocational training opportunities, enabling students to acquire practical, job-relevant skills through modular and progressive certification pathways. Employer engagement in certification design has improved graduate employability, particularly in technology-driven sectors such as IT, advanced manufacturing, and finance. However, challenges remain, including uneven certification recognition, faculty training gaps, and infrastructure limitations in vocational institutions. To maximize the effectiveness of the '1+X' system, future policy recommendations include strengthening national standardization, increasing digital learning adoption, enhancing faculty upskilling programs, and fostering greater industry-academic collaboration. Expanding certification pathways into emerging industries and international labor markets will further solidify the system's role in China's evolving education and workforce landscape. As the country advances its commitment to lifelong learning and skills-based economic growth, the '1+X' certification system stands as a key initiative in aligning vocational education with real-world job demands.

Keywords: 1+X certification, vocational education reform, competency-based learning

1. Introduction

The '1+X' certification system is a key initiative in China's vocational education reform, designed to integrate competency-based training with traditional academic qualifications. Introduced in 2019 by the Ministry of Education (MOE) and the Ministry of Human Resources and Social Security (MOHRSS), the system aims to bridge the gap between classroom learning and industry skills by allowing students to earn professional certifications alongside their diplomas. This reform aligns with the broader national strategy to modernize vocational education, enhance workforce adaptability, and

support China's economic transformation toward a skills-based labor market.

The policy origins of '1+X' certification can be traced back to earlier efforts to improve the quality and employability of vocational graduates. Before its launch, China relied on a National Occupational Qualification System, which primarily focused on standardized testing rather than competency-based learning. However, as industries demanded more specialized and adaptable workers, the government recognized the need for a more flexible and industry-aligned credentialing system. The '1+X' certification was introduced to address these gaps by embedding skill-based assessments within formal education, ensuring that students graduate with both theoretical knowledge and industry-recognized practical competencies.

Since its implementation, the system has undergone progressive expansion and refinement. The initial phase in 2019 targeted six key sectors, including manufacturing, construction, IT, elder care, finance, and transportation. By 2021, the scope had widened to include digital economy fields such as big data, artificial intelligence, and cloud computing, reflecting China's emphasis on high-tech industrial development. The 2022 policy updates emphasized greater industry collaboration, requiring vocational colleges to partner with enterprises in designing certification programs that reflect real-world job expectations. This has led to the active involvement of leading Chinese companies such as Huawei, Tencent, and Alibaba, which now co-develop certification content and provide training resources.

A critical aspect of the policy evolution has been the shift toward modular learning and lifelong education. Unlike traditional vocational programs that focus on broad, multi-year curriculums, '1+X' certification enables students to acquire stackable credentials that can be earned progressively. This supports China's lifelong learning strategy, allowing workers to continually update their skills in response to technological advancements and labor market shifts. Additionally, the system is becoming increasingly integrated with online learning platforms, enabling greater accessibility and flexibility, particularly for adult learners and employees seeking career advancement.

Government efforts have also been directed at standardizing and accrediting the certification process to ensure nationwide recognition. Policies now require certification programs to align with national occupational classification standards, reducing discrepancies in skill assessment across different provinces and industries. Furthermore, China is exploring international cooperation to enhance the global recognition of '1+X' credentials, particularly within Belt and Road Initiative (BRI) partner countries, which could improve mobility for Chinese vocational graduates in global labor markets.

While the '1+X' system has achieved significant progress, its continued success depends on scalability, institutional readiness, and employer acceptance. Future developments will likely focus on expanding digital certification methods, strengthening regulatory oversight, and increasing industry-driven curriculum reforms. The system represents a major shift in China's vocational education landscape, reinforcing the role of competency-based learning in workforce development and positioning vocational graduates as key contributors to China's evolving economy.

2. Curriculum Integration and Competency-Based Learning Approaches

The '1+X' certification system has fundamentally reshaped vocational education in China by embedding competency-based learning approaches within traditional curricula. This integration reflects a shift from knowledge-based instruction to skill-oriented training, ensuring that graduates are equipped with industry-relevant competencies that enhance their employability. Vocational colleges now emphasize practical application, modular certification pathways, and industry collaboration, aligning education with labor market demands.

A major change introduced by the '1+X' system is the restructuring of course content to accommodate both diploma requirements and certification training. Traditionally, vocational education in China focused heavily on theoretical instruction, with limited practical exposure. However, the '1+X' model integrates hands-on learning, workplace simulations, and industry-aligned competency assessments, ensuring that students develop technical proficiency alongside academic knowledge. This competency-based framework is particularly

evident in fields such as manufacturing, IT, and healthcare, where practical skills are essential for workforce readiness.

To effectively incorporate certification-based training, vocational colleges have adopted modular learning structures, where students earn credentials in progressive skill tiers. This allows them to build competencies step by step, acquiring foundational abilities before advancing to higher-level expertise. For example, in digital economy fields, students may begin with an entry-level certification in data analytics, followed by intermediate credentials in machine learning or cloud computing, culminating in advanced industry-specific qualifications. This stackable approach aligns with China's broader goal of fostering lifelong learning pathways and enabling workers to upskill continuously.

The success of competency-based learning depends on teaching methodologies that prioritize active engagement and industry collaboration. Many vocational institutions now implement project-based learning, case studies, and real-world problem-solving exercises, moving away from traditional rote memorization. Work-based learning models, such as internships and apprenticeships, have also gained prominence, allowing students to apply theoretical knowledge in real work settings. The partnership between vocational colleges and enterprises ensures that certifications remain up to date with industry trends, making graduates more adaptable to evolving job roles.

Additionally, the integration of digital learning technologies has enhanced the delivery of '1+X' certification programs. Many vocational institutions use virtual labs, AI-driven learning platforms, and online simulation tools to provide flexible, technology-enhanced training. This is particularly beneficial for students in remote regions who may have limited access to physical training facilities. The adoption of learning analytics and personalized feedback systems further supports competency development by identifying individual learning gaps and adjusting instructional content accordingly.

Despite these advancements, challenges remain in fully implementing competency-based approaches within vocational education. Standardization of skill assessments, faculty readiness, and alignment with national qualification frameworks are critical areas that require continued refinement. Some vocational instructors, accustomed to traditional teaching models, face difficulties in transitioning to competency-based pedagogies. To address this, professional development programs are being expanded to train educators in modern instructional strategies, industry collaboration, and digital teaching tools.

Moving forward, the success of '1+X' certification in vocational education will depend on scaling competency-based models, ensuring regulatory alignment, and strengthening industry-academic partnerships. As China continues to emphasize workforce development and lifelong learning, the integration of micro-credentials into vocational curricula will play a vital role in bridging education with employment, preparing students for a rapidly evolving job market.

3. Enhancing Skill Development and Employment Through '1+X' Certification

The '1+X' certification system has become a crucial mechanism in China's vocational education reform, significantly improving skill development and employment prospects for graduates. By integrating industry-recognized certifications with academic programs, the system ensures that students acquire practical, job-ready skills that align with market demands. The initiative has transformed vocational education by fostering competency-based learning, enhancing workforce adaptability, and strengthening employer confidence in vocational graduates.

One of the most significant impacts of the '1+X' system is the expansion of skill-based training in vocational colleges. Traditionally, vocational education in China relied heavily on theoretical instruction with limited hands-on experience, resulting in graduates who often lacked the necessary competencies for employment. The '1+X' model addresses this gap by introducing structured, skill-specific certifications that focus on practical application, real-world problem-solving, and industry-relevant expertise. This approach is particularly effective in technical fields such as manufacturing, IT, healthcare, and finance, where employers prioritize demonstrated competencies over academic qualifications alone.

Employability has also improved due to the direct involvement of industries in designing

certification standards. Leading corporations and industry associations collaborate with vocational colleges to develop certification programs that reflect current job market needs. For example, major technology firms like Huawei and Alibaba contribute to IT-related certifications, while state-owned enterprises help shape training in engineering, logistics, and energy sectors. This alignment ensures that students graduate with skills that are immediately applicable in the workplace, reducing the need for extensive on-the-job training by employers.

Another key advantage of the '1+X' system is the introduction of modular and progressive certification pathways, which allow students to build skills incrementally. Unlike traditional vocational programs, where qualifications are awarded only upon graduation, the '1+X' model enables students to earn micro-credentials throughout their studies. This structure supports a lifelong learning approach, enabling workers to upskill continuously as industries evolve. For example, in the digital economy sector, students may start with a basic certification in cloud computing, advance to data analytics, and eventually specialize in artificial intelligence or cybersecurity, making them more competitive in the job market.

In addition to improving technical skills, the '1+X' system promotes the development of soft skills that are essential for workplace success. Many certification programs incorporate problem-solving, teamwork, project management, and communication training, ensuring that graduates are not only proficient in their trade but also prepared for dynamic work environments. This shift addresses employer concerns that vocational graduates often lack the critical thinking and adaptability required in modern workplaces.

Evidence suggests that graduates with '1+X' certifications have a competitive edge in the job market. A 2022 report by the Chinese Ministry of Education found that students who obtained industry-recognized certifications alongside their diplomas had a 20% higher employment rate compared to those with traditional vocational degrees alone. Employers also reported greater confidence in hiring certified graduates, as these candidates demonstrated verified skills that reduced recruitment risks and training costs.

Despite these benefits, challenges remain in fully realizing the employment potential of '1+X' certification. Some industries and employers still lack awareness of certification programs, leading to inconsistent recognition of credentials across different sectors. Additionally, regional disparities in certification availability create unequal access to employment opportunities, particularly in rural areas where vocational colleges may have fewer industry partnerships.

To maximize the impact of the '1+X' system on employment outcomes, ongoing efforts are needed to increase employer engagement, expand certification categories, and enhance nationwide standardization. Future strategies should also focus on international recognition of Chinese vocational certifications, enabling graduates to compete in global job markets. As China continues to prioritize workforce development and industrial modernization, the '1+X' certification system will play an increasingly vital role in preparing students for high-demand careers, ensuring that vocational education remains a strong pathway to economic mobility and professional success.

4. Implementation Challenges and Institutional Barriers

The '1+X' certification system has introduced a transformative shift in China's vocational education by integrating competency-based training with academic curricula. However, its widespread implementation faces multiple challenges and institutional barriers that affect its effectiveness and scalability. These challenges stem from curriculum alignment issues, faculty preparedness, employer recognition, resource limitations, and regulatory inconsistencies, all of which need to be addressed for the system to reach its full potential.

One of the primary challenges is the integration of '1+X' certifications into existing vocational curricula. Many vocational colleges still operate under traditional educational models that emphasize rote learning and theory-based instruction, making it difficult to incorporate practical, skill-based training seamlessly. Some institutions struggle to redesign their programs to accommodate both diploma requirements and certification training within a limited academic timeframe. Without clear curriculum guidelines and standardized frameworks, there is a risk of uneven implementation across different colleges and regions, leading to inconsistencies in

student learning experiences.

Faculty readiness and professional training present another major barrier. Many vocational educators lack industry experience and are not fully equipped to deliver certification-based, competency-driven instruction. While some institutions provide professional development programs, many instructors still face difficulties adapting to modern teaching methodologies, hands-on training models, and assessment techniques required for '1+X' certification. The rapid evolution of industry standards further complicates this issue, as educators must continuously update their skills and knowledge to keep pace with technological advancements and labor market demands. Without sustained faculty training initiatives, the effectiveness of '1+X' certification programs may remain limited.

Another challenge is uneven employer recognition of '1+X' certifications. While some industries actively participate in certification design and implementation, others remain skeptical about the value of vocational micro-credentials. Many employers prioritize traditional diplomas over competency-based certifications, particularly in sectors where formal degree qualifications remain the dominant hiring criterion. This hesitancy reduces the employment advantages of certification holders, especially in industries where clear skill validation frameworks have not yet been established. Additionally, regional disparities in employer engagement further contribute to inconsistent recognition of credentials, limiting job opportunities for graduates in less industrialized areas.

Financial and infrastructural constraints also pose significant barriers to implementation. Developing and maintaining certification programs requires substantial investment in training facilities, industry partnerships, digital learning platforms, and skilled faculty. While well-funded urban institutions may have the resources to establish modern training labs and technology-enhanced learning environments, many rural vocational colleges lack adequate funding, equipment, and industry connections to support high-quality certification programs. This resource gap leads to disparities in training quality, preventing equal access to certification benefits across different regions.

The regulatory landscape and certification standardization further complicate implementation. Although the Ministry of Education (MOE) and the Ministry of Human Resources and Social Security (MOHRSS) oversee the certification framework, there is no universal standardization of certification assessment and credentialing processes. Some industries have well-defined certification criteria, while others operate under fragmented and inconsistent skill validation mechanisms. Without a unified national framework, vocational institutions face challenges in ensuring that certifications remain uniformly structured, widely accepted, and aligned with labor market needs.

Another key issue is the lack of clear career progression pathways for certification holders. While '1+X' certifications are designed to support lifelong learning and skill upgrading, there is currently no comprehensive system for stackable credentials that allow students to transition seamlessly between different qualification levels. Without a structured progression model, many certification holders may struggle to further develop their careers beyond entry-level positions, limiting the long-term impact of '1+X' training programs.

Addressing these challenges requires a multi-pronged approach that includes stronger curriculum guidelines, faculty upskilling initiatives, greater employer involvement, increased funding support, and improved regulatory oversight. Policymakers must work closely with educational institutions, industry leaders, and local governments to establish clear certification standards, promote employer awareness, and expand access to resources for vocational colleges. By overcoming these barriers, the '1+X' certification system can fully achieve its goal of enhancing workforce readiness, supporting lifelong learning, and creating a more dynamic and responsive vocational education system in China.

5. Future Prospects and Policy Recommendations

The '1+X' certification system has already demonstrated its potential to transform China's vocational education landscape, yet its long-term success depends on strategic policy refinements, institutional improvements, and greater industry collaboration. As China continues to modernize its workforce and align its vocational training with global economic trends, several key areas require further

development. Strengthening the scalability, credibility, and integration of the certification system will be crucial in ensuring its sustainability and effectiveness.

One of the most important future directions is the expansion of industry-aligned certifications. As technology-driven sectors such as artificial intelligence (AI), cloud computing, digital finance, and green energy grow in importance, the '1+X' system must adapt to include emerging skill areas. Future policies should encourage greater flexibility in certification offerings, allowing vocational colleges to quickly develop new certification programs in response to evolving industry needs and labor market shifts. This will help ensure that graduates remain competitive and job-ready, particularly in sectors undergoing rapid transformation.

Another key priority is improving national standardization and international recognition. While the system has been largely successful within China, regional inconsistencies and fragmented certification frameworks still pose challenges. Establishing a unified national assessment system will help maintain the quality and credibility of certifications across different provinces and industries. Additionally, China should strengthen partnerships with international accreditation bodies to enhance global recognition of '1+X' certifications, particularly in Belt and Road Initiative (BRI) countries. This would improve the mobility of Chinese vocational graduates and open opportunities for cross-border employment.

Further development of lifelong learning pathways is also critical for the future of the '1+X' system. While the program currently focuses on entry-level and mid-level skills, a more structured stackable credential model should be introduced. Creating clear progression routes that allow individuals to accumulate certifications over time, leading to higher-level qualifications or specialized expertise, would support career advancement and continuous skill development. Government initiatives should encourage vocational institutions, online learning platforms, and industries to collaborate in designing modular certification structures that enable flexible learning.

The use of digital technology in certification training and assessment should also be expanded. Leveraging AI-driven learning platforms, virtual reality (VR) training, and digital simulation tools can enhance the delivery of competency-based education. Digital credentials and blockchain-based certification verification could further increase transparency, security, and employer trust in the '1+X' system. Investing in technology-driven solutions will make certification programs more accessible, scalable, and adaptable to different learning environments, particularly for working professionals and rural students who may have limited access to traditional training facilities.

Enhancing faculty development is another crucial area for reform. Many vocational educators lack industry experience and training in competency-based teaching methodologies. To bridge this gap, the government should expand faculty upskilling programs, promote industry exchange opportunities for teachers, and establish vocational educator certification requirements. Creating joint training programs between universities, industries, and professional organizations would ensure that vocational instructors are well-equipped to deliver certification-based education effectively.

Finally, strengthening employer engagement is essential for increasing market recognition of '1+X' certifications. Many private companies and state-owned enterprises (SOEs) have already begun collaborating with vocational institutions, but wider adoption is needed across all industries. Government incentives, such as tax benefits for companies that integrate certified employees, could encourage more businesses to recognize and value '1+X' credentials. Additionally, policies should promote apprenticeship models, corporate training programs, and job placement partnerships, ensuring that certification holders have direct employment pathways upon completion of their training.

In conclusion, the future success of the '1+X' certification system will rely on expanding industry-relevant certifications, enhancing standardization, promoting lifelong learning, leveraging digital innovations, improving faculty training, and increasing employer engagement. By addressing these areas, China can ensure that vocational education remains a dynamic and responsive system, equipping graduates with the skills needed to thrive in a rapidly evolving economy. Through policy refinements, cross-sector collaboration, and continuous innovation, the '1+X' system can

serve as a global model for competency-based education and workforce development in the 21st century.

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Research on the Core Employment Ability of University Students in Applied Universities and the Promotion Path of Employment Guidance Work in the New Era — Taking Chengdu Technological University as an Example

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Abstract

To enhance the core employability of college students in application-oriented universities and optimize the employment guidance work in universities. This study takes Chengdu Technological University as an example and conducts a systematic analysis of the current situation of students' employability and the problems existing in the employment guidance services. The study discovers that there are still deficiencies in students' innovation ability, interdisciplinary ability and workplace adaptability during the employment guidance process of the university. The research findings indicate that strategies such as deepening College-enterprise cooperation, implementing personalized employment guidance services, and strengthening innovation and entrepreneurship education can enhance students' core employability and improve the employment guidance work in universities.

Keywords: application-oriented universities, core employability, employment guidance, college-enterprise cooperation

1. Introduction

The continuous increase in the number of university graduates and the increasingly fierce competition in the labor market, China is currently confronted with the employment environment and the employment problems of college students (Jiang et al. 2023). Against this backdrop, the educational goals of application-oriented colleges and universities should not merely focus on students' acquisition of professional knowledge but also enhance the cultivation of their core employability (Arranz et al., 2022). Effectively enhancing the core employability of college students and optimizing the employment guidance services will constitute an important direction for the educational reform in colleges and universities (Freire-Seoane et al., 2019). This paper takes Chengdu Technological University as a case to explore the improvement path of the employability cultivation model of application-oriented colleges and universities in

the new era, and also provides theoretical and practical references for cultivating high-quality application-oriented talents in line with the requirements of the new era.

2. Literature Review

2.1 The Connotation and Characteristics of Core Employability of University Students

2.1.1 The Connotation of Core Employability

Core employability is a comprehensive reflection of the knowledge, skills and professional qualities that college students need to be competent for positions in the workplace (Chen et al. 2023). Its core goal is to help students quickly adapt to the complex and changeable workplace environment and demonstrate excellent professional abilities (Arranz et al., 2022). With the continuous upgrading of talent demands in the employment market, core employability has become an important indicator to measure the workplace competitiveness of college students (Jiang et al., 2023). As an important position for cultivating applied talents, applied colleges and universities must attach importance to the cultivation of students' core employability to adapt to the rapidly changing social environment and the complex and diverse workplace demands (Pinto & He, 2018). Through the research and induction of relevant literature, this paper summarizes five aspects: professional ability, innovation ability, practical ability, communication and teamwork ability, and interdisciplinary comprehensive ability (Zhong & Preudhikulpradab, 2022; Jiang et al.2023). These elements constitute an important basis for improving students' core employability and help them better integrate into the future workplace.

Professional ability pertains to the knowledge and skills that students acquire in a specific professional domain and constitutes the foundation of core employability (Zhong & Preudhikulpradab, 2022; Chen et al., 2023; Jiang et al., 2023). For students in application-oriented universities, professional ability not only encompasses theoretical knowledge but also emphasizes the capacity to apply theory to practice (Guan et al., 2013). Innovation ability is a significant driving force in workplace competition, encompassing innovative thinking, the ability to solve problems, and the capacity to put forward novel viewpoints and methods (Zhao et al., 2022). Practical ability is a crucial indicator of the employability of students in application-oriented universities and refers to the ability of students to apply theoretical knowledge to actual work and ultimately solve problems (Pinto & He, 2018). Communication and teamwork ability are indispensable soft skills in the modern workplace (Pinto & He 2018; St. Louis et al., 2021; Chen et al., 2023). With the escalating trend of social demand for compound talents, interdisciplinary comprehensive ability has become vital (Costa et al., 2018).

2.1.2 Characteristics of Core Employability

The first characteristic is the equal emphasis on comprehensiveness and multi-dimensionality (Williams, 2015). The demand for compound talents in the modern workplace is escalating day by day. Core employability is no longer confined to a single professional field but emphasizes the comprehensive application of interdisciplinary knowledge (Jiang et al., 2023). The second characteristic is the continuous escalation of requirements for innovation and practicality. Innovation is the core driving force for social development, and the demand for innovative talents by enterprises shows a marked growth trend (Zhao et al., 2022). The third characteristic is the global vision and cross-cultural adaptability. With the acceleration of the globalization process, cross-cultural adaptability has also emerged as an important indicator in workplace competition (St. Louis et al., 2021). The fourth characteristic is the high degree of alignment with social needs. With the continuous upgrading of the industrial structure and the in-depth advancement of digital transformation, the job market exhibits significant characteristics of specialization and segmentation (Williams, 2015). College students will maintain a high degree of alignment between their core competitiveness and market demand (Zhong & Preudhikulpradab, 2022). The fifth characteristic is lifelong learning and self-drive (Sun & Yuen, 2012). The modern workplace is constantly evolving, and the ability of lifelong learning has become an essential quality (Zhong & Preudhikulpradab, 2022). Ultimately, the core employability of college students in application-oriented universities in the new era exhibits characteristics such as comprehensiveness, innovativeness, globalization, demand orientation and lifelong learning. These characteristics not only mirror the high standard demands for talents in the contemporary workplace, but also offer a distinct direction for universities to optimize the

talent cultivation model.

3. Population and Sampling

The study was conducted at Chengdu university in Chengdu city of Sichuan province of Chinese mainland. On the one hand, Chengdu is the capital city of Sichuan Province and has many universities in Chengdu. The employability of students from science and engineering universities is more representative. On the other hand, this university is an application-oriented undergraduate university. The establishment of majors adapts to the upgrading of the industrial structure in Sichuan Province and is a layout of applied disciplines and majors that connects with the local industrial chain and innovation chain. It is a one of public university of top employment rate in Sichuan Province.

There is total 19,477 students at Chengdu Technological University. According to morgan table, at least, 377 students at this university are chosen to participate in the survey with valid questionnaire (Krejcie & Morgan, 1970). The convenience sampling method was employed to recruit participants. This method could identify and discuss the selection process for participants in this sample and identify the population in the study and identifying individuals in the population (Creswell & Creswell, 2018). The convenience sampling method was adopted in this study to examine the items of professional ability, innovation ability, practical ability, communication and teamwork ability and employment guidance in an exploratory factor analysis.

The designed questionnaire in this research will be distributed to students through the "Wen Juan Xing" platform, a tool proficient in both designing and collecting survey data. Accessible through commonly used social media applications in China, the questionnaire link can be effortlessly opened, facilitating widespread dissemination via social media channels. Employing remunerative strategies in the investigative process aims to inspire active respondent engagement, foster heightened enthusiasm for questionnaire completion, and broaden the extent of questionnaire dissemination. Every respondent completing the questionnaire becomes eligible for a lucky draw, offering them a chance to receive a cash bonus. The probability of obtaining a reward is contingent upon the number of responses and the randomly drawn allocation of prizes—a truly random process. Rewards are seamlessly integrated into the "Wen Juan Xing" system, ensuring that participants who successfully complete the questionnaire receive their incentives directly through the platform.

Subsequently, the research employed the "Survey on Employability of College Students" questionnaire surveys as outlined by Li et al. (2022) for reference. Drawing upon the literature previously referenced, relevant factors influencing college students' employability were synthesized, and a set of 18 employability-related questions were extracted based on the perceived importance and correlation of these influencing factors. The questionnaire comprises six distinct sections covering professional ability, innovation ability, practical ability, communication and teamwork ability and employment guidance, detailed in the appendix. According to the Likert scale within a five-tier rating system, a score of 5 indicates full compliance, 4 signifies a good match, 3 denotes uncertainty, 2 represents a poor match, and 1 indicates non-conformance. All questions in the survey are framed in a positive manner, signifying that a higher score corresponds to heightened employability for college graduates. Conversely, a lower score suggests a weaker employability profile for the graduate.

4. Analysis of the Current Situation of University Students' Employability

A total of 796 valid questionnaires were collected, with the proportions of freshmen, sophomores, juniors and seniors being 26.76%, 26.51%, 17.59% and 28.77% respectively. The study revealed that students performed relatively well in professional ability and practical ability, but still required further enhancement in areas such as innovation ability, interdisciplinary collaboration ability and teamwork ability.

The survey findings indicate that approximately 54.52% of the students deem their professional capabilities to be relatively firm, among which students majoring in engineering demonstrate particularly remarkable performance in professional knowledge and skills. Nevertheless, the students' innovation ability is generally weak. About 48.99% of the students assess their innovation ability as moderate, and merely 5.9% of the students consider themselves to be "very capable" of innovation. Freire-Seoane et al. (2019)

found that there are differences in employment among students in different disciplinary fields. For example, students in the fields of humanities and social sciences have lower employability. Although the college offered project practice and scientific research training opportunities, their innovative thinking and practical ability were still at the initial stage, and there was a deficiency of systematic innovation education and practice platforms. The insufficient innovation ability not only affects the students' learning thinking but also undermines their ability to handle complex problems in the workplace. These research results are helpful for a better understanding of the factors affecting the employment of college students and provide a reference basis for colleges to formulate relevant policies. College should stimulate students' innovation awareness by establishing innovation laboratories, holding entrepreneurship competitions and other activities, and integrating innovation education into the curriculum system to further enhance students' overall innovation ability.

The college places significant emphasis on offering student's abundant internship and practical training opportunities in practical teaching, particularly in the manufacturing sector, where practical experience is regarded as a crucial competitiveness for students. The survey indicates that approximately 52.39% of the students rate their practical ability as moderate, while 18.22% of the students consider their practical ability to be strong and are capable of effectively converting theoretical knowledge into practical operational ability. Nevertheless, the cultivation of students' interdisciplinary ability remains insufficient. Students majoring in science and engineering perform relatively poorly in the integration and application of interdisciplinary knowledge. About 52.01% of the students rate their interdisciplinary ability as moderate, and only 8.04% of the students believe they are "highly competent" in interdisciplinary ability. In the survey, some students pointed out that the current discipline settings are relatively independent and interdisciplinary courses are relatively scarce, which restricts their integration and application of knowledge from other disciplines and majors. To enhance students' comprehensive ability to solve complex problems, the university urgently needs to strengthen the establishment of interdisciplinary courses and support the development of more interdisciplinary learning projects (Costa et al., 2018).

Communication and teamwork skills, being significant soft skills in the contemporary workplace, have held a crucial position in students' employability (Freire-Seoane et al., 2019). The survey outcomes reveal that approximately 45.98% of the students self-evaluated their communication skills as moderate, while 13.32% of the students considered themselves to have strong communication and teamwork skills. Around 42% of the students encountered communication obstacles or coordination difficulties during the teamwork process, and this issue was especially prominent in interdisciplinary cooperation projects. Students pointed out that universities placed excessive emphasis on individual performance assessment and failed to provide sufficient opportunities to enhance communication and teamwork skills. Colleges should strengthen students' teamwork skills and cultivate their positive team spirit through forms such as group projects and team competitions (Pinto & He, 2018; St. Louis et al., 2021).

At present, there are issues regarding the outdated update of employment information in the current employment guidance work. Firstly, approximately 29.27% of the students consider that the update speed of the employment information provided by the college is sluggish, especially the recruitment information of certain industries fails to be released promptly. Secondly, there is also the problem of the deficiency of individualized employment guidance services. Although the college has conducted career planning lectures and resume and interview coaching activities, students generally hold the view that these services are formalistic and lack pertinence. Finally, there exists the problem of insufficient employment practice opportunities. Some students reflect that, particularly in the economic management majors, they are in shortage of sufficient enterprise internship opportunities. In order to enhance the core employability of students, the university should optimize the employment guidance services, strengthen the cultivation of innovation ability and interdisciplinary collaboration ability, and offer more practical opportunities to better support the development and employment of students.

5. Enhancement Paths of Employment

Guidance

5.1 University-Enterprise Cooperation

At present, the society's demand for high-quality applied talents is constantly rising. The practical ability and the ability to solve practical problems of students have become the core criteria for assessing their employability (Albay, 2019). Through collaborating with enterprises, colleges can promptly grasp the industry demands, update the teaching contents, and offer more internship and employment opportunities for students (Arranz et al., 2022). College-enterprise cooperation, especially the cooperation with alumni enterprises, has become a crucial way to enhance the employability of college students and the employment guidance work (Scandura, 2016).

5.1.1 Joint Development of Customized Courses

Scandura (2016) explores application-oriented universities should emphasize the integration of industry, university and research, and jointly develop university courses through college-enterprise cooperation to ensure that the course content is in line with industry needs and enhance students' practical ability. By combining the disciplinary advantages of the university and the actual demands of enterprises, Chengdu Technological University should collaborate with enterprises to develop customized courses or classes to guarantee that the course content precisely meets the requirements of enterprises. On the other hand, through participation in enterprise projects, students can be exposed to real cases in the classroom to improve their ability to solve practical problems (Sun & Yuen, 2012). Especially in emerging industries and technological fields, the course content should be adjusted promptly according to the dynamics of industry development to enhance students' core employability (Arranz et al., 2022).

5.1.2 University-Enterprise Cooperation Platform

Universities ought to establish long-term and stable cooperative ties with enterprises to enhance the pertinence of employment guidance and form a regular College-enterprise cooperation mechanism (Senan & Sulphey, 2022). Establish long-term internship bases, targeted joint talent training programs and other projects to ensure that students can be exposed to the real working environment in advance through internships and project cooperation, and understand the employment demands of enterprises to enhance their core employability (Guan et al., 2013). Through the internship positions and mentor guidance offered by enterprises, students can accumulate work experience in practice, help them quickly understand the development trend of the industry, and make more targeted preparations for future employment (Senan & Sulphey, 2022).

5.1.3 Enterprises' In-Depth Participation

Universities strongly support enterprises' in-depth participation in employment guidance work (Senan & Sulphey, 2022). They regularly invite enterprise recruiters and industry experts to participate in campus job fairs, related competitions, career planning lectures and other activities to help students understand industry dynamics and employment trends (Pinto & He, 2018). Through this form of cooperation, students can obtain more accurate employment information and make preparations for employment in advance (Scandura, 2016). The modern workplace emphasizes cross-departmental collaboration and team communication skills (Pinto & He, 2018). Through forms such as group projects, team competitions and communication training, students' teamwork ability can be effectively strengthened (St. Louis et al., 2021). Especially in interdisciplinary project cooperation, students should be encouraged to participate in projects with students from different background majors, and such projects should be focused on and included in the teaching section (Bartolj & Polanec, 2021).

5.2 Personalized Employment Guidance Services

Employment guidance is not just about providing recruitment information, resume and interview skills; instead, it should be centered on offering students individualized career planning and development paths (Pinto & He, 2018). Due to the diverse interests, capabilities and career aspirations of students, personalized employment guidance helps students gain a better self-awareness and provides more accurate employment guidance services, thereby enhancing their employment competitiveness.

5.2.1 Personalized Career Planning Guidance

The university combines students' disciplinary backgrounds, hobbies and career goals to formulate individualized career development plans for each student. Through career planning counseling and personalized consulting services, it assists students in clarifying their career

directions and development paths (Sun & Yuen, 2012). Kuijpers (2019) support that the university can also establish a career mentor system and invite industry experts, business managers and alumni to act as mentors. Through one-on-one or one-to-many guidance, mentors can provide personalized career advice based on students' professional backgrounds, career goals and personality traits to help students plan their career paths. The university also holds career lectures, skills training and interview simulation activities on a regular basis to enhance the depth and breadth of employment guidance and improve students' core employment competitiveness (Pinto & He, 2018).

5.2.2 Precise Employment Information

Traditional employment information push can no longer meet the individualized demands of students. Michavila et al. 2015 proposed that based on students' backgrounds, interests and career plans, the university realizes the precise pushing of suitable employment positions to students and helps them connect with employers through the interactive utilization of new media, big data analysis and the employment information platform, thereby enhancing the employment success rate; and precisely recommends suitable internship opportunities to assist students in efficiently obtaining employment resources.

5.3 Integration of Innovation and Entrepreneurship Education

In the new era, innovation and entrepreneurship have emerged as significant driving forces in promoting social and economic development. Particularly for students in application-oriented universities, an innovative spirit is necessary to adapt to the rapidly changing workplace requirements (Giannopoulou et al., 2019). Xu & Fan (2021) proposed that colleges should cultivate students' innovative thinking and practical ability through innovation and entrepreneurship education, offering them broader employment and entrepreneurial opportunities.

In the employment guidance work, the university promotes the seamless integration of innovation and entrepreneurship education with traditional employment guidance. Zhao et al. (2022) argued that it actively establishes entrepreneurship practice platforms and offers funds, venues, technical guidance, as well as market promotion to students having entrepreneurial intentions. This not only assists students in enhancing their practical capabilities but also enables them to have a profound understanding of the challenges encountered in the entrepreneurial process (Giannopoulou et al., 2019). The college holds regular innovation and entrepreneurship competitions or exchange meetings, inviting winners, entrepreneurs, and entrepreneurial mentors to share experiences and answer questions, constantly inspiring students to embark on innovation and entrepreneurship and also providing them with rich experiences (Xu & Fan, 2021).

As an application-oriented university, Chengdu Technological University will, in light of the characteristics and requirements of students, continuously optimize its employment guidance services, comprehensively enhance students' comprehensive capabilities, and assist them in achieving better development in the new workplace. The university's employment guidance efforts also need to adapt to the rapidly changing market demands and effectively enhance students' employment competitiveness by strengthening College-enterprise cooperation, providing personalized employment guidance services, and integrating innovation and entrepreneurship education to facilitate their smooth transition to the workplace.

6. Conclusion

Currently, due to the transformation of the economic structure and changes in the job market, the core employability of undergraduate students, particularly those in application-oriented universities, has emerged as a significant topic in higher education reform. Taking Chengdu Technological University as an example, this paper examines the current status of the employability of college students in this university and puts forward corresponding improvement strategies. The study reveals that students perform well in professional skills and practical abilities, but have shortcomings in innovation ability and interdisciplinary ability. The existing employment guidance services need to be enhanced in terms of personalization, accuracy, and the speed of information update. Based on the result analysis, this paper suggests three approaches to improve the employment guidance work: Firstly, strengthen College-enterprise cooperation, promote the in-depth integration of industry, academia, and

research, and offer more practical opportunities; Secondly, provide personalized employment guidance services and assist students in tailoring their career development paths; Thirdly, strengthen innovation and entrepreneurship education and enhance students' ability to cope with market changes. The enhancement of the core employability of college students is the outcome of the combined efforts of universities, enterprises, and the government. Application-oriented universities will keep innovating the education model to satisfy the market's demand for high-quality talents.

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