VILNIUS UNIVERSITY
BUSINESS SCHOOL

INTERNATIONAL PROJECT MANAGEMENT PROGRAMME

Yuanhao Xu

MASTER'S THESIS

NUOTOLINĖS LYDERYSTĖS ĮTAKA INTERNETINIŲ ŠVIETIMO PROJEKTŲ SĖKMEI	**THE IMPACT OF REMOTE LEADERSHIP ON THE SUCCESS OF ONLINE EDUCATION PROJECTS**

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SUMMARY

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THE IMPACT OF REMOTE LEADERSHIP ON THE SUCCESS OF ONLINE EDUCATION PROJECTS

Supervisor: Assoc. prof., Dr. Dalia Bagdžiūnie

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Short description of the thesis: This thesis explores the performance of remote leadership in online education projects and its impact on project success, focusing on analyzing how the three elements of leadership style, team communication and technical tools work together to promote the success of the project.

The question with this thesis: How do the key elements of remote leadership (leadership style, team communication, and technology tools) work together to influence the success of online education projects?

The aim of this thesis: This study aims to reveal the key role of remote leadership in online education projects and propose feasible leadership strategies to improve project results and meet the complex needs of team management in remote environments.

The main tasks of the thesis:

1. Explore the application characteristics of different remote leadership styles in online education projects and their potential impact on project outcomes.
2. Understand the actual performance of team communication in online education projects and reveal its relationship with project success.

3. Explore the specific ways in which technology tools support leadership behavior and team communication in remote project management.
4. Extract the best practices of remote project management and propose a practical remote leadership strategy framework to improve the success rate of online education projects.

Research methods used in thesis: This study adopts qualitative research methods, collects data through semi-structured interviews, uses thematic analysis to systematically identify and summarize core themes, and combines visualization tools to present the research results.

Research and results obtained: The results show that transformational and distributed leadership have significant advantages in remote education projects, while hybrid leadership style combine multiple leadership characteristics and show higher flexibility and adaptability. Team communication has been proven to be the core factor connecting leadership style and project success, and technical tools have further improved project results by optimizing information flow and collaboration efficiency. The measurement of project success needs to combine traditional standards such as time, cost, and quality with new dimensions such as participation and innovation.

Conclusions of the thesis: Remote leadership plays an important role in online education projects. The synergy of leadership style, team communication, and technical tools can significantly improve the success rate of projects. It is recommended that organizations optimize leadership strategies, improve communication mechanisms, and strengthen the integration and use of technical tools to comprehensively improve the management level of remote education projects.

SANTRAUKA

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Trumpas baigiamojo darbo aprašymas: Šiame darbe nagrinėjamas nuotolinio vadovavimo efektyvumas internetiniuose švietimo projektuose ir jo įtaka projekto sėkmei, daugiausia dėmesio skiriant analizei, kaip trys lyderystės stiliaus elementai, komandos komunikacija ir techninės priemonės veikia kartu, skatinant projekto sėkmę. .

Šios disertacijos klausimas: kaip pagrindiniai nuotolinio vadovavimo elementai (vadovavimo stilius, komandos bendravimas ir technologijų įrankiai) veikia kartu, kad įtakotų internetinių švietimo projektų sėkmę?

Baigiamojo darbo tikslas: Šiuo tyrimu siekiama atskleisti pagrindinį nuotolinės lyderystės vaidmenį internetiniuose švietimo projektuose ir pasiūlyti įgyvendinamas lyderystės strategijas, siekiant pagerinti projektų rezultatus ir patenkinti sudėtingus komandos valdymo poreikius nuotolinėje aplinkoje.

Pagrindinės baigiamojo darbo užduotys:

1. Ištirkite skirtingų nuotolinio vadovavimo stilių taikymo ypatybes internetiniuose švietimo projektuose ir galimą jų poveikį projektų rezultatams.

2. Suprasti realius komandos bendravimo rezultatus internetiniuose švietimo projektuose ir atskleisti jo santykį su projekto sėkme.

3. Ištirkite konkrečius būdus, kuriais technologijų įrankiai palaiko lyderystės elgesį ir komandos bendravimą nuotolinio projektų valdymo metu.

4. Išskleiskite geriausią nuotolinio projektų valdymo praktiką ir pasiūlykite praktinę nuotolinio vadovavimo strategijos sistemą, kuri pagerintų internetinių švietimo projektų sėkmės rodiklį.

Baigiamajame darbe taikomi tyrimo metodai: Šiame tyrime taikomi kokybiniai tyrimo metodai, renkami duomenys per pusiau struktūruotus interviu, naudojama teminė analizė, siekiant sistemingai nustatyti ir apibendrinti pagrindines temas, derinamos vizualizacijos priemonės tyrimo rezultatams pristatyti.

Tyrimai ir gauti rezultatai: Rezultatai rodo, kad transformacinė ir paskirstyta lyderystė turi didelių pranašumų nuotolinio mokymo projektuose, o hibridiniai lyderystės stiliai sujungia daugybę lyderystės savybių ir rodo didesnį lankstumą bei prisitaikomumą. Įrodyta, kad komandos bendravimas yra pagrindinis veiksnys, jungiantis vadovavimo stilių ir projekto sėkmę, o techninės priemonės dar labiau pagerino projekto rezultatus optimizuodamos informacijos srautą ir bendradarbiavimo efektyvumą. Matuojant projekto sėkmę, reikia derinti tradicinius standartus, tokius kaip laikas, sąnaudos ir kokybė, su naujais aspektais, tokiais kaip dalyvavimas ir naujovės.

Baigiamojo darbo išvados: Nuotolinė lyderystė vaidina svarbų vaidmenį internetiniuose švietimo projektuose. Vadovavimo stiliaus, komandos bendravimo ir techninių priemonių sinergija gali žymiai pagerinti projektų sėkmės rodiklį. Siekiant visapusiškai tobulinti nuotolinio mokymo projektų valdymo lygį, organizacijoms rekomenduojama optimizuoti lyderystės strategijas, tobulinti komunikacijos mechanizmus, stiprinti techninių priemonių integraciją ir naudojimą.

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INTRODUCTION

Research background

In recent years, with the rapid development of information technology and the promotion of globalization, remote work has gradually become an important trend in various industries, especially under the impetus of COVID-19 epidemic, remote work mode has been unprecedentedly popular. This shift has not only affected traditional industries, but the online education industry has also rapidly developed into one of the mainstream forms of teaching. In this context, the management and leadership of online education are increasingly concerned. The traditional face-to-face management model is transitioning to virtual management, and how leaders motivate, guide and coordinate teams in a remote environment has become a focus of discussion in both academia and practice.

Research shows that there are significant differences between leadership in an online education environment and leadership in a traditional face-to-face teaching environment. In the project management of online education, leaders should have control over course design and effective management of teaching delivery, but more importantly, leaders need to flexibly use remote leadership to improve the quality of team communication and collaboration, so as to enhance students' learning experience (Awais, 2023; Casiello, 2019). In the face of such a rapidly changing online education environment, adaptive leadership theory often shows high adaptability and flexibility, and leaders are able to establish high-quality communication and trust mechanisms, thus driving teams to deal with complex challenges in remote management (Casiello, 2019).

Online education projects are often complex, especially when it comes to managing remote projects. The process of remote management involves a variety of challenges, including team communication and collaboration, the use of technical tools and support. Effective online leadership can lead teams to deliver projects on time and improve team performance and communication and collaboration (Maruyama & Inoue, 2020). Education is evolving rapidly, and projects with remote working teams put new challenges on leadership to adapt to virtual environments and ensure quality learning for students (Kelly et al., 2016). This is critical since online platforms for education have revolutionized into becoming an essential part of many educational institutions across the world (Fredericksen, 2017).

Research shows that leaders are the technical supporters of online education. On the other hand, leaders are also classic agents of change in the world of online education industries. The leaders build effective technical tools as well as communication strategies to drive project success that would bring about team performance and project enhancement in engagement (Meech & Koehler, 2023). It is also essential for promoting student learning and improving levels of satisfaction among students (Hishamuddin & Shukor, 2021). It reflects online education leadership in how to improve in the remote management team's degree of participation in knowledge sharing and behavior, hence enhancing team cohesion and raising the rate of project success (Jameson, 2015).

Over the last few years, the rapid growth of the online education industry has become one of the high-profile industries. It is in how the leaders effectively manage the remote projects that has become a key factor to the success of online education projects. The aim of this thesis is to explore which leadership styles, research tools, and the application of specific effective communication strategies are likely to generate varied impacts on the utilization of remote leadership toward the successful completion of the online education project (Awais, 2023; Maruyama & Inoue, 2020).

Research question, purpose, objectives and significance

Research question: How do the key elements of remote leadership (leadership style, team communication, and technology tools) work together to influence the success of online education projects?

Research purpose: This study aims to explore the manifestation of remote leadership in online education projects and its potential impact on project success. By deeply analyzing the application of different remote leadership styles, the support of technology tools, and the dynamic process of team communication, this study attempts to reveal how these elements work together to promote the achievement of project results. In addition, this study hopes to summarize the key experiences of remote project management and provide practical leadership strategies for online education institutions to cope with the complex and changing remote environment.

Research objectives:

Explore the application characteristics of different remote leadership styles in online education projects and their potential impact on project outcomes.

Investigate the actual performance of team communication in online education projects and reveal its relationship with project success.

Explore the specific ways in which technology tools support leadership behavior and team communication in remote project management.

Extract the best practices of remote project management and propose a practical remote leadership strategy framework to improve the success rate of online education projects.

Practical implications： This study fills some research gaps in the existing literature by focusing on the application of remote leadership in online education projects. On the one hand, although existing studies have explored the impact of traditional leadership styles on team performance, there are relatively few in-depth studies on remote leadership situations. This study combines the characteristics of transformational, transactional, and distributed leadership styles, and proposes an application scenario for a hybrid leadership style, providing a new perspective for the development of remote leadership theory. On the other hand, this study systematically analyzes how team communication and technical tools interact with leadership styles to affect project success. This exploration of the interaction of multidimensional factors enriches the theoretical methodological system of qualitative research and provides a solid theoretical foundation for further quantitative analysis in the future. In addition, this study proposes a multidimensional measurement standard for the success of remote education projects, extending traditional time, cost, and quality standards to new dimensions such as scientific standards, innovation, and satisfaction, providing a new evaluation framework for the academic community.

Practical implications： With the popularization of remote work models and the rapid development of the online education industry, the importance of remote leadership in project management has become increasingly prominent. This study summarizes the best practices of different leadership styles, team communication strategies, and technical tools through qualitative analysis, providing a highly operational management guide for online education institutions. In practical applications, the hybrid leadership style found in the study can provide leaders with flexible response strategies at different project stages, while the optimization suggestions for team communication and technical tools can help teams improve collaboration efficiency, reduce information loss, and better adapt to remote work environments. In addition, the multidimensional project success evaluation framework provides educational institutions with a tool to comprehensively evaluate the effectiveness of online projects, which helps to

improve project management efficiency and education quality. The results of this study not only provide guidance for the development of the remote education industry, but also provide valuable references for other industries that rely on remote collaboration.

Research methods

This thesis adopts a qualitative research method. It will explore the relationship between leadership style, team communication and technology tools in achieving project success in the field of online education. Qualitative methods are more suitable for this study as it facilitates in-depth exploration of complex, context-related phenomena.

The main data collection method is semi-structured interviews. Participants are selected from different roles and experiences in the online education industry to ensure a wide range of perspectives. Thematic analysis will be used for data interpretation.

The detailed research design and methods will be described in Chapter 2

Thesis structure

Theoretical section: This section analyzes relevant literature and systematically reviews theories and research results on remote leadership, leadership style, project success, team communication, and technical tools, providing a theoretical basis for the study.

Research methods: This section describes in detail the specific steps of the research design, including the construction of the research model, the design and implementation of semi-structured interviews, and the data collection and processing methods. At the same time, this section also explains the ethical considerations and data analysis process in the study.

Research results: This section presents the research findings through thematic analysis, and conducts in-depth discussions around the influence of leadership style, the role of team communication, the supporting role of technical tools, and the multidimensional measurement of project success, and combines visual analysis tools to enhance the presentation and interpretation of the research results.

Recommendations: Based on the research results, this section puts forward specific suggestions for leadership style optimization, team communication improvement, technical tool integration, and project success evaluation, providing practical guidance for the practice of remote education project management.

Conclusion: This section summarizes the core findings of the study, discusses the limitations of the study, and proposes future research directions to provide reference for subsequent research and practice.

1. THEORETICAL PART

1.1 Purpose and structure of the literature review

This literature review aims to explore the application and development of remote leadership in the current remote work environment, and systematically analyze the online education industry, the definition and measurement of project success, leadership style theory and its application in remote teams, and the key role of communication strategies and technology tools in virtual teams. This review summarizes the core concepts, key challenges and practical strategies of remote leadership in remote environments by combing relevant theoretical and empirical research in recent years, and then provides theoretical support for the efficient management of remote teams.

First, the literature review will explore the concept and current status of the online education industry, and analyze the new needs and challenges of remote team management under the background of the rapid development of the industry. Then, the classic theories and measurement criteria of project success are reviewed, especially their application in remote education project management. Subsequently, the core theoretical basis of remote leadership and the application and effectiveness of various leadership styles in remote environments are discussed in detail. In addition, this chapter also analyzes in detail the commonly used communication strategies in virtual teams and their impact on team collaboration, and further explores the key role of technology tools in remote teams in combination with the Technology Acceptance Model (TAM). Finally, the review also points out the direction of future research and potential research gaps in view of the shortcomings of current remote leadership research.

1.2 Concept and status of online education industry

Definition and characteristics

Online education industry refers to the industry that provides educational resources, courses and teaching services to learners through the Internet. With its flexibility, wide coverage and innovation, online education breaks the time and space constraints of traditional education and enables global learners to access knowledge anytime and anywhere (Palvia et al., 2018). Driven by technology, online education adopts various forms, such as e-learning platforms, virtual classrooms, video courses, etc., aiming to improve learners' learning experience and teaching efficiency (Hussein & Mourad, 2014). Compared with traditional

classroom teaching, online education not only provides a more personalized learning pathway, but also provides more educational opportunities for learners from different cultures and backgrounds (Zhou et al., 2020).

Industry development trend

With the deepening of technological advances and digital transformation, the online education industry is growing rapidly and is expected to continue to expand in the next few years. In particular, driven by the COVID-19 pandemic, the global use of online education has increased significantly, becoming a new mainstream education mode (Zhou et al., 2020). Palvia et al. (2018) predict that online education will become a core component of the education landscape by 2025, covering all levels from basic education to higher education. In addition, the development of Industry 4.0 and Education 4.0 has also brought more opportunities and challenges to the online education industry, prompting educational institutions to constantly adopt new technologies to improve the quality of education (Maria et al., 2018; Agrawal et al., 2021).

The innovation of online education is mainly reflected in the redefinition of learning methods and the progress of teaching tools. Through artificial intelligence, virtual reality and big data analysis, online education can realize the formulation of personalized learning paths and accurate learning feedback (Chang, 2016). The application of these new technologies not only improves the engagement of learners, but also promotes the deep integration of online education with actual industry needs (Fuertes et al., 2021).

Industry challenges and opportunities

Although the online education industry shows great potential for development, it still faces many challenges. First, quality control and student engagement in online education are major issues facing the industry. Due to the lack of face-to-face interaction in online learning, how to ensure that students can maintain a high level of engagement and learning effectiveness is a long-standing problem (Lingard, 2019). In addition, cultural differences, uneven technical infrastructure, and digital skills of teachers are also urgent challenges for the global online education industry (Tan et al., 2018).

On the other hand, online education also offers unprecedented opportunities for the global education system. With the advancement of technology, online education has gradually become an important tool to deal with the imbalance of educational resources, especially in

remote areas and developing countries. Through cooperation with enterprises, online education can also better meet the needs of modern society for skills and knowledge, and promote the deep integration of education and industry (Agrawal et al., 2021; Fuertes et al., 2021).

1.3 Definition and measurement of project success

Theoretical basis for project success

Project success has always been the core issue of project management research, and its theoretical basis mainly includes the classical theories of project management, such as the iron triangle theory of project management (time, cost, quality) and stakeholder satisfaction theory. According to the Iron Triangle theory, the key to project success is that the project is completed on time, on budget, and meets the established quality standards (Serrador & Turner, 2015). However, with the increasing complexity of project management, stakeholder satisfaction has gradually become one of the key criteria to measure project success. Davis (2014) proposed that different stakeholders have different definitions of project success, so the measurement of project success should comprehensively consider the expectations and satisfaction of multiple stakeholders.

Influencing factors of project success

There are many factors affecting the success of a project, including leadership, communication and technical support, etc. research by Gunduz and Yahya (2018) shows that in project management, leadership is one of the key factors for project success, and good leadership ensures that team members work together efficiently to drive the project forward. For remote team or online education project, communication quality is also very important in the project, timely and effective communication can reduce misunderstanding and ensure the smooth implementation of the project (Todorovic et al., 2015). Technical support is fundamental to the success of an online education project, and appropriate technology platforms and tools can enhance learner interaction and engagement, thus increasing the overall effectiveness of the project (Mir & Pinnington, 2014).

Measure of online education project success

In online education projects, learner satisfaction and engagement are becoming important factors in measuring project success (Badewi, 2016). With the development of educational technology, the success of a project is not only reflected in the completion time and budget control of the project, but also in the improvement of the learner experience and

the enhancement of the educational effect of the project (Berssaneti & Carvalho, 2015). Online education projects can better achieve these goals through the use of effective project management methods and technical tools.

1.4 Concept and theoretical basis of remote leadership

Remote Leadership Theory

Remote leadership is a specific type of leadership: leaders manage geographically dispersed team members through electronic media or technological tools to maintain leadership effectiveness in the absence of face-to-face contact (Contreras et al., 2020). Remote leadership theory emphasises how leaders adapt to the challenges of remote work environments, where leaders enhance team cohesion and productivity through flexible communication and management strategies (Chamakiotis et al., 2021). Nowadays, remote working patterns have become commonplace globally and remote leadership theory provides a theoretical basis for businesses and organisations to cope with decentralised working patterns.

Contreras et al. (2020) argue that there will be increasing challenges for leaders now and in the future, as more and more people choose to work remotely due to the global environment and pandemic. But there are also challenges: delays in connecting work, reduced employee motivation, and reduced trust between the leader and the team. Therefore, in the current research topics, the remote leadership theory is particularly important, precisely because it can solve the bottleneck period of team performance and the decline of project success rate.

The characteristics of remote leadership mode are mainly embodied in flexibility, innovation and challenge. The flexibility of remote leadership is demonstrated by the need for leaders to quickly adapt to different communication tools and work arrangements. When it comes to remote leadership innovation, leaders who want to motivate and support their employees often need to innovate in the way they manage. Overcoming the communication and trust issues that physical distance creates for remote employees is a major challenge for leaders. In terms of remote leadership opportunities, it mainly includes a broad global search for talent and providing them with more flexible working arrangements, which will help increase the creativity of the team and the adaptability of the employees. (Barua & Patranabis, 2023).

Trust Building and Maintenance

In a team or organization, leaders who want to build and maintain trust need to suggest transparent communication mechanisms and provide channels for employees to give timely feedback, which helps maintain trust among team members (Sull et al., 2020). According to Contreras et al. (2020), one of the characteristics of remote teams is that employees have very little real interaction in the real world due to distance constraints. In this case, it is very difficult to build trust, so leaders need more communication to establish emotional connection in order to maintain trust within the team.

In a remote work environment, building and maintaining trust is one of the core elements of leadership. In the absence of face-to-face interaction, building and maintaining trust is a huge challenge for remote leaders, which requires leaders to implement effective behavioural and communication strategies to solve. According to the study of Sull et al. (2020), trust is very important to unite the team and improve employees' job satisfaction.

Contreras et al. (2020) proposed that it is very important to maintain the emotional connection and trust relationship between leaders and team members. When trust is lacking, team members will often fall apart, which will inevitably affect the success of the project to a large extent. Leaders should take proactive measures to flexibly use various remote management tools and organize regular online meetings through video conferencing, instant messaging and other tools, which can make the communication between team members more frequent and make up for the challenges caused by too long distance. (Costantini & Weintraub, 2022).

Virtual Team Theory

Virtual team theory studies how leaders use technology to keep team members in communication and collaboration when team members are distributed in different geographical locations, so that the team can successfully complete the task. (Chamakiotis et al., 2021). Virtual team theory summarizes that the main issues related to virtual teams are related to problems of communication and collaboration, especially when the team members represent different cultural backgrounds and time zones. Virtual team theory focuses on how leaders can get rid of such barriers and make every member collaborate for the success of the whole (Spagnoli et al., 2020).

Chamakiotis et al. (2021) argued that virtual teams have many challenges to burden their leaders compared to the traditional teams, such as problems with time zones and the use of different technologies, which may lead to misunderstandings because of cultural issues. A

virtual team leader should possess not only traditional leadership competencies but also good cross-cultural communication and flexible management approaches. Spagnoli et al. (2020) explained that the barriers to communication in virtual teams are more complicated than those in face-to-face teams, and leaders have to emphasize clear and frequent communication so that the information can be correctly delivered. In terms of cultural differences, leaders in virtual teams should develop more culturally sensitive attitudes to reduce misunderstanding and conflict, and thus respect diversity for the improvement of productivity and successful project outcomes.

1.5 Application of leadership style theory in remote environment

Main leadership style

Transformational Leadership: Key characteristics of transformational leadership include vision shaping, personalized care, and motivating employees to actively pursue higher goals (Al Khajeh, 2018). Transformational leadership inspires the potential of team members by setting a clear vision to help them improve individual and team performance. Especially in a remote work environment, transformational leaders use effective communication and technology tools to ensure that team members remain effective collaborators. Contreras et al. (2020) point out that in remote Settings, leaders need to pay more attention to emotional support and trust building to improve employees' job satisfaction and sense of belonging.

Transactional Leadership: Transactional leadership emphasizes managing team performance through clear goal-setting and reward and punishment mechanisms (Al Rahbi et al., 2017). In remote teams, transactional leaders can ensure projects are completed on time through clear communication and rigorous performance reviews. The study by Nawaz and Khan (2016) has established that the transactional leader is capable of enhancing the efficiency of the implementation of team tasks through the adoption of the electronic performance management tools in the virtual environment leadership.

Distributed Leadership: Distributed leadership stimulates teamwork through shared responsibility and authority, especially strongly in distributed remote teams. Fernandez and Shaw (2020) stated that distributed leadership in remote teams can increase autonomy and decision-making capability of the team. Distributed leadership enhances team flexibility and thereby enhances overall project performance due to autonomous collaboration among team members (Gunzel-Jensen et al., 2018).

Situational Leadership Theory: The situational leadership theory states that the leader should flexibly turn his leadership style regarding the abilities of the members in the team and the exact needs of the task. Buble et al. (2014) pointed out that in a remote working environment, leaders need to be adaptable and choose appropriate leadership styles for different situations and project requirements to achieve optimal work efficiency. Diversity and complexity in remote environments require leaders to have the flexibility to adapt management strategies to changing project environments.

1.6 Communication and use of technical tools in virtual teams

Remote communication theory

Media richness theory: The Media Richness Theory, proposed by Daft and Lengel, maintains that different communication media have different "richness", that is, the ability of information transmission. The higher the complexity of information, the greater the need for high-richness communication media (Morrison-Smith & Ruiz, 2020). In virtual teams, video conferencing, phone calls, etc. are seen as high-richness mediums because they provide immediate feedback and visual cues. On the other hand, email and instant messaging are considered to be low-richness media (Lilian, 2014). In handling complex tasks, the virtual teams should make more use of high-richness tools for better effectiveness in communication (Raghuram et al., 2019).

Communication adaptation theory: The Communication Accommodation Theory highlights that people converge to one another's communication behavior, which in turn will encourage the improvement of the communicative effect on both parties concerned (Gibbs et al., 2017). In virtual teams, cultural and technological differences are rather a given, and members have to learn to embrace such variability. Members who adopt flexible communication tools tend to be more adaptable, therefore reaping the positives for the entire team. Tools are chosen based on how much adaptiveness members perceive to be able to demonstrate in the change of media richness levels for varying task requirements. Adaptiveness, therefore is one of the most important strategies that ascertains continuity and effectiveness of communication (Marlow et al., 2017).

Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) also becomes an important framework when understanding how the virtual teams originally adopt and make use of technology tools. The

subjective perceptions of usefulness regarding a technology and how easily it can be used by users have a strong influence on their intentions to actually use it (Dulebohn & Hoch, 2017). Thus, for good acceptance by team members, technology applications depend on effective frequency. In fact, research has indicated that team members are most likely to accept the communication tools more available, such as Slack and Zoom (Gilson et al., 2015). Where necessary, technical support and training could be provided in order to ensure wider diffusion by increasing the acceptance of new tools by members (Jimenez et al., 2017).

Theoretical basis for communication tool selection

The selection of the tools influenced by such factors as complexity of the tasks, richness of communication media, cultural backgrounds of team members, distribution of time zones, and type of tasks (Breuer et al., 2016). As Liao (2017) expresses, Leaders play an important role in virtual teams. The choices of leaders for communication tools contribute much to enhance team cooperation. It will also help a member to overcome temporal barriers by using asynchronous communication methods, which include email or shared documents, for teams operating in different time zones (Morrison-Smith & Ruiz, 2020). Jimenez et al., (2017) put greater emphasis on the tool of real-time communication-video conferencing and instant messaging-in teamwork development.

Media richness, communication adaptability, and technology acceptance are a few factors that affect how virtual teams communicate and use different effective communication and technology tools. Tool selection should be guided by the nature of the task and characteristics of the team in order to have the value-added impact in the realms of communication and collaboration.

1.7 Effective remote leadership strategy

Organizational change management theory

Organizational change management theory points out that in a complex and uncertain work environment, leaders have to promote change and adjust towards the changing environment. Among them, remote leaders have a higher challenge while working and giving attention to virtual teams. As noted by Contreras et al. (2020), the leaders who need to adapt to the shift in the remote work environment have to bear certain skills for the smooth operation of organizations in the remote environment. Change management theory can help a remote leader to understand that effective communication and technology lead teams in adapting to

the complexities of remote work, hence driving appropriate change and enhancing organizational flexibility.

Cultural intelligence theory

When the different cultural backgrounds exist within the virtual team, the theory of Cultural Intelligence (CQ) suggests a leader should adapt and adjust to such cultural background. According to Pellikka (2021), a remote leader must be highly culturally intelligent to communicate and manage people in cross-cultural settings. Because in a globally dispersed team, due to cultural differences, there can be hurdles regarding communication. Cultural intelligence can help remote leaders observe the needs of other members in a team. In this respect, leaders use adaptive communication strategies which enhance team cohesion and productivity.

Best practice model

Best practice models are an important part of most remote leadership strategies. According to research by Lewis (2023), developing clear policies and standardized processes for remote work is likely to improve the efficiency and productivity of teams better. Five significant practices related to remote leadership include regular meetings virtually, clarity in setting goals, psychological support, flexibility in work schedules, and technical support (Sull et al., 2020). These practices can increase employee job satisfaction and also increase the communication efficiency of each team and finishing rate of tasks. According to Flood (2019), due to the needs of the remote leading for a team and the complexity of tasks, the leader must switch communication approaches and managerial behavior according to different situations.

1.8 Literature review summary

Advantages of transformational leadership in remote environment

The merits of transformational leadership in virtual teams are significant, with principal characteristics emphasizing vision shaping and personalized care for team members. Transformational leadership strengthens team cohesion through clear vision and strong communication. Transformational leadership will also be able to motivate team members and actively involve them in the virtual environment by caring about their personal needs (Al Khajeh, 2018). It is also guaranteed that transformational leadership in remote education and other online industries enables team members to work in decentralized working environments because of effective communication and use of technology tools (Contreras et al., 2020).

Transformational leadership style can effectively improve employees' self-efficacy and job satisfaction, especially in remote work environments.

The critical role of communication in remote team success

Communication is one of the key factors for remote team success. In the absence of face-to-face communication, remote leaders build and maintain trust among team members through effective communication strategies and transparent leadership (Gibbs et al., 2017). Transformational and distributed leadership improves remote team collaboration and overall efficiency by enhancing communication and trust among team members (Fernandez & Shaw, 2020). Meanwhile, transactional leadership, while maintaining short-term team performance through clear reward and punishment mechanisms, falls short in communication and trust building and long-term team cohesion (Nawaz & Khan, 2016).

Flexibility and adaptability of distributed leadership

Distributed leadership in remote teams emphasizes how responsibilities and authority be delegated to enable teams to cope better with increasingly complex and dynamic work environments. Distributive leadership places greater responsibility on team members, hence fostering their autonomy to be more innovative (Gunzel-Jensen et al., 2018). In other words, distributed leadership may effectively take some of the pressures off centralized management in virtual teams and enhance the flexibility and decision-making capability of the team. Distributed leadership has wide prospects in the application of the management of a remote project and virtual team collaboration.

The key role of technology tools in remote teams

The choice of tools for communication and technology platforms in the virtual environment directly pertains to the ways the teams will collaborate. Rich media for communications, such as video conferencing and instant messaging, support immediate feedback and visual cues in cases where the task is complex and thus allow group members to surmount the challenges of geographical dispersion. (Morrison-Smith & Ruiz, 2020). According to the technology acceptance model (TAM), remote team members' acceptance of technology tools and frequency of use, depends on how easy the tools are to use and how useful they are (Dulebohn & Hoch, 2017). When choosing and promoting remote working tools, leaders must consider the technical adaptability of the tools and the needs of team members,

which can ensure the effectiveness of the tools in improving communication efficiency and team performance

Measure of project success and influence of remote leadership

While traditional project success measures mainly include time, cost, and quality, remote project success measures also include customer satisfaction, team cohesion, and communication efficiency (Badewi, 2016). By motivating team members, transformational leadership improves the overall quality of the project and the members' sense of involvement. Transactional leadership ensures timely delivery of projects through clear goals and performance appraisal mechanisms (Serrador & Turner, 2015). For remote projects, the leadership style and communication strategy of the team will directly affect the final outcome of the project.

Best practice model for remote leadership

Current research shows that remote leadership strategies need to be constantly adjusted and optimized in practice. Remote leaders should combine the advantages of transformational, distributed, and transactional leadership and adopt a flexible leadership style as much as possible, which can promote efficient collaboration among team members in a virtual environment (Lewis, 2023). Successful remote leadership strategies should also include communication and trust building, clear goal setting, and psychological support (Sull et al., 2020). The leader should flexibly select and adjust the corresponding leadership strategy according to the specific needs of the team and the complexity of the project, so as to promote the productivity and innovation of the team

Sum up

Transformational and distributed leadership styles can enhance team cohesion and job satisfaction through vision shaping, personalized care, and assignment of responsibility, especially in remote Settings. The key to the success of remote teams is also the establishment and maintenance of communication. In addition, the use of technical tools is the core means to improve the efficiency of communication. In order to adapt to rapidly changing work environments and team needs, future research and practice should continue to explore how to balance the application of leadership styles, communication, and technology tools in remote Settings.

1.9 Research gap

Insufficient contextual application of remote leadership theory

Existing studies have mostly focused on the performance of traditional leadership styles (such as transformational, transactional, and distributed leadership) in face-to-face work environments, but lack in-depth exploration of how these leadership styles interact and their application characteristics in remote contexts. In addition, there is little systematic research on hybrid leadership styles in the current literature. This study fills this gap and explores the application and adaptability of the combination of transformational and transactional leadership styles in remote education projects.

Limited research on the interaction between team communication and technology tools

As key elements in remote work, the interaction between team communication and technology tools is only mentioned sporadically in the existing literature, and lacks comprehensive and systematic analysis. Especially in the complex context of online education projects, how to improve team communication efficiency through technology tools and how to effectively use tool support in communication is still an area that has not been fully studied.

Insufficient multidimensional perspective on project success measurement

Traditional project management research usually relies on the three elements of time, cost, and quality to measure success, while ignoring the unique success dimensions in the field of education, such as the scientific standards and innovation of the course, learner satisfaction, and team growth. This study proposed a multidimensional measurement framework through qualitative analysis, combined with the characteristics of remote education projects, and expanded the scope of application of existing evaluation standards.

Practical research on remote education projects is scarce

Although remote leadership has been widely discussed in theory, empirical research on online education, a rapidly developing industry, especially on specific projects, is relatively scarce. This study uses online course development, teaching implementation, and teacher training projects as cases to provide a systematic discussion on the application and practice of leadership in remote education projects, filling the gap in empirical research in related fields.

2. RESEARCH METHODOLOGY

2.1 Research model

Based on literature review and theoretical analysis, this study constructs a conceptual framework model to explore the role of remote leadership in the success of online education projects. The model aims to describe the core research elements and their interactive relationships, and provide structured guidance for subsequent data collection and analysis.

2.1.1 Model Elements

The design of the research model revolves around the following four core elements:

Leadership style: Covers transformational leadership, transactional leadership, and distributed leadership styles. Different leadership styles affect the communication and collaboration methods of team members in their own unique ways.

Team communication: Refers to the overall quality of information flow, collaboration, and feedback between team members. Effective team communication is an important driving force for project success in a remote environment.

Technical tools: Tools that support remote work and communication, such as collaboration platforms, video conferencing software, and knowledge sharing systems. The selection and use of technical tools have an important impact on the implementation of team communication and leadership styles.

Project success: Takes team performance, learner satisfaction, and project goal completion as the core measurement criteria, comprehensively reflecting the final results of the remote education project.

2.1.2 Model logic

This model is based on theory from the literature review and describes the core interactional logic of remote leadership in the success of online education projects. Leadership style affects the depth and quality of team communication by shaping the team atmosphere and incentive mechanism, thereby promoting the realization of project goals. Transformational leadership improves team morale by motivating and shaping vision, and promotes efficient communication and cooperation among team members (Contreras et al., 2020). This style significantly improves the quality of team communication, enhances members' sense of

participation and responsibility, and lays the foundation for project success. Transactional leadership motivates team members to focus on project tasks through clear goals and reward and punishment mechanisms (Al Rahbi et al., 2017). In a remote environment, this style promotes clarity in task assignments, helping to improve communication efficiency and project outcomes. Distributed leadership allocates responsibilities to different team members and improves the team's self-organization and adaptability by enhancing the team's autonomy and collaboration capabilities (Gunzel-Jensen et al., 2018). This leadership style further supports the achievement of project goals by strengthening trust and communication among team members.

As a core element of the model, team communication plays an important role in connecting leadership style and project success. High-quality communication can promote the flow of information, collaboration and feedback among team members, thereby ensuring the successful completion of project tasks. Media richness theory shows that high-rich media (such as video conferencing) can improve team members' sense of participation and collaboration efficiency, and to a certain extent make up for the physical isolation between remote team members (Morrison-Smith & Ruiz, 2020). In a remote environment, team communication not only reflects the dynamic management ability of the leadership style on the team, but also directly affects the realization of project success.

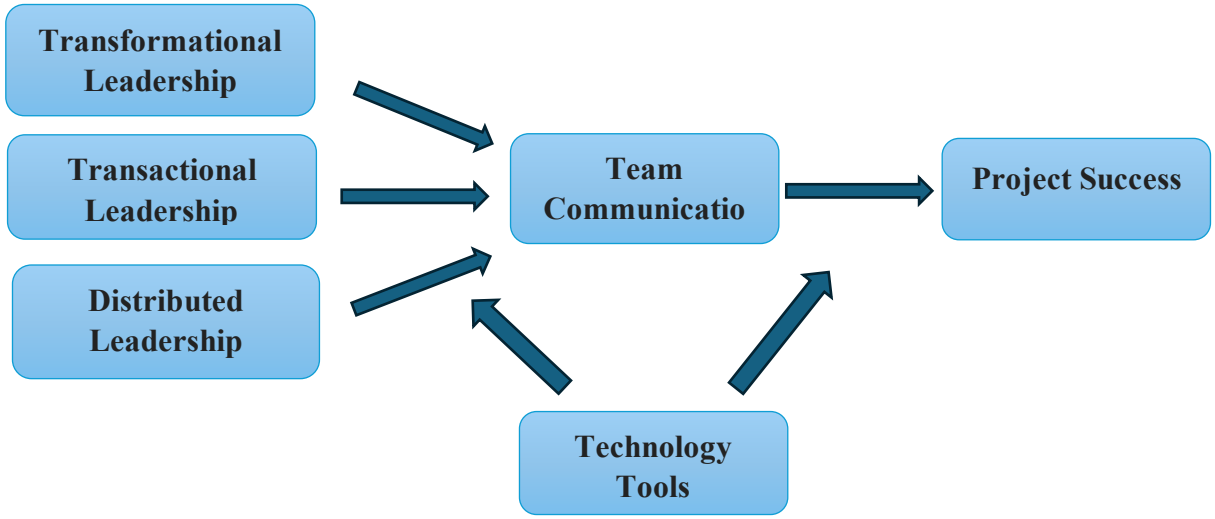
Technical tools provide an important supporting role in the model. Efficient technological tools (such as video conferencing and instant messaging tools) can ensure the implementation of team communication and leadership styles by improving the efficiency of information transfer and transparency of collaboration. According to the Technology Acceptance Model (TAM), team members' acceptance of a technology tool determines the effectiveness of its use (Dulebohn & Hoch, 2017). High-media-rich tools not only facilitate real-time messaging but also compensate for the shortcomings of remote communication and enhance the effectiveness of leadership styles in motivating teams and clarifying missions. These technology tools also improve the team’s understanding of tasks and goals, further increasing the likelihood of project success.

The successful realization of the project is the result of the combined effect of the above factors. By optimizing the interaction of leadership styles, team communication, and technology tools, project goals were achieved while reflecting an overall improvement in educational quality and team performance.

2.1.3 Model presentation

Figure 1

Research model



Source: compiled by the author

2.2 Research method

This study uses qualitative research methods to explore the impact of leadership style, team communication, and technical tools on project success through semi-structured interviews. Qualitative research methods, with their flexibility and in-depth analytical capabilities, provide an appropriate research path for the exploratory questions of this study. Unlike quantitative research that focuses on the causal relationship between variables, qualitative research focuses on revealing the internal logic and deep subjective experience behind complex phenomena. This method is particularly suitable for the topic of leadership style and team communication in the online education industry, which is complex and rarely fully explained by quantitative research.

According to Rahman (2016), qualitative research provides unparalleled insights into complex issues by digging deep into the behaviors, perceptions, and emotions of respondents. In contrast, although quantitative research can provide general conclusions based on statistical analysis, it usually lacks a detailed description of the subjective experience of the research subjects. Trafimow (2014) further pointed out that the goal of qualitative research is to describe and explain subjective experience, which is highly consistent with the needs of exploratory

research. In addition, Aspers and Corte (2019) believe that qualitative research is an iterative process, the core of which is to gradually deepen the understanding of the research problem through close contact with the research phenomenon.

The reasons for choosing qualitative research methods are mainly based on the following points: First, existing research on remote leadership is mostly focused on quantitative analysis, and qualitative methods can provide a more delicate research perspective for this field (Rahman, 2016). Second, Sale et al. (2002) mentioned that qualitative research can supplement the complex interactive processes and contextualized information that cannot be captured by quantitative research, especially when exploring the specific impact of team communication and technical tools on project success. Finally, the exploratory goal of this study is highly consistent with the descriptive characteristics of qualitative research methods.

2.3 Data collection

2.3.1 Selection of Data Collection Methods

This study selected semi-structured interviews as the main data collection method. This method is widely used because it is flexible and systematic, and can deeply explore the subjective experience and cognitive process of complex phenomena in qualitative research (Kallio et al., 2016). Semi-structured interviews combine open-ended questions with structured frameworks, allowing researchers to flexibly adjust the direction of the interview to capture more in-depth information while ensuring the consistency of the data system and research objectives.

The advantage of semi-structured interviews is that they can provide researchers with the opportunity to fully explore the unique perspectives of the interviewees, while avoiding the data redundancy or topic deviation problems that may be caused by completely unstructured interviews. Through the preset interview framework, this study can cover core topics such as leadership style, team communication, technical tools and project success, and gain an in-depth understanding of the interactive relationship between these elements through open-ended questions. In addition, during the interview process, the researcher can flexibly ask relevant details based on the interviewee's answers, revealing unforeseen topics, thereby providing new theoretical inspiration for the research.

Remote education projects involve diverse roles and complex interactive relationships, including project managers, course designers, technical support personnel and teaching

instructors. Semi-structured interviews can fully adapt to this complex situation. By flexibly adjusting questions and in-depth questioning, they can tap into the unique insights and deep cognition of the interviewees on the research topic. In addition, this method, by combining open-ended questions and preset frameworks, can not only ensure the coverage of the research objectives, but also capture the diverse experiences of the interviewees in leadership style, team communication and application of technology tools, providing a rich and detailed source of data for the research.

Another important advantage of semi-structured interviews is that they can reveal unexpected findings. Since remote leadership and its application in online education projects is an emerging and underexplored field, semi-structured interviews allow researchers to flexibly adjust the direction of the interview, explore in depth the unforeseen topics or views provided by the interviewees, and provide expansive contributions to theory and practice. At the same time, this method also supports a detailed analysis of complex social phenomena, captures the subjective experience of the interviewees in the remote environment and their understanding of the interactive relationship between key elements, thereby enhancing the theoretical depth and practical value of the research.

In summary, semi-structured interviews can not only meet the needs of this study to explore the complex interactive relationship between multidimensional factors, but also provide comprehensive and specific theoretical support for the study of the role of remote leadership in online education projects by deeply analyzing the practical experience and subjective cognition of the interviewees.

2.3.2 Selection of research projects

This study selected three key projects of Xueersi Online School as research cases: online course development, online teaching implementation, and remote teacher training. These projects cover the core links in the field of online education, from course design to teaching implementation, and then to teacher capacity building, and can fully present the impact of remote leadership on project success. In order to meet the "one-time" and "temporary" characteristics of "projects", this study focuses on independent projects of these business activities in the second half of 2024 (June-November), including:

Online course development: focusing on the development project of the new middle school physics course, covering multiple stages such as demand analysis, framework design, content creation and technical implementation.

Online teaching implementation: focusing on the teaching execution of middle school physics courses, studying how to coordinate teaching teams and improve teaching effectiveness in a remote environment.

Remote teacher training: focusing on new teaching method training projects for middle school physics teacher teams, exploring the role of leadership in training management and implementation.

By studying these projects, this study can systematically explore the actual impact of remote leadership on team communication, technology tool application and project success.

2.3.3 Selection of interview subjects

Based on the research objectives and project characteristics, this study selected 10 key roles as interview subjects, covering three projects and cross-project supplementary roles to ensure the comprehensiveness and diversity of data sources. This diverse selection of roles can fully reflect the role of leadership style, team communication and technical tools in different project stages. However, for complex multi-factor research, the sample size may be small, especially for some roles (such as students, only one person) whose data representativeness is limited. Despite the small sample size, the qualitative method of this study focuses on in-depth understanding and exploratory analysis, so it can reveal the intrinsic relationship between factors through a small sample. This design is in line with the characteristics of qualitative research that focuses on detailed characterization and theory generation (Trafimow, 2014). In subsequent research, the sample size can be expanded and the participation ratio of specific roles (such as students and teachers) can be increased to further verify and expand the research conclusions.

Table 1

NUMBER	PROJECT	POSITION	RESPONSIBILITIES
01	Online course development	Project Manager	Coordinates work across various stages of course development.
02	Online course development	Course Designer	Responsible for designing the course framework and creating content.
03	Online teaching implementation	Teaching Team Leader	Plans teaching tasks and manages the teaching team.

04	Online teaching implementation	Teacher	Frontline teaching staff responsible for classroom instruction.
05	Online teaching implementation	Student Support Staff	Provides classroom management support and resolves student issues.
06	Remote teacher training	Training Project Leader	Coordinate the overall management of the training project.
07	Remote teacher training	Training Instructor	Teachers directly responsible for delivering training sessions.
08	Remote teacher training	Participating Teacher	The primary audience for teacher training.
09	Cross-project	Technical Support Staff	Ensures the operation of the technical platform.
10	Cross-project	Students	The end users of the project.

Interviewee Information Table

Source: compiled by the author

2.3.4 Interview Design

The interview design of this study is based on the research model as the core framework. It combines the project background and the role characteristics of the interviewees to deeply explore the relationship between leadership style, team communication, technical tools and project success. The interview questions revolve around the four core elements of the research model (leadership style, team communication, technical tools and project success). Through open-ended questions and flexible adjustments, the interviewees' multi-dimensional experience and deep cognition are fully captured.

The design logic of the interview questions is highly consistent with the research model, focusing on both the independent performance of key elements and the interactive relationship between elements. Questions about leadership style mainly focus on how leaders support team collaboration and goal achievement in a remote environment through different leadership styles such as transformational, transactional and distributed. Team communication questions aim to reveal the efficiency of information flow, obstacles in collaboration and the application of feedback mechanisms, while exploring the potential impact of leadership style on team communication quality. Technical tool questions focus on the specific role of tools in promoting remote collaboration, improving communication efficiency and supporting leadership behavior, and try to understand the limitations and improvement directions of technical tools. Finally, the project success questions evaluate the measurement criteria of team

performance, learner satisfaction and project goal completion through the actual experience of the respondents, and clarify the specific contribution of each factor to the project results.

Given that the study selected three online education projects (online course development, online teaching implementation and remote teacher training) as cases, the design of the interview questions was adjusted according to different projects and roles to reflect the characteristics of different project stages and responsibilities. For the online course development project, the questions focused on the performance of leadership style in team support during course design and implementation, the impact of technical tools on collaboration efficiency, and the role of team communication in promoting the achievement of project goals. The online teaching implementation project focused more on the communication and collaboration of the teaching team in classroom management and teaching support, the application of technical tools in solving teaching problems, and the promotion of leadership style to the overall efficiency of the team. The questions of the remote teacher training project focused on the adaptability of leadership style in the training project, the quality of collaboration between teams and the support of technical tools for the achievement of training goals.

In addition, this study further refined the interview questions for different roles (such as project managers, course designers, teaching team leaders, teachers, technical support personnel and students) to adapt to the specific responsibilities of each role in the project. For example, the design of questions for project managers and other responsible persons focuses on the implementation of their leadership style and the management of team communication, while for technical support personnel, more attention is paid to technical requirements and tool optimization in cross-team collaboration. Through role-based questioning, the interview can fully capture each role's unique perspective and in-depth feedback on the research topic.

The openness and flexibility of the interview questions are important features in the design. This design not only helps to systematically cover the key content of the research model, but also provides space for respondents to express their individual experiences and opinions, thereby revealing unforeseen themes or potential factors. Combined with different project backgrounds and interviewee roles, the interview questions achieve an organic integration of theoretical frameworks and actual situations, providing a rich and in-depth empirical basis for subsequent data analysis.

The interview design of this study ensures the systematic and in-depth data collection by closely focusing on the core elements of the research model and combining the characteristics of specific projects and roles. Through this design, the study can not only capture the impact mechanism of leadership style, team communication and technical tools on project success, but also reveal the complex interactive relationship in the actual operational experience of respondents, providing new insights into remote leadership theory and practice.

Examples of specific interview questions are as follows:

Project manager: "What role does your leadership style play in improving the quality of team communication?"

Teaching team leader: "In a remote environment, which leadership style do you prefer (such as transformational, transactional, distributed, etc.)? How does this leadership style help you achieve project goals?"

Teacher: "Do you feel that the leadership style of the teaching team leader supports your teaching work? If so, in what specific aspects?"

Student support service staff: "Do you rely on technical tools to support your work? Which tools are most helpful for you to deal with student problems?"

Training project leader: "What technical tools does your team mainly use to support remote communication? How do these tools affect the efficiency of team communication in conjunction with your leadership style?"

Training instructor: "Do you communicate more with other team members at work? Is this communication smooth?"

Participating teachers: "How do you evaluate the effectiveness of this training? Did you achieve the expected learning goals?"

Technical support staff: "What specific role do you think technical support plays in the success of the project?"

Student: "Do you feel that the collaboration and organization of the teaching team have special highlights? How do these help your learning?"

All interview questions are presented in Appendix 2.

2.3.5 Interview implementation

This study uses semi-structured interviews as the main data collection method to ensure that the interviews can conduct in-depth discussions around the core elements of the research model while providing interviewees with space for free expression. In order to maximize the quality of the interviews and the validity of the data, the interview implementation process was carefully designed and followed the following steps.

First, the interviews were conducted online, mainly through the voice call or video call function of WeChat. This flexibility can adapt to the different preferences and technical conditions of the interviewees. One week before the formal interview, the researcher sent an invitation to the interviewees online, so that the interviewees had enough time to consider whether to participate in the interview and prepare relevant materials. In order to help the interviewees better understand the professional concepts involved in the interview, such as leadership style, team communication and technical tools, the researcher sent a concise and easy-to-understand introduction to the concepts in text form one day before the agreed interview date, so that the interviewees could familiarize themselves in advance.

At the beginning of the interview, the researcher first clarified the academic purpose of this study to the interviewees, emphasized the principle of confidentiality, and ensured that the information of the interviewees would not be leaked or used for other purposes outside of the research. Subsequently, the researcher briefly introduced the research background and key concepts such as leadership style to ensure that the interviewees could accurately understand the core intention of the interview questions. During this process, the researcher will also agree with the interviewee on the interview duration (usually 20-30 minutes) and make expected communication for the specific process of the interview.

After the interview officially begins, the researcher first guides the interviewee to briefly introduce his or her job title, main responsibilities and specific role in the project. Next, the interview will be gradually carried out according to the pre-designed outline, and each question will discuss the four core themes of leadership style, team communication, technical tools and project success. The questions are designed in detail for different roles to ensure that the questions are closely related to the interviewee's responsibilities and project context. For example, questions for project managers mainly focus on their choice of leadership style and the impact on team communication, while questions for technical support personnel focus more on tool optimization and support for cross-team collaboration. The discussion time for each question is controlled at about 5 minutes, and the researcher will ask follow-up questions in a

timely manner according to the interviewee's answer to ensure that key information is fully excavated.

During the interview, the researcher presided over the whole process and used recording equipment to fully record the content of the interview to ensure the accuracy of subsequent data analysis. Before recording, the consent of the interviewee will be obtained again, and the principle of confidentiality will be reiterated. The language of communication was Mandarin Chinese, and the researchers tried to use easy-to-understand expressions as much as possible to avoid communication barriers that may be caused by complex terms.

At the end of the interview, the researchers thanked the interviewees for their participation and invited them to share any additional ideas or suggestions related to the research topic to provide more possibilities for potential unexpected discoveries. The interview recordings were backed up immediately after the end and properly stored in accordance with ethical standards to ensure the security and privacy of the interviewees' data.

Overall, the interview implementation process of this study focused on respecting the interviewees' experience and ensuring data quality. Through clear process design and flexible questioning strategies, this study was able to deeply explore the interviewees' practical experience and subjective cognition in remote leadership, team communication, technical tools, and project success, providing strong support for the realization of research objectives.

2.3.6 Data Recording and Processing

This study recorded the entire interview process based on the informed consent of the interviewees to ensure the integrity of the interview content and provide high-quality data support for subsequent analysis. The recorded data will be transcribed into text in a timely manner after the interview for more detailed analysis and coding. In this process, the researchers are committed to retaining the context and details to ensure the authenticity and integrity of the interview content.

The verbatim recording method is used in the transcription stage, which not only records the content of the interviewee's speech, but also captures his tone, pauses and other non-verbal information as much as possible to more comprehensively reflect the context. Although the interview was conducted in Chinese, all transcripts will be translated into English after completion. During the translation process, the researchers strive to accurately convey the

original meaning of the interviewee while retaining the cultural and linguistic characteristics in the context to avoid losing important information due to language conversion.

In order to protect the privacy of the interviewees, this study strictly implements data anonymization. All recordings and text transcription data remove sensitive information that may reveal the identity of the interviewee, including name, position and other personal characteristics. The anonymized data is managed by using a unified numbering system to ensure the coexistence of data traceability and privacy protection. At the same time, the relevant recordings and transcripts were stored in separate folders for subsequent analysis and retrieval.

In terms of data quality management, the researchers conducted multiple rounds of proofreading for each transcript and repeatedly checked it with the recordings to ensure the accuracy of the text records. Once ambiguities or omissions were found in the translation or transcription, the recordings would be listened back in time to make supplements and corrections. The researchers paid special attention to the subtleties in the interviewees' statements, such as emotional expressions or changes in tone, because this information has important explanatory value in qualitative research.

To ensure the security of the data, this study adopted a double backup mechanism. All recordings and transcripts are stored in encrypted local devices and secure cloud storage platforms. The cloud storage platform is equipped with a double authentication function, while the local storage device uses advanced encryption technology to prevent unauthorized access. The researchers regularly check the storage status of the data and update the backup version synchronously to prevent data loss due to technical failures or accidents.

Anonymization and multiple data protection measures not only meet ethical requirements, but also provide a solid foundation for the transparency and scientific nature of data analysis. Through rigorous recording and processing procedures, this study ensures the integrity, confidentiality and availability of the data, laying a solid foundation for subsequent coding and analysis.

2.4 Data analysis

2.4.1 Selection of data analysis methods

This study uses thematic analysis (TA) as the main data analysis method to systematically identify, analyze and report recurring themes or patterns in interview data.

Thematic analysis is a highly flexible qualitative analysis tool that is widely used in exploratory research and the analysis of complex social phenomena. Its characteristics are that it can extract higher-level insights while maintaining the original characteristics of the data, providing a solid theoretical basis for answering research questions.

Thematic analysis gradually reveals the key patterns and potential relationships contained in the data by structuring the data (Thomas & Harden, 2008). Specifically, this method is divided into three core stages: first, coding the data text line by line to mark preliminary concepts and key points; second, integrating similar codes to generate descriptive themes to summarize the main content of the data; third, further refining analytical themes to go beyond the level of raw data and provide extensive theoretical insights. This multi-level analysis method is particularly suitable for exploring complex and diverse viewpoints in the data.

The applicability of thematic analysis is reflected in its compatibility with different research scenarios, such as education, medical and social behavior research (Cruzes & Dybå, 2011). In this study, thematic analysis not only helps to identify the relationship between the four core elements of "leadership style", "team communication", "technical tools" and "project success", but also provides an analytical framework for a deeper understanding of the dynamic interaction of these elements. This method is particularly suitable for the exploratory goal of this study and can systematically explore the specific impact of remote leadership in online education projects.

Braun and Clarke (2024) pointed out that thematic analysis presents research results in a transparent and systematic way, gradually revealing the core themes in the data through clear steps, which is of great significance in ensuring the reliability and validity of the research. This study chose thematic analysis method, aiming to reveal how leadership style promotes project success through the role of team communication and technical tools through systematic analysis, and provide academic and practical support for the optimization of remote education project management.

In addition, thematic analysis not only focuses on high-frequency patterns, but also pays attention to low-frequency but important phenomena. This ability enables it to comprehensively analyze the multidimensional characteristics of interview data, thereby extracting representative and explanatory conclusions (Thomas & Harden, 2008). For example, in this study, the low-frequency mention of "lack of integration of technical tools" in the

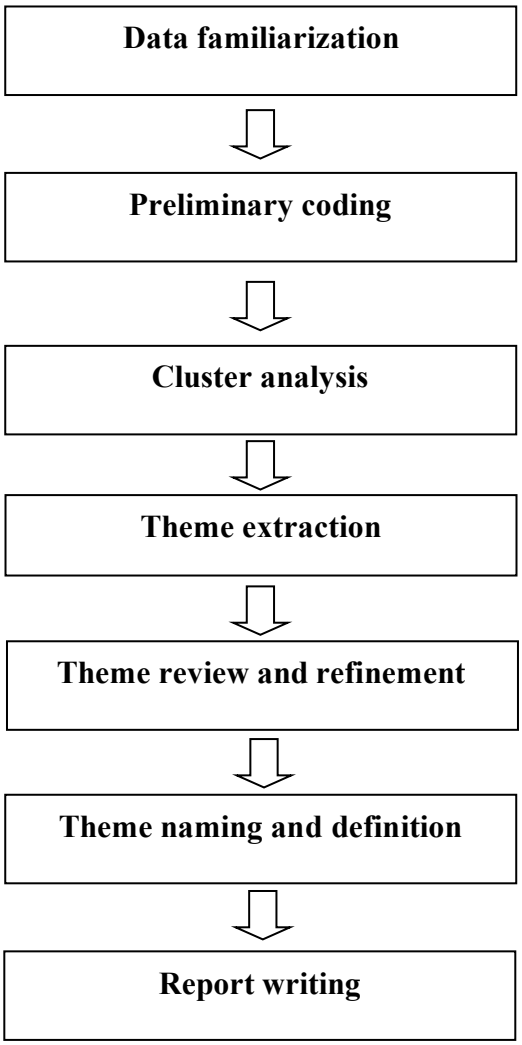
interviews may reveal key directions for improvement, while this finding may be overlooked by other analysis methods. Therefore, while ensuring a detailed description of the data, the thematic analysis method provides a deeper theoretical perspective and practical inspiration for this study.

2.4.2 Data Analysis Process

This study combines the principles of "reflective thematic analysis" of Braun and Clarke (2024) and uses a phased approach. The interview data analysis process is as follows:

Figure 2

Interview data analysis flow diagram



Source: compiled by the author based on Braun and Clarke (2024)

Data familiarization: The researcher read the interview transcripts several times to gain an in-depth understanding of the data content and record initial impressions and key points. This stage aims to fully grasp the overall framework of the data and provide direction for subsequent coding. In this process, the researcher pays special attention to the contextual information and details expressed by the interviewees to ensure a comprehensive understanding of the data. Repeated reading helps researchers discover potential research clues and record important initial perceptions and observations.

Preliminary coding: Based on familiarity with the data, the researcher analyzes the interview text line by line to identify keywords or phrases related to the research topic. These keywords are marked one by one and form preliminary coding. For example, the interview mentioned that "transformational leadership also helps me improve the overall cohesion of the team in cross-departmental collaboration" will be coded as "improve cross-departmental collaboration cohesion", and "I like to use a clear vision to motivate everyone, and I think this can well improve everyone's commitment" will be coded as "motivate team commitment". The preliminary coding process emphasizes refinement, with the aim of capturing all key information in the data and providing full support for subsequent analysis.

Table 2

Coding table

Code
Motivating team engagement. Enhancing cross-department collaboration and cohesion. Providing emotional support and trust. Inspiring team confidence and direction through vision. Improving team efficiency through clear organization and goal setting.
Enhancing team engagement and responsibility. Enhancing autonomy and flexibility. Promoting direct communication in teams. Supporting cross-department collaboration and reducing information gaps.
Combining transformational and transactional leadership styles. Simultaneously encouraging innovation and ensuring execution.
Overly controlling leadership reduces efficiency.

Source: compiled by the author

Code
Enhancing transparency through information-sharing platforms. Aligning goals and sharing information to improve communication efficiency. Using technology tools to facilitate smooth communication.

Improving communication quality through regular feedback. Leaders coordinating needs and problem-solving. Enhancing efficiency through real-time feedback mechanisms.
Information asymmetry and vague requirements. Leveraging leadership as a bridge to resolve communication issues.

Source: compiled by the author

Code
Enhancing communication and collaboration efficiency through technology tools. Optimizing document collaboration and task tracking. Integrating platform features to reduce information fragmentation.
Technical issues lower efficiency. Lagging functionality in high-concurrency scenarios.
Providing technical training and support. Enhancing collaboration and reducing rework through tools

Source: compiled by the author

Code
Scientific and innovative course development standards. Teacher and student engagement and satisfaction. Time, cost, quality as traditional measurement criteria
Leadership style is the most important. Team communication is the most important. Technology tools are the most important.

Source: compiled by the author

Cluster analysis: After the initial coding is completed, the researcher clusters the coded content and classifies the codes with similar or related meanings into higher-level categories. For example, "improving communication quality through regular feedback" and "immediate feedback mechanism improving efficiency" may be classified as "feedback mechanism and efficiency improvement". In this stage, through the integration and classification of coding, an analysis framework that reflects the research objectives is gradually formed.

Table 3

Category table

Category
Transformational Leadership
Distributed Leadership
Hybrid Leadership Style
The Impact of Dysfunctional Leadership

Source: compiled by the author

Category
Information Transparency and Sharing
Feedback Mechanisms and Efficiency Improvement
Cross-Department Communication Challenges and Solutions

Source: compiled by the author

Category
Technology Tool Optimization
Limitations of Technology Tools
Tool Usage and Training

Source: compiled by the author

Category
Project Outcome Evaluation Standards
Key Factors for Project Success

Source: compiled by the author

Theme extraction: Based on the results of cluster analysis, the researcher further abstracts the core themes. Each theme reflects the key patterns and main line logic in the research data. For example, "the influence of leadership style", "the role of team communication", "the supporting role of technical tools", and "multidimensional measurement of project success" are the main themes extracted in this study. These themes provide a theoretical basis for the construction of research conclusions.

Table 4

Theme table

Theme
The Impact of Leadership Styles
The Mediating Role of Team Communication
The Moderating Role of Technology Tools
Multidimensional Metrics for Project Success

Source: compiled by the author

Theme review and refinement: The researcher systematically reviews the initially extracted themes to ensure that the themes have clear boundaries and internal consistency. At the same time, the researcher eliminates redundant or irrelevant themes to the research objectives and merges themes with overlapping meanings. For example, "information transparency" and "reducing misunderstandings" are merged into "information sharing and transparency" to enhance the explanatory power of the theme. The review process is centered

on the research questions to ensure that the final theme system can fully reflect the internal logic of the interview data.

Theme naming and definition: Each extracted theme is clearly defined and named for easy expression. For example, "the role of team communication" is defined as "a dynamic process in which team communication promotes collaboration, reduces misunderstandings and promotes the achievement of project goals in a remote environment." At the same time, the researcher describes in detail the connotation, boundaries and relevance of each theme to the research objectives to ensure that the theme has clear theoretical significance.

Report writing: After completing the theme extraction and definition, the researcher organizes the analysis results into a report form and discusses them in combination with the research objectives and interview data. The report content includes a detailed explanation of the core theme and citations of specific examples to enhance the persuasiveness and readability of the results. At the same time, the researcher uses visualization tools (such as word frequency clouds and theme clustering diagrams) to intuitively present the data analysis results, further enhancing the transparency and scientific standards of the research.

2.4.3 Data Analysis Tools

This study combined manual analysis with NVivo software to complete data analysis. NVivo is a professional qualitative data analysis tool that provides researchers with systematic coding, theme extraction and visualization support. With the assistance of NVivo, this study can efficiently organize, analyze and present data, thereby enhancing the scientific nature of the research and the transparency of data processing.

Text Coding: During the text coding stage, this study used NVivo software to systematically code the interview data line by line. As a professional qualitative analysis software, NVivo can support researchers to flexibly and efficiently manage large amounts of text data. Researchers use NVivo's coding function to mark key information in interview records and assign coding tags related to research topics. The hierarchical classification function of the software helps researchers clearly manage preliminary coding and clustering results to ensure the traceability and systematicity of coding.

Keyword Extraction: In order to further understand the core content of the interview data, researchers use the word frequency analysis function in NVivo to extract keywords. This function can generate a list of frequently occurring words that intuitively reflects the topics of

concern to the interviewees. For example, high-frequency words such as "communication", "leadership" and "team" highlight the key concerns in the research data. Keyword extraction helps researchers focus on content that is highly relevant to the research topic and provides direction for subsequent clustering and thematic analysis.

Cluster analysis: In the cluster analysis stage, researchers use NVivo's node classification function to classify the codes. By aggregating codes with similar meanings into higher-level categories, researchers gradually build a framework for core themes. For example, "information transparency" and "reducing communication misunderstandings" are classified as "information sharing and transparency", while "smooth cross-departmental collaboration" and "reducing information gaps" are aggregated into "cross-departmental communication". This clustering process helps researchers systematically summarize the logical relationships in the data and ensure the scientific validity and hierarchy of the topic extraction.

Visual analysis: In order to intuitively present the data analysis results, this study uses the NVivo tool to generate word frequency cloud diagrams and theme clustering tree diagrams. The word frequency cloud diagram shows the high-frequency keywords in the interview data, helping researchers identify the core concepts and key points in the data. The topic clustering tree diagram intuitively shows the relationship between the research topic and its subtopics in a hierarchical structure. Visual analysis not only enhances the intuitiveness of data presentation, but also provides strong support for the logic of the research conclusions.

Data management: In terms of data management, this study uses NVivo's project management function to store all interview data and analysis results in a secure database. The researchers numbered and classified each data file to ensure good data organization and traceability for subsequent analysis. In addition, to protect data privacy, all files are anonymized and stored in encrypted cloud systems and local backup devices. NVivo's automatic save function also effectively reduces the risk of data loss.

2.5 Ethical considerations

Informed consent: Before the interviews began, the researchers explained in detail to all interviewees the purpose, content, and methods of the study, including the impact of leadership styles, team communication, and technical tools involved in the study on project success. The researchers clearly informed the interviewees that participating in the interviews was completely voluntary and that they had the right to withdraw from the interview or not

answer any questions at any time without providing a reason. In order to ensure that the interviewees fully understood the research information, the researchers sent detailed research instructions and interview outlines by email one week in advance, so that the interviewees could decide whether to participate after fully understanding the research background. Before the interviews officially began, the researchers obtained the informed consent form from the interviewees through electronic signatures, recording the interviewees' explicit consent to participate in this study. These consent documents include an overview of the research objectives, the length of the interview, instructions for data collection and processing methods, and commitments on data anonymization and privacy protection.

Privacy protection: To protect the privacy of the interviewees, the researchers anonymized all interview data throughout the research process. During the transcription and analysis of the interview recordings, all information that could identify the interviewees was removed to ensure that the personal identity of the interviewees would not be exposed during the data analysis process. In addition, the researcher promised to use the data only for the purpose of this study and would not disclose any interview content to a third party without the consent of the interviewee. The researcher further stated that all information involving personal privacy will be permanently deleted after the study is completed.

Data security: To ensure the security of the interview data, this study has adopted multi-level data protection measures. All interview recordings and transcription files are stored on encrypted local devices and secure cloud storage platforms, and access rights are set so that only the researcher can access the data. The data storage status is backed up and checked regularly to prevent data loss or accidental leakage. The researcher also uses encryption software to protect the data security during transmission to ensure that the data will not be attacked by external networks or unauthorized access during the interview recording transcription and data analysis stages.

2.6 Challenges and responses during the research process

2.6.1 Challenges in data collection

Time difference is a major challenge in data collection. The researcher is located in the Eastern European time zone (UTC+2), while the interviewees are all located in the Chinese time zone (UTC+8), with a time difference of 6 hours. This difference has brought great difficulties to the coordination of interview time. In order to overcome this problem, the

researcher fully communicated with the interviewees, arranged the interviews during the overlapping working hours of both parties, and reserved enough time to cope with possible temporary adjustments.

There were also some problems in the use of communication tools. The interviewees preferred to use WeChat, a social software, for interviews, but because the researcher was in Europe, the platform server had certain limitations in network support for overseas users, resulting in occasional network instability during the online interview. For this reason, the researcher tested the stability of the tool in advance and switched to other network forms when necessary, and even used VPN tools to ensure the smooth progress of the interview.

Some interviewees did not understand the professional concepts in the research clearly. Although the researcher provided relevant materials in advance to help the interviewees understand, some interviewees still showed unfamiliarity with certain terms during the interview. In this regard, the researcher used more understandable language to explain the concepts in the interview and gave examples to help the interviewees understand better.

During the interview with the only student interviewee, due to his young age (15 years old), he showed some nervousness, which led to insufficient freedom of expression and even fear of speaking his true thoughts. This situation may affect the authenticity and depth of the interview content. In order to ease the students' nervousness, the researcher adopted a variety of guidance and encouragement strategies, including using relaxed and informal language to create a friendly atmosphere, and clearly emphasized the confidentiality of the interview, and explained to the interviewee that the interview content was only used for academic research and would not have any negative impact on them.

2.6.2 Challenges in data analysis

The diverse views of the interviewees increased the complexity in the process of thematic induction, especially the inconsistent or even contradictory answers of different interviewees. In order to improve the reliability of the analysis, the researcher adopted a strict thematic analysis method, and ensured the consistency and scientific validity of the analysis results through multiple rounds of coding and cross-validation. In addition, when faced with ambiguous or contradictory information, the researcher reviewed the background of the original data and combined the context of multiple answers to find a reasonable explanation.

Since the interviewees included project managers, course designers, technical support staff, and students, the backgrounds and identities of these interviewees varied greatly, resulting in significantly different answer styles and focuses, which further increased the difficulty of data classification and theme extraction. To this end, the researchers divided the data according to the roles or groups of the interviewees, and coded and extracted themes separately. When summarizing the themes, the researchers focused on refining common content and analyzing individual differences separately to avoid fragmentation of the analysis results.

2.7 Summary

This chapter introduces the research methods of this study in detail, including the construction of the research model, the design and implementation of data collection, and the process and ethical considerations of data analysis. Through the use of qualitative research methods, especially the combination of semi-structured interviews and thematic analysis, this study can deeply explore the complex relationship between remote leadership, team communication, technical tools and project success.

In the data collection part, the researchers fully considered the exploratory nature of the research questions and the diversity of the interviewees' backgrounds, and ensured the credibility and breadth of the data sources by reasonably designing interview questions, selecting appropriate communication tools, and taking rigorous ethical protection measures. At the same time, in response to the challenges that may be encountered in the research process, such as time difference, technical limitations, and the obstacles to the interviewees' understanding of professional concepts, the researchers formulated practical coping strategies, laying the foundation for the smooth progress of data collection.

In the data analysis part, this study adopted a reflective thematic analysis method, which revealed the core mechanism of leadership style, team communication and technical tools from a multidimensional perspective through step-by-step coding, clustering and extracting themes. The design of the data analysis process strictly follows academic norms and combines the diverse views of the interviewees to ensure the reliability and theoretical value of the analysis results.

In summary, the research methods in this chapter provide a solid foundation for the presentation and discussion of the research results in the subsequent chapters. Through a

systematic and careful method design and implementation, this study is able to provide in-depth insights into the role of remote leadership in online education projects from both theoretical and practical levels.

3. RESEARCH RESULTS

Based on the coding and thematic analysis of the interview data, this chapter systematically presents the core research findings of remote leadership in online education projects. The research results are organized around four major themes: "the influence of leadership style", "the role of team communication", "the supporting role of technology tools", and "multidimensional measurement of project success" to reveal the specific performance of each factor in the project and their interactive relationship.

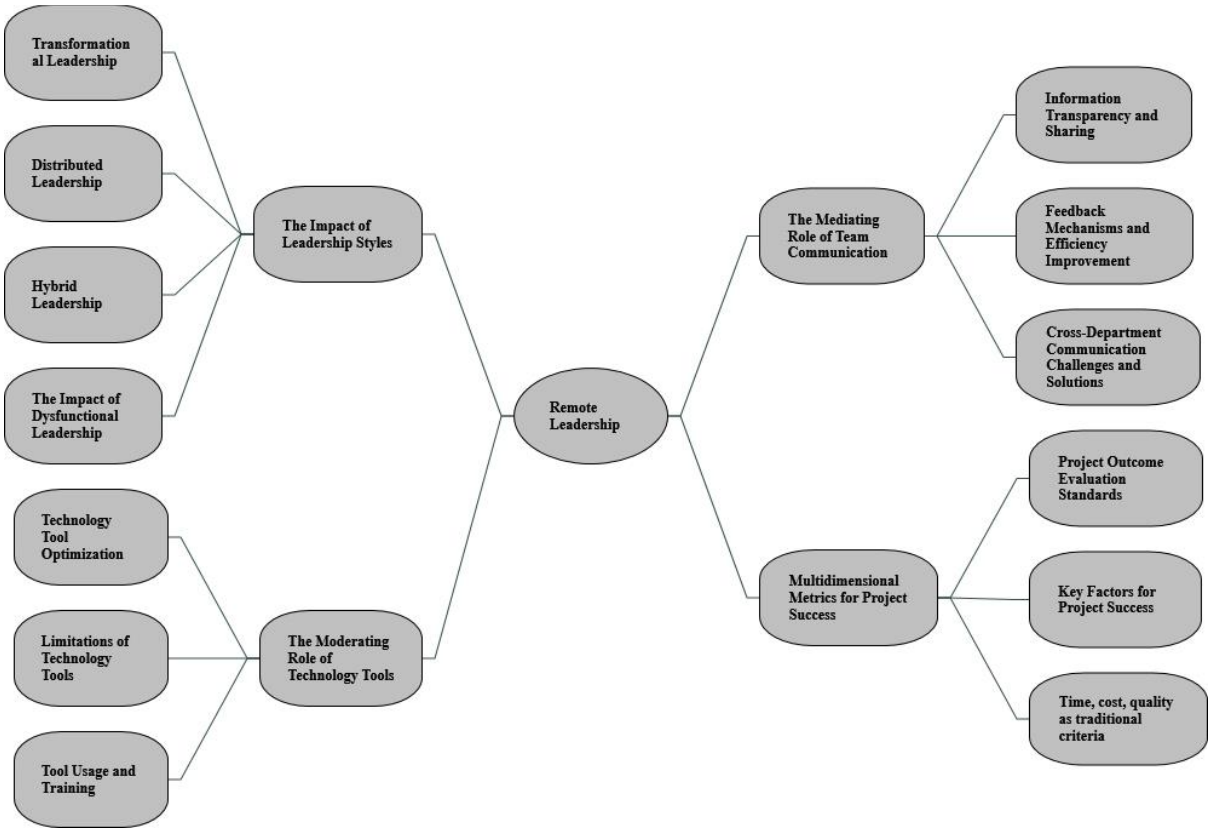
3.1 Overview of main themes

Through the systematic analysis of the interview data, this study extracted four core themes: the influence of leadership style, the role of team communication, the support role of technology tools, and the multidimensional measurement of project success. These themes comprehensively cover the practical areas of remote leadership in online education projects, reflecting the complex interactive relationship between leadership behavior, teamwork, technology support and project results, and providing a clear framework for subsequent analysis.

Figure 3 shows the clustering relationship between the themes and sub-themes extracted in this study. For example, "the influence of leadership style" includes sub-themes such as "transformational leadership", "distributed leadership" and "hybrid leadership style", while "the support role of technology tools" covers "optimization of technology tools" and "limitations of technology tools". This visual structure clearly presents the stratification of core themes and their internal connections, providing a logical basis for further exploration.

Figure 3

Theme and cluster dendrogram.



Source: compiled by the author

In addition, Figure 4 shows the high-frequency keywords in the interview data through word frequency analysis, such as "communication", "team" and "tools". These keywords highlight the importance of teamwork, communication and tool use in remote leadership contexts. At the same time, words such as "leadership" and "training" reflect that the interview data set is centered around the research topic, indicating that the interviewees pay more attention to the multi-dimensional evaluation of project success.

Figure 4

Visualization of Word Frequency.

Source: compiled by the author

These visualization tools provide intuitive support for the extraction and presentation of research topics. The tree diagram reveals the logical structure and hierarchical relationship of the topic, laying a framework for data analysis, while the word frequency cloud strengthens the core concepts and key points in the interview data. These analyses not only summarize the key findings of the study, but also provide a solid theoretical basis for the in-depth discussion and conclusions in subsequent chapters.

3.2 The influence of leadership style

Interview data revealed that different types of leadership styles play a unique role in managing online education projects. The original model of this study listed three main leadership styles (transformational, distributed, and transactional) independently, but the interview results revealed an unexpected phenomenon: no leader adopted the transactional leadership style alone; In actual leadership practice, some leaders adopt a hybrid leadership style. This hybrid leadership style, which combines transformational and transactional leadership characteristics, demonstrates strong adaptability and flexibility, especially in situations where project tasks are complex and cross-department collaboration requirements are high. Further analysis shows that leadership style not only has a direct impact on team communication, but also plays a significant role in project success in multiple scenarios, providing rich inspiration for leadership practice.

Transformational leaders demonstrate significant strengths in shaping vision, motivating teams, and providing emotional support. The project manager (role 1) stated: “By motivating the vision, my team has a greater sense of direction, which directly improves the quality of their communication and focus.” This leadership style promotes the It enables

efficient and smooth communication within the team and helps team members maintain goal consistency in their actions. Both the training project leader (role 6) and the teaching team leader (role 3) emphasized the role of transformational leadership in cross-departmental collaboration. Role 6 stated: “Transformational leadership helps me establish a vision in the team, such as letting everyone understand the importance of this training, not just to complete tasks, but to help teachers improve their teaching capabilities.” This vision motivation makes team members more profound Understand the importance of work, thereby enhancing commitment and responsibility. Feedback from team members further supports the positive effects of transformational leadership. Curriculum Designer (Role 2) mentioned: “The support and recognition of transformational leadership has enabled me to work more efficiently and have a greater sense of direction in teamwork.” Feedback from Role 2 highlighted the importance of the leader’s recognition and support to members direct impact on work motivation. In addition, transformational leadership alleviates friction in team communication by providing emotional support. The project manager (role 1) added: “When there is friction in communication, I will take the initiative to have one-on-one conversations with both parties to ease the relationship, while using the vision to inspire them to focus on the final results.” This shows that transformational leadership can not only improve the team goal consistency and strengthen team cohesion through emotional support.

Distributed leadership has significant effects on empowerment and flexibility. Its core feature is to promote team members' participation and sense of responsibility through the distribution of responsibilities and the release of autonomy. The teaching team leader (role 3) stated: “I will set clear goals and frameworks so that everyone knows what they are responsible for, while giving them enough autonomy.” This approach is achieved through clear goal setting and task allocation , which enhances collaboration efficiency while releasing the creativity of team members. In addition, the technical support staff (role 9) added: “Distributed leadership makes cross-department collaboration smoother and effectively reduces obstacles in information transfer.” This shows that with the support of distributed leadership, information in cross-department collaboration The fault problem has been effectively alleviated, and the overall communication efficiency has been significantly improved.

Distributed leadership also increases trust and responsibility among team members. The training instructor (role 7) mentioned: “Under the framework of distributed leadership, I feel trusted, and this trust makes me more willing to participate and take on more responsibilities.” Role 9 also mentioned that distributed leadership is a technology Support work provides greater

flexibility: “The person in charge is clear about which technical requirements are the highest priority, but allows me the freedom to organize specific operations.” This feedback shows that distributed leadership further improves team members’ autonomy and responsibility by increasing their autonomy and responsibility. Promotes the quality of team collaboration and overall results.

Another notable phenomenon in the interviews was the use of a hybrid leadership style, which was not preset in the research model and interview design. The Training Project Leader (Role 6) stated: “I tend to adopt a hybrid leadership style that combines characteristics of transformational and transactional leadership. The complexity of remote training requires motivating the team to remain innovative while ensuring that tasks are clear and Execution is orderly. ” Hybrid leadership style enables teams to achieve a balance between innovation and efficiency by combining the motivational effects of transformational leadership with the execution capabilities of transactional leadership. For example, role 6 further describes: “The transformational leadership style inspires the innovative spirit of the team, while transactional management ensures the orderliness of execution.” This dual role is particularly suitable for project environments with complex tasks and tight time constraints. In summary, hybrid leaders demonstrated unique adaptability in the interviews, and their flexible leadership strategies provide valuable reference for the complex management of online education projects.

Based on the interview results, transformational leadership has won high recognition from team members for its significant role in vision inspiration, emotional support and cross-department collaboration; distributed leadership further enhances the team's autonomy and flexibility through empowerment and flexibility. Collaboration efficiency; hybrid leadership style shows unique adaptability in balancing innovation and execution by combining transformational and transactional characteristics. These findings reveal the multi-layered role of leadership style in the success of online education projects and provide important theoretical and practical references for remote leadership practice.

3.3 The role of team communication

Interview data showed that team communication was unanimously considered by the interviewees to be the core element connecting leadership style and project success. In remote project management, team communication is not only the basis for information flow, but also a key link in team collaboration, task coordination and problem solving. Through the collation and theme analysis of the interviewees’ views, team communication demonstrates its

importance in three major areas: information transparency, feedback mechanisms, and cross-departmental collaboration.

Research has found that information transparency is the basis for efficient team communication and project success. The project manager (role 1) significantly improves the team's information sharing efficiency by using Feishu documents to share task assignments and goal descriptions. He pointed out: "Through the sharing of Feishu documents, my team can understand the project goals and task assignments at any time, thereby reducing information omissions and misunderstandings." This information transparency allows team members to keep abreast of project goals, tasks, and progress. Consistent understanding reduces repetitive work and conflicts in communication.

Other interviewees also emphasized the importance of transparency. For example, technical support staff (role 9) mentioned: “The bridging role of the leader reduces cross-department misunderstandings through transparent information flow.” Similarly, course designer (role 2) stated: “By sharing project progress, a lot of Repetitive work improves overall efficiency. "The implementation of information transparency not only improves the team's task execution efficiency, but also strengthens the atmosphere of trust and collaboration among members, laying a solid foundation for project success.

Leaders’ emphasis on feedback mechanisms significantly improves team efficiency and task coordination. In a remote environment, regular feedback sessions prove to be an effective tool for improving the quality of team communication. The leader of the teaching team (role 3) mentioned: "Weekly fixed feedback meetings reduce misunderstandings and duplication of work, making communication smoother." This regular feedback mechanism provides the team with a platform to share information and solve problems. At the same time, it helps the team adjust the direction in time during task execution.

Feedback from team members further validates this. For example, the student support service staff (role 5) said: "The leaders also often organize online meetings. Everyone actively participates, speaks freely, and gives feedback on their latest problems. This is also very useful for efficient communication." Regular feedback not only helps Identifying potential problems also provides the team with a dynamic mechanism for collaboration and improvement, thereby improving the flexibility and adaptability of the project. The successful implementation of feedback mechanisms makes up for the lack of face-to-face interaction in remote work to a certain extent, allowing teams to collaborate efficiently.

Interviewees generally mentioned that information asymmetry in cross-department collaboration is a major challenge in remote project communication. For example, the leader of the teaching team (role 3) stated: “The requirements descriptions of the course design team and the technical support team are inconsistent, which increases the difficulty of communication.” The technical support staff (role 9) further added: “Good leadership plays a bridging role , 'translating' the needs of different teams into technical language, so that many cross-department communication issues can be quickly resolved.

The bridging role of leaders in cross-department collaboration was mentioned by many interviewees. By helping different teams understand each other's needs, leaders not only speed up the flow of information, but also effectively reduce information misunderstandings and enhance trust between teams. The course designer (role 2) mentioned: “When the technical support team understood our needs, the solution formulation became more efficient, which helped the project progress a lot.” This leader’s role as a bridge is very important in solving the problem. The importance of information asymmetry fully reflects its role in promoting the efficiency of cross-department collaboration.

As a core element connecting leadership style and project success, team communication plays a key role in three aspects: information transparency, feedback mechanism and cross-department collaboration. Information transparency helps team members maintain a consistent understanding and reduce misunderstandings; the feedback mechanism improves task coordination and flexibility through regular communication platforms; the leader's bridging role in cross-department collaboration effectively solves the problem of information asymmetry and strengthens Build team trust and collaboration. These findings provide profound insights into further understanding the core role of team communication in remote project management, and also provide useful references for optimizing communication mechanisms in practice.

3.4 Supportive role of technology tools

Interview data show that technology tools play a vital role in supporting remote collaboration and improving team communication efficiency. These tools not only provide a platform for interaction between team members, but also demonstrate strong support capabilities in project management and task coordination. However, the effectiveness of their use varies depending on the functional characteristics of the tools, the degree of integration, and the degree of matching with the leadership style.

Interviewees generally recognize the value of efficient technology tools such as Feishu and DingTalk in promoting team communication. For example, the course designer (role 2) pointed out: "These tools have indeed improved communication efficiency, especially Feishu's comment and collaboration functions. Team members can complete a lot of discussions in the document, reducing unnecessary meeting time." Similarly, the training instructor (role 7) mentioned: "Feishu's real-time collaboration function allows us to complete document modifications in real time, reducing time waste." These tools effectively improve the team's ability to respond quickly to problems through functions such as instant messaging, real-time collaboration, and task management.

However, some respondents mentioned that insufficient integration between different tools may affect communication efficiency. Technical support staff (Role 9) pointed out: "Feishu's chat function is not as good as DingTalk. If there is a better integration between the two, communication efficiency will be higher." This feedback shows that although a single tool can optimize certain specific processes, the parallel use of multiple tools may lead to information dispersion or even omission, weakening its support role.

The study found that the use of technical tools is closely related to leadership style, and their combination can amplify the advantages of leadership style. The training project leader (Role 6) mentioned: "These tools are combined with my leadership style to enable the team to collaborate efficiently. When using Feishu, I will emphasize the team's innovation responsibility through transformational leadership and inspire members to invest in content design; in the task allocation of DingTalk, I will use transactional means to ensure that everyone's goals are clear and the execution is strong." This flexible use of technical tools highlights the leader's sensitivity to different situational needs: inspiring innovation through Feishu reflects the vision shaping of transformational leadership, while emphasizing clarity through task allocation of DingTalk reflects the standardized management of transactional leadership.

This combination of tools and leadership style can further enhance the team's communication quality and task execution. For example, the project manager (role 1) emphasized: "With the support of technology tools, I can clarify team goals more quickly and help members stay aligned at different stages." This shows that efficient tools provide a platform and resources for the implementation of leadership styles, enabling teams to work together more efficiently.

Although technology tools are outstanding in improving communication efficiency, their limitations cannot be ignored. Project manager (role 1) mentioned: "One shortcoming is the problem of tool integration and data redundancy. Sometimes team members switch between multiple technology tools, which may cause some information to be missed." This information dispersion problem caused by insufficient tool integration is particularly obvious in remote environments, which may not only reduce communication efficiency, but also hinder task execution and team collaboration.

In addition, technical support staff (role 9) added: "When team members need to switch between multiple platforms, it is not only easy to miss information, but also increase the operational burden." This phenomenon shows that insufficient tool integration may lead to time waste and workflow disruption. To this end, respondents recommend optimizing tool integration and simplifying processes to further improve collaboration efficiency.

In the context of effective use of technology tools, their support role can significantly enhance the team's collaboration and amplify the management effectiveness of leaders. The training project leader (Role 6) mentioned: "When technology tools are used efficiently, I feel that I can communicate goals and progress requirements faster, which keeps the team consistent." This shows that the proper use of technology tools can not only promote the flow of information, but also improve the communication efficiency of leaders and team cohesion.

In summary, technology tools play an important role in supporting remote collaboration and improving communication efficiency. Despite the problem of insufficient integration, these tools provide key support to the team through functions such as instant messaging, task assignment, and real-time collaboration. The organic combination of technology tools and leadership style further enhances their effectiveness, laying an important foundation for the success of remote projects by amplifying leadership effectiveness and optimizing communication quality. At the same time, the improvement suggestions for the limitations of the tools provide valuable reference for the optimization of future technology tools.

3.5 Multidimensional measurement of project success

The interview results revealed that the success of online education projects cannot be simply measured by a single dimension, but requires a comprehensive analysis from multiple perspectives such as scientific standards and innovation, participation and satisfaction, traditional standards, and key influencing factors. This multidimensional measurement method

reflects the multi-level characteristics of remote projects in terms of complexity and outcome evaluation.

3.5.1 Diversity of success criteria

Interviewees generally believe that the scientific standards and innovation of the results are important criteria for measuring the quality of online education projects, while the satisfaction of students and teachers and the efficiency of teamwork are also key indicators for measuring success. The project manager (role 1) pointed out: "It is important whether the course content is scientific, innovative, and can attract students' interest." The training project leader (role 6) added: "For our project, teacher satisfaction is definitely the first priority. Then we look at whether the training results are well implemented."

The feedback from teachers and students further confirmed these views. The teacher (role 4) emphasized: "The collaboration of our team makes me feel that this project is a complete closed loop: the course design is reasonable, the teaching implementation is efficient, and the students' feedback is relatively positive." The student (role 10) also said: "Overall, I am quite satisfied with this course." These descriptions show that the success of a project is not only reflected in the scientific and innovative nature of the results themselves, but also needs to meet the high standards of quality, efficiency and experience required by project participants.

In addition, the traditional standards of time, cost and quality are also reflected in the feedback of some respondents. The course designer (role 2) pointed out: "I am generally quite satisfied with the final result of this course development. First of all, our project was completed on time and met the predetermined budget requirements. The company's quality assessment also met the standards. I think this is at least a success in the traditional sense." This view supplements the traditional evaluation dimensions of project success and reflects the respondents' multi-angle cognition of project results.

Satisfaction and growth within the team are also seen as extended indicators of project success. The head of the teaching team (role 3) mentioned: "The satisfaction of our team members is also an indicator of success." The introduction of these internal dimensions makes the definition of project success more comprehensive, covering a comprehensive perspective of outcomes, processes and participant experience.

3.5.2 Key factors for project success

When analyzing the core factors affecting project success, respondents with different roles in the interviews showed a diverse understanding and ranking of the importance of leadership style, team communication and technical tools.

Leadership style was considered the most important factor by some respondents. Project manager (role 1) pointed out: "If I have to choose the most important factor, I think it is leadership style. Because whether it is communication or technical tools, a strong leader is ultimately needed to integrate resources and promote execution." This view emphasizes the core role of leadership style in project planning, resource integration and team motivation.

However, the role of team communication has a higher priority among other respondents. The teaching team leader (role 3) believes: "If I have to choose the most important factor, I would say it is team communication. Because no matter how good the leadership style is or how advanced the technical tools are, if the communication is not in place, the project will still have problems." The training project leader (role 6) also said: "Although I have a very good leadership style, if the team communication is not smooth, I think the execution of the project will be greatly affected."

In contrast, the importance of technical tools was most directly emphasized in the answer of the technical support staff (role 9): "If I have to choose a factor that has the greatest impact on the results, I would choose technical tools. In a remote situation, without technical tools, there is no so-called team communication, that is, there is no project success." This view further highlights the fundamental role of technical tools in supporting communication and collaboration in a remote environment.

Comprehensive analysis and significance

Through a comprehensive analysis of the traditional standards of scientific standards and innovation, participation and satisfaction, time cost quality, and key influencing factors, it can be found that the measurement criteria and core factors of project success are both independent and complementary. For example, leadership style enhances project execution by optimizing team communication, while technical tools provide the necessary support carrier for communication. This dynamic relationship of mutual dependence provides practical guidance for remote education project management.

The multidimensional measurement of project success not only reflects traditional standards such as time, cost, and quality, but also introduces novel dimensions such as scientific

standards and innovation, participation and satisfaction, as well as the synergy between key influencing factors. By integrating the perspectives and experiences of different roles, this study provides a comprehensive framework for the evaluation and practice of remote education projects, which will help optimize the management and improve the results of similar projects in the future.

3.6 Comparative analysis of leaders' and team members' perspectives

In terms of leadership style, both leaders and team members recognize the importance of transformational leadership in remote education projects. Leaders tend to evaluate the role of transformational leadership in shaping vision, motivating teams, and improving collaboration efficiency from an overall perspective. The project manager (role 1) said: "By motivating vision, my team has a better sense of direction." Team members pay more attention to the actual effect of leadership style on their own support. The course designer (role 2) pointed out: "The support and recognition of transformational leadership makes me more efficient at work." In addition, leaders generally attach importance to the role of distributed leadership in promoting autonomy, while team members evaluate it more from the perspective of collaborative flexibility and trust.

In terms of team communication, the two roles agree on the importance of communication transparency. Leaders emphasize the key role of information sharing platforms in reducing cross-departmental misunderstandings. For example, the project manager (role 1) mentioned: "Through Feishu document sharing, the team's information sharing efficiency has been greatly improved." Team members are more concerned about the actual experience of communication. For example, the teacher (role 4) mentioned: "Team collaboration makes me feel that this project is a complete closed loop." However, in terms of feedback mechanisms, leaders emphasize their timely resolution of global issues, while team members are more concerned about the reception and implementation of personal feedback.

In terms of technical tools, leaders tend to evaluate the efficiency of tools from the perspective of system integration. For example, the training project leader (role 6) pointed out: "By integrating task management and collaboration tools, I can deliver goals and progress requirements faster." Team members pay more attention to the ease of operation and practicality of the tools. For example, the course designer (role 2) emphasized: "Feishu's collaboration function reduces unnecessary meeting time." In addition, the technical support staff (role 9) raised the issue of insufficient tool integration, indicating that leaders need to pay

more attention to the feedback of actual users in the selection and optimization of technical tools.

In terms of measuring project success, leaders pay more attention to the achievement of traditional indicators (time, cost and quality). For example, the project manager (role 1) said: "Completing the development task on time and on budget is a success." Team members are more inclined to evaluate the participation and satisfaction of learners and teachers. For example, the teacher (role 4) pointed out: "The positive feedback from students makes me feel that this is a successful teaching practice." In addition, different roles show a certain personalized tendency in defining project success. For example, technical support personnel (role 9) believe that the effectiveness of technical tools is the core of measuring project success, while students (role 10) are more concerned about the learning experience of the course.

Comprehensive analysis found that there are significant differences and commonalities in the evaluation of leaders and team members on the four core topics. Leaders pay more attention to macro management and overall performance, while team members tend to evaluate relevant factors from the perspective of specific support and actual effects. This differentiation and unification of role perspectives provides a more three-dimensional analytical framework for remote education project management, and emphasizes the importance of balancing the needs of the two perspectives when formulating leadership strategies.

3.7 Summary

This chapter systematically presents the main research findings revealed by the interview data through qualitative analysis and thematic analysis, focusing on four core themes: leadership style, team communication, technical tools, and multidimensional measurement of project success. On the basis of the above analysis, a comparative analysis of the perspectives of leaders and team members is added to further enrich the multidimensional understanding of each core theme. The study found that transformational, distributed, and hybrid leadership styles show different advantages in remote management. Transformational leadership emphasizes motivation and vision shaping, distributed leadership focuses on empowerment and flexibility, and hybrid leadership styles combine the characteristics of both to show stronger adaptability. Leaders and team members show unity and differences in perspective in the evaluation of leadership style. The former pays more attention to overall management, while the latter focuses on individual support.

As the core element connecting leadership style and project success, team communication effectively improves team performance through information transparency, feedback mechanism, and cross-departmental collaboration. At the same time, the role of leaders as bridges in cross-departmental communication is particularly significant, and their accurate information translation and mediation capabilities are crucial to solving the problem of information asymmetry in collaboration. In addition, the supporting role of technical tools is reflected in improving communication efficiency and optimizing collaboration. Efficient tools such as Feishu and DingTalk have significantly improved the flow of information in remote environments, but the lack of tool integration has also exposed potential limitations. The actual experience of team members shows that the optimization and integration of technical tools should pay more attention to user needs and adaptability.

Finally, the multidimensional measurement of project success integrates traditional standards such as time, cost, and quality with emerging indicators such as scientific standards, innovation, and satisfaction, reflecting the complexity and diversity of the success of remote education projects. These indicators not only reflect the comprehensive role of leadership style, team communication, and technical tools, but also reflect the diverse understanding of project success by different roles. In summary, this chapter reveals the key role of each element in remote leadership practice and their mutual influence. At the same time, by integrating role perspectives and experiences, a systematic analytical framework is constructed to provide comprehensive support for subsequent theoretical discussions and practical optimization.

RECOMMENDATIONS

Optimizing leadership style

The results show that the hybrid leadership style combines the characteristics of transformational and transactional leadership and is highly adaptable in remote projects. It can not only improve team efficiency through goal clarity, but also enhance members' creativity and participation through vision motivation.

Leaders should adjust their leadership style according to team characteristics and project stages. For example, in the project launch phase, the distributed leadership style can give team members greater autonomy and stimulate their creativity while ensuring clear division of tasks. In the project execution phase, the vision motivation and emotional support of the transformational leadership style can enhance team morale, promote task collaboration and efficient completion. In the project evaluation phase, the transactional leadership style is more suitable for focusing on performance analysis and promoting future improvements through clear feedback and incentive mechanisms.

In addition, leaders also need to pay attention to the emotional needs of team members, especially in a remote working environment, and enhance team cohesion and members' sense of belonging through regular one-on-one communication and team building activities. At the same time, companies should provide leaders with remote management skills training to help them better master core skills such as task authorization, motivation and coordination, and enhance their ability to switch leadership styles in different situations, thereby optimizing project management.

Team communication improvement

Team communication is one of the core elements of the success of remote education projects, and its management runs through all stages of the project. Research shows that strengthening information transparency and sharing is the key to improving communication efficiency. Building an information sharing platform through efficient collaboration tools (such as Feishu and DingTalk) can ensure that team members get the latest updates on tasks and goals in a timely manner, thereby reducing information misunderstandings and duplication of work.

In addition, regular team meetings and the establishment of a fixed feedback mechanism can provide the team with a clear communication channel, help solve problems

quickly and enhance the team's cohesion and sense of responsibility. Leaders need to actively pay attention to the communication needs of team members and establish a clear information flow mechanism to reduce project risks caused by communication barriers.

Cross-departmental communication in a remote environment is susceptible to technical barriers and geographical dispersion. It is recommended that enterprises build a unified collaboration platform to make the information flow between different departments smoother, and through virtual team building activities and collaboration training, further enhance the trust and tacit understanding between team members and solve potential collaboration problems.

In cross-departmental collaboration, leaders should play a bridging role, solve the information asymmetry problem between departments through accurate information translation and mediation, and provide support for teamwork. These strategies can significantly improve the communication quality and collaboration efficiency of the team, thereby promoting the achievement of project goals.

Optimize the use and integration of technical tools

Technology tools play an important role in remote education project management. Their effectiveness depends not only on the functions of the tools themselves, but also on their use strategies and integration levels. The results show that by reducing the need for teams to switch between multiple platforms, the smoothness of information flow and the efficiency of task management can be improved. For example, integrating the task management function of DingTalk with the collaboration function of Feishu can optimize the team's collaboration process. Enterprises should strive to integrate multi-functional collaboration platforms. If conditions permit, project management, document sharing and instant messaging functions should be integrated into one platform as much as possible to reduce the efficiency loss caused by frequent tool switching.

This study also found that team members are not proficient in the use of technical tools, which is a constraint on team collaboration. It is recommended that enterprises provide comprehensive and regular technical training for team members to ensure that they are proficient in the use of existing tools, which is a necessary condition for improving the effectiveness of technical tools. When selecting technical tools, organizations should give priority to tools with high media richness and ease of use based on project requirements, team

size and task complexity to give full play to the role of technical tools in communication and collaboration.

At the same time, as the project progresses, the team's needs for technical tools may change. Therefore, it is recommended that companies regularly evaluate the applicability of existing technical tools, collect feedback from team members, and dynamically adjust the tool combination according to project needs. This will ensure that technical tools always serve team efficiency rather than adding additional burdens.

Expand the measurement criteria for project success

The traditional measurement criteria for project success mainly focus on time, cost and quality. However, in remote education projects, the definition of success should be more multidimensional, combining novel dimensions such as scientific standards, innovation and satisfaction. Research shows that scientific standards and innovation are the core standards for course development, while the participation and satisfaction of teachers and students are key measurement indicators for teaching implementation and training projects. Therefore, organizations should establish a diversified evaluation system, include course content quality, team growth and learner feedback in the evaluation scope, so as to fully reflect the achievement of project goals. At the same time, by collecting and analyzing feedback from students and teachers, optimizing course design and implementation links, and ensuring that the project can bring a positive experience to learners. In addition, organizations should continue to summarize project experience, identify successful practices and improvement points, and provide valuable references for future project management.

Establish a flexible remote management support system

The complexity of remote education projects requires organizations to establish a more flexible and comprehensive support system to help teams cope with the challenges of remote work. First, organizations should formulate clear remote management policies, standardize work processes and communication rules, and provide teams with clear behavioral guidelines. Second, in international or multicultural teams, leaders need to improve cultural intelligence and cross-cultural communication skills to reduce the negative impact of cultural differences on team collaboration. Finally, paying attention to team mental health is also an important part of the support system. Through regular informal communication and psychological support plans, team members can be helped to relieve the isolation and pressure of remote work,

thereby enhancing team cohesion and productivity. These support measures can provide a strong guarantee for the efficient operation and long-term success of remote education projects.

Summary

Through the above suggestions, this study aims to provide a pragmatic management framework and operational guidelines for remote education projects. These suggestions cover the flexible use of leadership styles, the optimization of team communication mechanisms, the efficient integration of technical tools, and the expansion of project success evaluation systems, and jointly promote the overall improvement of online education quality and management effectiveness. The suggestions not only focus on the core role of leaders in management, but also emphasize the collaborative relationship between team members and the effective application of technical tools. In the future, the success of remote education projects will increasingly rely on the flexible use of leadership styles, the improvement of communication mechanisms, and the efficient integration of technical support. The synergy of these factors will lay a solid foundation for improving the quality of online education and project success.

This study focuses on the role of remote leadership in online education projects and systematically explores the interactive relationship between leadership style, team communication, technical tools and multidimensional measurement of project success. Through the use of qualitative research methods, the practical experience and subjective cognition of the respondents were deeply analyzed, providing theoretical support and practical guidance for the management of remote education projects.

CONCLUSIONS

Main research findings

First, this study reveals the specific performance and role of transformational, distributed and hybrid leadership styles in different situations. The study found that hybrid leadership style shows unique adaptability in remote projects, which can combine the motivational advantages of transformational leadership and the task-oriented characteristics of transactional leadership to provide support for team collaboration and goal achievement. This finding breaks through the research framework of a single leadership style and provides new ideas for the flexibility and effectiveness of remote project management.

Secondly, team communication has been verified as the core element of the success of remote education projects. Research shows that information transparency, feedback mechanism and cross-departmental collaboration are the key driving factors for efficient communication. Under the bridge role of the leader, the information asymmetry and potential conflicts between different roles can be effectively alleviated, thereby improving the overall coordination and productivity of the team. Team communication is not only a manifestation of the role of leadership style and technical tools, but also an important guarantee for project success.

Technology tools play an indispensable role in supporting the collaboration and communication of remote education projects. The study found that efficient technology tools can optimize information flow and improve team efficiency. At the same time, by combining with leadership style, they further enhance the team's execution. However, the lack of integration of tools and unskilled use still exist, becoming the main constraints affecting the effectiveness of technology tools. Solving these problems will provide stronger technical support for future remote education projects.

The measurement of project success includes not only traditional standards such as time, cost, and quality, but also new dimensions such as scientific standards, innovation, participation, and satisfaction. The study shows that this multidimensional evaluation framework can more comprehensively reflect the goal achievement of remote education projects, and at the same time provide an important reference for the practice optimization of similar projects.

Limitations

This study also has certain limitations. First, the sample size is small, covering only 10 respondents, which may not fully reflect the diverse practices in remote education projects. Second, the interview data is subjective, and the personal preferences and experiences of the respondents may affect the objectivity of the research conclusions. In addition, the research method mainly adopts qualitative analysis and lacks the support of quantitative data, which limits the generalizability of the research results. The rapid iteration of technical tools may also limit the timeliness of research conclusions, especially in the context of rapid technological development, the research results may not be applicable in the long term. Finally, this study is mainly based on a single cultural background and fails to explore the characteristics of cross-cultural remote project management in depth, which may limit the global applicability of the conclusions.

Future research directions

Future research can be expanded in the following directions. First, expand the sample size and scope to cover more types of remote education projects and participants of different roles to improve the external validity of the research results. Second, combine quantitative research methods, such as questionnaires and statistical analysis, to explore the causal relationship and significance between variables in depth and enhance the scientific nature of the research conclusions. In addition, further research on the application of emerging technologies (such as artificial intelligence and virtual reality) in remote projects and their impact on leadership and communication will provide a more comprehensive perspective for remote project management. Cross-cultural comparison is also an important direction, exploring remote leadership styles and team collaboration characteristics under different cultural backgrounds, and providing a reference for global remote project management. In addition, a multi-stage tracking study of remote projects can be conducted through a dynamic research design to reveal the dynamic changes and interactions of variables in different stages. Finally, refining the success measurement indicators of online education projects and clarifying the weights of learner experience and team satisfaction in different project types will help to further improve the project evaluation system.

Through the findings and suggestions of this study, we hope to provide a solid theoretical foundation and operational guidance for future remote education project

management and practice, and contribute to the long-term development of the online education industry.

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APPENDICES

Appendix 1. Interview with role1 (Project manager)

Interviewer: First of all, thank you very much for agreeing to be interviewed by me. If possible, please briefly introduce yourself, what is your position, and how long have you worked at Xueersi Online School.

Role 1: You're welcome. I'm glad you invited me, and I'm happy to help college students with their research. After all, I'm also in the education industry, and I like to discuss with people. I'm currently the project manager of the online course development project, and I've been working at Xueersi Online School for more than five years. Our projects usually have a cycle of half a year, which is basically synchronized with the school's semester. So for this interview, I'll use the most recent project as a reference. Now you can ask formal questions, and we'll get it done as soon as possible.

Interviewer: In a remote environment, which leadership style (e.g., transformational, transactional, distributed) do you prefer to adopt? How does this leadership style help you achieve project goals?

Role 1: I prefer a transformational leadership style, which is particularly suitable for innovative projects. I like to inspire everyone with a clear vision, which I believe significantly enhances their engagement. Transformational leadership also helped me enhance the overall cohesion of the team during cross-department collaboration. Our project involves curriculum designers, technical support teams, and subject matter experts, all of whom have different goals and backgrounds. If we only relied on rules and task-driven methods, it would be difficult for everyone to truly understand each other’s needs. I actively guide team members to identify shared goals. For example, we all want this course to be both engaging and efficient, which aligns our efforts. This makes everyone more willing to participate and collaborate with each other.

Interviewer: What are the main issues you’ve observed in team communication? How has your leadership style improved the quality of communication within the team?

Role 1: The biggest challenge, I think, is the information asymmetry between departments. For instance, curriculum designers might focus more on the scientific nature of the teaching content, while the technical support team cares more about the feasibility of implementation. This can

lead to discrepancies in requirement transmission. In such cases, I use my leadership style to promote transparent communication and mutual understanding. For example, by sharing all project requirements, stage goals, and task assignments through Feishu documents, I ensure information sharing is strengthened.

Additionally, I hold regular cross-department meetings where everyone can openly discuss issues. I focus on emotional support. When communication friction occurs, I initiate one-on-one conversations with both sides to ease tensions, while motivating them with the vision to stay focused on the final outcomes. These approaches not only improve communication efficiency but also build trust among team members.

Interviewer: What technical tools does your team primarily use to support remote communication? How do these tools align with your leadership style to enhance communication efficiency?

Role 1: Our team primarily uses DingTalk for video meetings and Feishu for file sharing and collaborative editing. Feishu's commenting feature allows me to provide specific feedback on details within documents, and team members can respond in real-time. These tools complement my leadership style by enabling open, transparent, and efficient communication. For instance, during DingTalk meetings, I use transformational leadership techniques to inspire the team to focus on the big-picture goals, while Feishu's collaborative tools help turn that vision into actionable tasks.

Interviewer: Do you think the current technical tools have optimized team collaboration and communication efficiency? To what extent has this optimization contributed to achieving project goals?

Role 1: I believe these tools have significantly optimized our team's collaboration and communication efficiency, particularly in terms of timely information transmission and clear task tracking. DingTalk's task management and Feishu's document collaboration are two critical features that ensure everyone stays updated on project progress and their individual responsibilities. That said, there are some limitations. The integration and data redundancy issues with tools can be problematic. Sometimes team members switch between DingTalk, Feishu, and WeChat, which may lead to information being overlooked. I plan to further integrate tool usage in the next project to reduce repetitive communication. These optimizations have clearly played an important role in achieving project goals. For instance, the development

cycle for this course was shortened by 10% compared to the original timeline, thanks to improved team collaboration efficiency.

Interviewer: What roles did leadership style, communication, and technology tools play in this project? Which factor had the greatest impact on the results?

Role 1: First, in terms of course content quality, it's important that the course content is scientific, innovative, and able to capture students' interest. Next is execution efficiency—success means completing development tasks on time and within budget. Additionally, internal team satisfaction and growth are also critical indicators. In the second half of 2024, leadership style, team communication, and technology tools all played key roles. Leadership style helped unify team goals and provided clear direction when challenges arose, boosting team confidence. Team communication reduced errors in information transmission across departments, ensuring project progress and content quality. Technology tools greatly optimized the communication and collaboration process, enabling different teams to complete their tasks more efficiently. If I had to choose the most critical factor, I would say it's leadership style. Ultimately, both communication and technology tools require a strong leader to integrate resources and drive execution.

Interviewer: OK, I have finished my questions. If you have nothing else to add, our conversation ends here. Thank you again for agreeing to participate in the interview. Your answers are very clear and I feel that this is very helpful for my research. Thank you for your time. Goodbye.

Role 1: OK, it was faster than I thought. I hope this helps you. I wish you all the best. Goodbye.

Appendix 2. Interview questionnaire

Role 1: Online course development project manager

1. In a remote setting, which leadership style (e.g., transformational, transactional, distributed, etc.) do you prefer to adopt? How does this leadership style help you achieve project goals?
2. What are the main issues you have observed in team communication? How has your leadership style contributed to improving the quality of team communication?
3. What technical tools does your team primarily use to support remote communication? How do these tools, combined with your leadership style, affect team communication efficiency?
4. Do you think the current technical tools optimize team collaboration and communication efficiency? To what extent has this optimization contributed to achieving project goals?
5. How do you define project success? For the course development project in the second half of 2024, what roles do leadership style, team communication, and technical tools play? Which factor has the greatest impact on the outcome?

Role 2: Course designer in an online course development project

1. Do you feel supported by the project manager's leadership style? Has this support improved your efficiency?
2. How would you describe the communication efficiency among team members? What role do you think leadership style plays in this?
3. What technical tools do you primarily use to support your work? Have these tools improved team communication and collaboration efficiency?
4. How would you evaluate the final outcome of this course development project? What are some successes or areas for improvement?

Role 3: Teaching team leader in the online teaching implementation team

1. In a remote setting, which leadership style (e.g., transformational, transactional, distributed, etc.) do you prefer to adopt? How does this leadership style help you achieve project goals?
2. What are the main issues you have observed in team communication? How has your leadership style contributed to improving the quality of team communication?
3. What technical tools does your team primarily use to support remote communication? How do these tools, combined with your leadership style, affect team communication efficiency?
4. Do you think the current technical tools optimize team collaboration and communication efficiency? To what extent has this optimization contributed to achieving project goals?
5. How do you define project success? For the teaching project in the second half of 2024, what roles do leadership style, team communication, and technical tools play? Which factor has the greatest impact on the outcome?

Role 4: Teacher in the online teaching implementation team

1. Do you feel supported by the teaching team leader's leadership style in your teaching

work? If yes, in what specific ways?
2. Is communication among teaching team members smooth? What areas could be improved?
3. What role do technical tools play in your teaching implementation? Have they helped you perform your teaching tasks better?
4. How satisfied are you with this teaching implementation project as a whole? To what extent has team communication influenced teaching outcomes?

Role 5: Student support service staff in the online teaching implementation team

1. In managing classrooms and addressing student issues, do you feel supported by the teaching team leader? Has this support helped you complete your work more efficiently?
2. Is communication among teams smooth in the remote setting? If not, have leadership style and technical tools helped address the challenges?
3. Do you rely on technical tools to support your work? Which tools have been most helpful for handling student issues?
4. How would you evaluate this teaching implementation project? What role do you think team communication played in it?

Role 6: Training project leader in the remote teacher training team

1. In a remote setting, which leadership style (e.g., transformational, transactional, distributed, etc.) do you prefer to adopt? How does this leadership style help you achieve project goals?
2. What are the main issues you have observed in team communication? How has your leadership style contributed to improving the quality of team communication?
3. What technical tools does your team primarily use to support remote communication? How do these tools, combined with your leadership style, affect team communication efficiency?
4. Do you think the current technical tools optimize team collaboration and communication efficiency? To what extent has this optimization contributed to achieving project goals?
5. How do you define project success? For the teacher training project in the second half of 2024, what roles do leadership style, team communication, and technical tools play? Which factor has the greatest impact on the outcome?

Role 7: Training instructor in the remote teacher training team

1. Do you feel supported by the training project leader's leadership style? Has this support helped you overcome challenges in your work?
2. Do you frequently communicate with other team members in your work? Are these communications smooth? Has leadership style played a role in this?
3. What role did technical tools play throughout the training process? Have they helped improve the training outcomes?
4. How would you evaluate the outcomes of this training project? In achieving the training goals, what roles did leadership style, team communication, and technical tools play?

Role 8: Participating teacher in the remote teacher training team

1. Do you think the leadership style of the training project leader or training mentors had

a positive impact on the training outcomes? Please provide specific examples.
2. Was communication among the team smooth during the training? Did it affect your learning experience?
3. Did the technical tools used in the training contribute to your learning process? Do you have any suggestions for improving their use?
4. How would you evaluate the outcomes of this training? Did it meet your expected learning goals?

Role 9: Technical support staff

1. When supporting multiple projects, different leadership styles may be present. Which leadership style helps you work most efficiently?
2. Is communication and collaboration with other teams smooth? In your work, has leadership style facilitated cross-team communication?
3. Do the technical tools you primarily support meet project needs? Are there areas that require optimization?
4. What specific role does technical support play in project success? Has the combined effect of leadership style, team communication, and technical tools been critical to the outcomes?

Role 10: Student

1. Have you noticed any collaboration between teachers and the student support team? How has this collaboration affected your learning experience?
2. During your learning process, have you observed any highlights in the teaching team's collaboration and organization? How have these helped your learning?
3. Have the technical tools used in teaching (e.g., interactive classroom platforms) enhanced your learning experience? Do you have any suggestions for their improvement?
4. How satisfied are you with the overall learning experience in this course? What areas do you think could be further optimized?