Collaborative Transformation of Teachers and Principals in Strengthening the Quality of Science Learning in Elementary Schools

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Received:	Reviewed:	Accepted :	Published :
Nov. 07, 2025	Nov. 19, 2025	May. 22, 2026	June 22, 2026
DOI	https://doi.org/10.47625/fitrah.v17i1.1151		

ABSTRACT

This study aims to analyze the collaborative transformation between teachers and principals in strengthening the quality of Natural Science (IPA) learning in elementary schools through a qualitative literature study approach. Educational collaboration is not only understood as technical cooperation, but also as a transformational process involving paradigm shifts, participatory leadership, and a culture of continuous learning in the school environment. This research method uses a literature study approach by analyzing various scientific sources, such as reputable journals, academic books, and national education policy documents. The results of the study indicate that collaborative transformation between teachers and principals plays a significant role in improving the quality of science learning through strengthening pedagogical competence, methodological innovation, and visionary collaborative leadership. This transformation takes place through three main dimensions: structural, cultural, and pedagogical transformation. First, in the structural dimension, principals reform the learning management system to be more participatory, by involving teachers in strategic decision-making, curriculum planning, and evaluation of learning outcomes. Second, in the cultural dimension, collaboration is transformed into a school culture that fosters mutual trust, openness, and a commitment to quality learning. The principal acts as a catalyst for change, fostering reflective, innovative, and collaborative values within the school environment. Third, in the pedagogical dimension, collaboration generates innovation in science learning practices.

Keywords : Collaborative Transformation**,** Teachers, Principals, Learning Quality, Science, Elementary Schools

INTRODUCTION

Improvement quality learning is issue central in development education basis in indonesia. In the middle demands globalization and change paradigm education 21st century learning knowledge natural sciences (IPA) in elementary school is required for no only emphasize aspect cognitive , but also building skills think critical , creative , and collaborative.[1] in context said , collaboration between teachers and principals school become element strategic determining quality of the learning process. Collaboration this no just nature administrative , but rely on the spirit transformation together for create ecosystem learning that is oriented towards quality , relevance and sustainability .

Various policy education national, including implementation independent curriculum, emphasizing importance role leadership head collaborative schools and reflective teachers in face complexity science learning in schools ministry of [2]education, culture, research, and

[1] Yusron Abda'u Ansya and Tania Salsabilla, *Science Learning Model in Elementary Schools* (Semarang: Cahya Ghani Recovery, 2024).

[2] Muhammad Ferry Irawan, Zulhijrah Zulhijrah, and Andi Prastowo, 'Planning Natural Science Learning Based on Project Based Learning in the Independent Curriculum in Elementary Schools', *PIONIR: Jurnal Pendidikan* , 12.3 (2023), 38–46.

technology confirm that success transformation education depends on synergy inter-actor education in units school.[3] head school no again just an administrator, but facilitator innovation; while teachers become agent changes that enliven the learning process meaningful through exploration and experimentation scientific. Synergy this is what it is foundation main for formation transformation collaborative in improvement quality science learning .

However thus , the reality on the ground show that collaboration between teachers and principals school still often hampered by structure bureaucracy, low communication professional, as well as limited culture reflective in the environment school basic. Some teachers still put head school as figure authoritative, not partners dialogic in development learning . Instead , head school often focused on aspects administrative and supervisory , not mentoring pedagogical conditions this demand existence transformation paradigm going to leadership collaborative , participatory , humanistic , and improvement - oriented quality study participant educate .[4]

Literature study previously show that transformation collaborative in context education rooted in theory leadership distributive and learning organization . According to hallinger, leadership collaborative allows the occurrence of shared vision between head schools and teachers, ultimately strengthen capacity collective school in manage innovation learning.[5] in context science learning, collaboration this can encourage teachers to integrate approach inquiry, learning based projects, and reflections scientific that grows character scientists young since early. With thus, collaboration no only repair system teaching, but also transforming culture school become more adaptive to development science and technology.

Based on thinking said, research this aim for describe and analyze transformation collaborative between teachers and principals school in strengthening quality science learning in elementary schools through approach studies literature qualitative . This study expected can enrich perspective academic about importance leadership collaborative and cultural reflective as base improvement quality learning. More from that, the result study this expected give contribution conceptual for development policy education synergy - oriented basis inter-actor school as well as become reference empirical for researchers and practitioners education in indonesia.

RESEARCH METHODS

This study uses a qualitative approach with a library research design *that* focuses on conceptual and interpretive analysis of various scientific sources related to teacher and principal collaboration in improving the quality of science learning in elementary schools. The research data is sourced from secondary literature obtained through reputable databases such as Google Scholar and SINTA, with inclusion criteria including publications from 2019-2025 that discuss the topics of educational collaboration, school leadership, transformation of learning quality, and science learning. References Good from journal articles and Academic books were selected through a rigorous selection process based on relevance, validity, and the context of basic education studies. Data collection techniques were carried out through a systematic search *using* keywords such as collaborative leadership, teacher-principal partnership, quality of science learning, and educational transformation, followed by classification, data extraction, and the preparation of a literature matrix.

Data analysis used content analysis *based* on the stages of Miles and Huberman (data reduction, data presentation, conclusion drawing), while data validity was maintained through

[3] Mujiono Sang Putra, 'Educational Transformation in the Digital Era: Creative Solutions in Improving the Quality of Learning', *JPSL: Journal of Education, Social and Environmental Studies* , 3.2 (2025), 68–78.

[4] Wensly Peniel Raprap and others, *Educational Leadership 5.0: Managing Schools in the Era of Disruption* (Yogyakarta: Star Digital Publishing, 2025).

[5] Niken Ardaningtyas Utami and Lia Yuliana, 'The Influence of Instructional Leadership, Implementation of the Independent Curriculum, and Professional Learning Communities on Organizational Culture in Senior High Schools in Yogyakarta City', *Research and Development Journal of Education* , 11.2 (2025), 971–85.

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the [6]*trustworthiness* principles of Lincoln and Guba which include credibility, dependability, transferability, and confirmability.[7] Through this approach, the research produces a comprehensive conceptual synthesis regarding the dynamics of collaborative transformation of teachers and principals in strengthening the quality of science learning in elementary schools.

RESULTS AND DISCUSSION

The Concept of Collaboration between Teachers and Principals in Improving the Quality of Science Learning

The results of a literature study indicate that collaboration between teachers and principals is a strategic synergy in building a culture of quality learning. The principal acts as an instructional leader who creates a conducive academic climate, while teachers act as pedagogical implementers who transform policies into learning actions. In the context of science learning, this collaboration is realized through joint planning, the development of experiment-based media, and authentic assessments oriented toward the scientific process. According to Fullan, effective educational collaboration requires trust, openness, and a shared commitment to improving student learning outcomes.

A literature review shows that collaboration between teachers and principals is a strategic synergy in building a culture of quality learning, particularly in the context of teaching Natural Sciences (IPA) in elementary schools. This collaboration is not merely administrative but rather a dynamic process involving professional, reflective, and pedagogical interactions oriented toward improving the quality of learning.

Research by Werang et al. in 2010 2023 revealed that principals play a dominant role in facilitating collaboration between teachers through professional role models, joint training activities, and reflective forums that enhance performance and mutual trust among educators. [8]Furthermore, Sukinem, Wasilah, and Musyarapah conducted research in the year 2023 demonstrated that the implementation of collaborative supervision significantly increased teacher professional competence from 61.81% to 83.18%, with the principal acting as a reflective partner at every stage of supervision. [9]Meanwhile, Marniawarsih et al. in 2023 2025 emphasizes that the effectiveness of collaboration can be identified in three main areas, namely planning, implementation, and evaluation of learning carried out in a participatory and transparent manner.[10]

Susanti's research results in 2019 2025 strengthened previous findings with a Systematic Literature Review approach to 20 studies related to principal leadership and teacher collaboration. He concluded that transformational, democratic, and supportive leadership styles have a positive influence on improving teacher performance. Teacher collaboration manifested in the form of regular meetings, group discussions, and joint training has been proven to accelerate the exchange of knowledge and sharing of best practices, which ultimately has a

[6] Ajeng Wahyu Saputri, Sri Handayani, and Oktiana Handini, 'Analysis of Responsibility Character of Grade III Students of Bayan State Elementary School No. 216 Surakarta in Integrative Thematic Learning', *Journal on Education* , 5.02 (2023), 5449–55.

[7] Nurul Muslihah and others, *Qualitative Nutrition Research* (Malang: Universitas Brawijaya Press, 2022).

[8] Basilius Redan Werang, Ni Made, and Dwi Septia, 'The Role of the Principal in Encouraging Collaboration Between Elementary School Teachers at SD Negeri 2 Belantih', *Tambusai Education Journal* , 7.3 (2023), 30260–64.

[9] 'Collaborative Supervision in Improving Teachers' Professional Competence at Al Manar IT Elementary School, Madurejo Village, South Arut District, West Kotawaringin Regency, Pangkalan Bun, Central Kalimantan', *Lencana: Journal of Educational Science Innovation* , 1.1 (2023), 206–20.

[10] Dayang Marniawarsih, Wahab, and Sugeng Listyo Prabowo, 'Collaboration between Teachers and Principals in Maintaining the Quality of Education at Sdn 04 Sanggau', *Pendas: Scientific Journal of Elementary Education* , 10.September (2025), 346–59.

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significant impact on the quality of learning. [11] These findings are relevant to be applied in the context of science learning in elementary schools, where professional collaboration between teachers and principals can strengthen the integration of science, technology, and the development of students' scientific competencies.

Thus, the concept of teacher-principal collaboration must be understood as a transformational process that integrates visionary leadership, reflective communication, and a collective commitment to quality learning. The values of mutual trust, shared vision, and professional dialogue serve as the epistemological foundation for building an adaptive science education ecosystem oriented toward sustainable quality .

Table 1. Research Results Previously about Collaboration between Teachers and Principals in Improving the Quality of Learning

Author Name & Year	Title Study	Focus Study	Research result	Implications for This research
Werang , Basilius Redan, et al . (2023)	*The role of the principal in Push Collaboration Between Elementary School Teachers at SD Negeri 2 Belantih*	Researching role head school in build culture collaborative in the school teacher environment base .	Head school play a role as example professional , facilitator training , and builders culture discussion reflective ; collaborative increase Spirit work , trust , and quality learning .	Become runway empirical for study This For strengthen analysis role head school as agent transformation in create culture collaborative in science learning .
Sukinem , Wasilah, & Musyarapah (2023)	*Supervision Collaborative in Increase Competence Professional Teachers at SD IT Al Manar Kelurahan Madurejo South Arut District, Regency West Kotawaringin*	Review implementation of supervision models collaborative head school to improvement teacher competency .	Supervision collaborative increase competence teacher professionalism from 61.81% to 83.18%; occurred change behavior teaching and improvement innovation learning through partnership parallel between teachers and principals school .	Support findings theoretical that approach supervision collaborative is an effective strategy in strengthening quality science- based learning reflection and partnership .
Marniawarsih , et al . (2025)	*Collaboration between Teachers and Principals in Maintaining*	Analyze form and effectiveness collaboration between	Collaboration effective happened in three domains : planning , implementation , and	Give base conceptual that multi-dimensional collaboration

[11] Ismi Susanti, 'The Influence of Principal Leadership and Teacher Collaboration on Teacher Performance in Kindergarten Schools: A Systematic Literature Review', *Journal of Innovation in Teaching and Instructional Media* , 6.1 (2025), 239–51.

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	the Quality of Education at SDN 04 Sanggau	teachers and principals school in guard quality education .	evaluation learning ; producing improvement quality education and commitment professional teachers.	can implemented in a way contextual in science learning for strengthen planning , implementation , and evaluation based quality .
Susanti, Ismi (2025)	*Influence Leadership Principal and Teacher Collaboration on Teacher Performance in Kindergarten Schools : A Systematic Literature Review*	Reviewing in a way systematic connection leadership head school and teacher collaboration towards improvement teacher performance .	Leadership transformational , democratic , and supportive proven strengthen teacher collaboration ; collaboration increase exchange knowledge and practice best , impactful directly on quality learning and profession	

Principals' Strategies in Building a Collaborative Culture

The principal plays a crucial role in building a collaborative system oriented towards educational quality. Based on a literature review, the main strategies implemented include: (a) strengthening the vision and mission based on learning quality, (b) empowering teachers through reflective academic supervision, and (c) creating a school climate open to innovation and participation. Leithwood and Jantzi in Inez Wilson Heenan et al ., emphasized that the principal's transformational leadership is able to encourage the creation of professional collaboration between teachers, which has a significant impact on learning effectiveness. [12]In the elementary school context, this strategy is very important to encourage the integration of science with character values and local contextualization, so that science learning becomes more relevant, meaningful, and contextual.

The results of research by Wenny Dwi Lestari and Muhamad Sholeh in 2010 The 2021 regulation emphasizes that building a collaborative culture can be achieved through systematic stages: planning, implementation, and evaluation based on a quality culture. In the planning stage, the principal establishes quality culture standards, analyzes the school situation, and forms a working team focused on improving teacher collaboration. The implementation stage includes monitoring team performance and building effective communication among all school

[12] Inez Wilson Heenan and others, 'The Impact of Transformational School Leadership on School Staff and School Culture in Primary Schools—A Systematic Review of International Literature', *Societies* , 13.6 (2023), 1–27.

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members. The evaluation stage involves assessing program achievements, analyzing supporting and inhibiting factors, and formulating steps for continuous improvement.[13]

In addition, the study highlights elements of quality culture that need to be considered in collaborative leadership, such as: (a) providing positive role models and habits, (b) motivating and accompanying teachers, (c) strengthening performance through briefings and evaluative meetings, (d) establishing internal and external cooperation for quality development, (e) creating a safe and pleasant learning environment, (f) building harmonious interactions between school members, and (g) fostering a sense of belonging through the active involvement of all school members in the policy-making process.

These findings indicate that collaborative leadership strategies not only emphasize managerial aspects but also require humanistic, reflective, and participatory leadership. In the context of strengthening the quality of science learning in elementary schools, the principal plays a role as a transformational learning leader who fosters collective responsibility in managing the learning process, encourages science-based innovation, and creates a learning ecosystem oriented towards sustainable quality. The results of the research by Purnomo, Wibawa, & Soedjono in 2025 reinforces these findings, showing that the principal at SMKN 1 Wirosari Grobogan plays a central role by communicating a clear vision and mission, empowering teachers and staff, and building positive relationships within the school. Strategies implemented include regular meetings, collaborative projects, technology utilization, and proportional delegation of tasks, resulting in a collaborative culture that enhances teacher motivation, student engagement, and school operational efficiency.[14]

Based on the literature framework and empirical findings, it can be concluded that a principal's strategic planning, which includes a quality vision, systematic implementation of teacher supervision and empowerment, and the creation of an innovative and participatory climate, will result in a strong collaborative work culture. The direct impact is seen in improving the quality of science learning in elementary schools. Thus, the principal is not only an administrative manager but also a learning leader who initiates teacher-principal partnerships, facilitates professional dialogue, and encourages collective action towards continuous quality improvement.

The Role of Teachers in Strengthening the Quality of Science Learning

Teachers play a central role in strengthening the quality of science learning in elementary schools. As key actors in the learning process, teachers are responsible for ensuring that every collaboration results in tangible pedagogical innovations that are relevant to students' needs. [15]Through the application of innovative learning strategies, teachers can improve the quality of teaching and learning interactions and foster students' in-depth conceptual understanding. Literature studies show that teachers implement various approaches, such as *inquiry-based learning* , contextual learning, and the use of simple experimental media, to facilitate more active, critical, and meaningful learning for students. These approaches not only improve

[13] Wenny Dwi Lestari and others, 'Principal's Strategy in Improving School Quality Culture', *Journal of Educational Management Inspiration Volume* , 9.2 (2021), 312–26.

[14] Amal Purnomo and Bebet Adi Wibawa, 'Principal Leadership in Developing a Collaborative Culture at SMKN 1 Wirosari Grobogan', *Tambusai Education Journal* , 9.1 (2025), 2506–8.

[15] Dwi Indah Lestari and Heri Kurnia, 'Implementation of Innovative Learning Models to Improve Teachers' Professional Competence in the Digital Era', *JPG: Journal of Teacher Education* , 4.3 (2023), 205–22.

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students' understanding of science concepts but also instill scientific thinking and problem-solving skills in students.

. In addition, collaborative-oriented teachers actively participate in professional learning communities (PLCs), where they engage in the exchange of good practices, reflection on learning outcomes, and the continuous development of innovative strategies. Participation in PLCs enables teachers to support each other, collectively solve pedagogical challenges, and adapt learning practices to local contexts and student characteristics. Raharjo's research confirms that consistent and structured teacher collaboration improves pedagogical competence, enriches content knowledge, and broadens insight into the diversity of student learning styles, making learning more inclusive and effective.[16]

Furthermore, the role of teachers in building a collaborative culture has direct implications for the success of strengthening the overall quality of science learning. Teachers are not only managers of teaching materials, but also agents of innovation, facilitating the integration of science concepts, character values, and local contextualization. Therefore, teacher collaboration, both formally through PLCs and informally through daily interactions, plays a crucial role in creating a dynamic, participatory, and quality-driven learning ecosystem. This strategy ultimately supports the achievement of science education goals that are relevant, meaningful, and capable of equipping students with strong scientific competencies and character.

Dynamics of Collaboration between Teachers and Principals in the Context of Elementary Schools

Collaboration between teachers and principals at the elementary school level has a complex and unique dynamic, as it involves not only professional aspects but also strong emotional, social, and cultural dimensions. This relationship is not merely structural or administrative, but is built through effective communication, empathy, and a shared vision and goal of improving the quality of science learning. Research literature shows that harmonious interactions between principals and teachers create a mutually supportive work culture, strengthen motivation, and foster a sense of collective responsibility for the quality of the teaching and learning process.[17]

Despite its great potential, this collaboration is not without its challenges. Limited time for collaborative activities, differing leadership styles, administrative pressures, and varying teacher pedagogical abilities often present obstacles that require careful management. [18]These challenges can be minimized through ongoing coaching, systematic collaborative activity planning, and open and reflective communication. When these elements are consistently implemented, collaboration between teachers and principals can produce pedagogical innovation and more integrated and relevant learning practices.

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[16] Joko Sugiarto, *Indonesian Professional Teachers: Competence, Integrity, and Transformation of 21st Century Education* (Pamekasan: Joko Sugiarto, M. Pd, 2025).

[17] Tisna Ayu Selvia, Sofwan Adi Putra, and M Badrun, 'The Role of School Principals in Improving the Work Culture of Elementary School Teachers', *Educational Management* , 19.2 (2024), 209–23.

[18] Intan Savitri and Makmur Syukri, 'Implementation of Interpersonal Communication of Madrasah Principals in Increasing Teacher Work Motivation', *Didaktika: Journal of Education* , 14.2 May (2025), 3193–3204.

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Furthermore , well-established collaboration significantly impacts the quality of science learning, particularly in science- and literacy-based planning, implementation, and evaluation. Teachers supported by visionary and communicative principals tend to be more innovative in designing inquiry-based learning strategies, using simple experimental media, and contextualizing learning that takes into account local characteristics and student learning styles. Thus, the synergy between teachers and principals not only creates a productive and participatory learning ecosystem but also forms a school culture that is adaptive, reflective, and oriented towards sustainable quality.

Implications of Collaboration for Improving the Quality of Science Learning

Literature findings indicate that collaboration between teachers and principals has a significant impact on improving the quality of science learning, both in terms of process and learning outcomes. This collaboration enables teachers and principals to design more innovative, reflective, and data-driven learning strategies, allowing pedagogical interventions to be tailored to students' needs appropriately. With this synergy, teachers can effectively integrate inquiry-based learning approaches, contextual learning, and the use of simple experimental media, making science learning more meaningful, relevant, and able to improve students' conceptual understanding.

Furthermore, effective collaboration also contributes to increased teacher motivation, improved evaluation systems, and increased student participation in scientific activities and classroom experiments. Through regular meetings, reflective discussions, and the sharing of best practices within a *Professional Learning Community* (*PLC*) framework, teachers can support each other in addressing pedagogical challenges, broadening their understanding of student learning styles, and adapting teaching methods to local contexts. This collaborative impact creates an inclusive, adaptive learning ecosystem oriented toward continuous quality improvement.

Conceptually, this collaboration reflects a school-based quality improvement model that emphasizes continuous improvement, where schools collectively review, evaluate, and develop learning practices. This concept aligns with DuFour's theory of *Professional Learning Communities* . Istuningtyas Pramesti et al. , who emphasized that collective work between teachers and principals is key to creating a learning school . By [19]implementing this model, collaboration is not merely an administrative interaction, but also a strategic mechanism for improving the quality of education, strengthening a professional culture, and ensuring the sustainability of science learning at the elementary school level.

Collaborative Transformation of Teachers and Principals in Strengthening the Quality of Science Learning in Elementary Schools

The collaborative transformation between teachers and principals in the context of improving the quality of science learning in elementary schools reflects a paradigm shift from conventional management to learning *-centered leadership* . Based on the results of the literature synthesis, this transformation occurs through three main dimensions: structural, cultural, and pedagogical transformation. *First* , in the structural dimension, principals reform

[19] Istuningtyas Pramesti, Yovitha Yuliejantiningsih, and Supriyono Purwosaputro, 'The Influence of Teacher Leadership and Participation in Learning Communities on Elementary School Teachers' Learning Agility', *Didaktika: Jurnal Kependidikan* , 14.3 (2025), 4333–46.

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the learning management system to be more participatory, by involving teachers in strategic decision-making, curriculum planning, and evaluation of learning outcomes. This makes teachers not merely policy implementers, but equal partners in building the quality of education.

Second , in the cultural dimension, collaboration is transformed into a school culture that fosters mutual trust, openness, and a commitment to quality learning. The principal acts as a catalyst for change, fostering reflective, innovative, and collaborative values within the school environment. *Third , in the pedagogical dimension, collaboration results in innovations in science learning practices, such as the implementation of STEM-based learning , project-based learning* , and *scientific inquiry* approaches that emphasize strengthening students' critical and creative thinking skills.

This collaborative transformation also strengthens teacher professionalism through continuous learning or *continuous professional development* , and strengthening the principal's role as a transformational leader who inspires and facilitates positive change. Overall, this collaborative transformation creates a science learning ecosystem that is adaptive, contextual, and oriented toward sustainable quality.

CONCLUSION

Based on the results of the literature study that has been conducted, it can be concluded that the collaborative transformation between teachers and principals in strengthening the quality of science learning in elementary schools is a strategic process that requires a change in paradigm, leadership, and professional culture in the school environment. The collaboration between the two does not only function as a form of administrative cooperation, but has developed into an intellectual and pedagogical synergy oriented towards creating quality, innovative, and sustainable learning. The principal acts as a transformational leader who creates a collaborative academic climate, while teachers become agents of change who implement the values of professionalism, reflectivity, and science-based learning in real contexts. Through this collaboration, a more participatory, contextual, and student-centered science learning system is created.

Furthermore, the synthesis results indicate that the success of improving the quality of science learning depends heavily on the integration of three main dimensions: structural, cultural, and pedagogical. The structural dimension encompasses school policies and management that support ongoing collaboration; the cultural dimension emphasizes the formation of values of mutual trust, openness, and innovation in the work environment; while the pedagogical dimension relates to the development of inquiry-based learning approaches, projects, and technology integration that strengthen students' scientific competencies. Thus, systematically managed and transformative collaboration is the main foundation in creating a superior and competitive science learning ecosystem.

Conceptually, this study confirms that collaborative transformation of teachers and principals is not an end in itself, but rather a dynamic process toward school-based quality improvement. The theoretical implications lie in strengthening educational leadership models based on collaboration and reflection, while the practical implications require institutional support for ongoing professional development programs for teachers and principals. Therefore,

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the results of this study are expected to serve as a conceptual and empirical reference for the development of science learning quality policies in elementary schools, as well as a foundation for further research examining the effectiveness of collaborative models in the context of schools based on 21st-century educational transformation .

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