Transformational leadership for deeper learning: shaping innovative school practices for enhanced learning

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Abstract

Purpose – This research aims to explore leadership approaches that foster deeper learning and facilitate the transition from traditional schooling to a model aligned with the demands of the post-industrial digital knowledge society.

Design/methodology/approach – Employing a mixed-methods approach, the authors conducted surveys among school principals within a network of schools embracing deeper learning based on ten distinct but interlocking criteria that define this particular model of deeper learning. Through in-depth follow-up interviews with school leaders, the authors investigated the factors and obstacles that support sustainable implementation and scalability of deeper learning, with a specific focus on the role of transformational leadership.

Findings – During the implementation of transformative practices like deeper learning, school leaders demonstrate diverse perspectives on the necessary changes for their successful integration. Leaders inclined toward a "transactional" leadership style concentrate on changes within individual classrooms. Conversely, leaders exemplifying "transformational leadership" possess a broader vision and address systemic factors such as teacher collaboration, assessment regulations and the effective utilization of time and space within schools. To achieve widespread adoption of deeper learning across schools and the education system, it is essential to recruit more transformational leaders for formal leadership positions and reorient leadership training toward transformational approaches.

Practical implications – The deeper learning model developed for this intervention encompasses a four-stage process: Teachers initially collaborate in small teams to co-design interdisciplinary, deeper learning units. The actual units consist of three sequences: knowledge acquisition, where students gain knowledge through direct instruction supplemented by personalized learning on digital platforms; team-based co-creative and co-constructive tasks facilitated by teachers once students have acquired a solid knowledge base and the completion of authentic tasks, products or performances in sequence III. While small groups of intrinsically motivated teachers have successfully implemented the model, achieving broader scalability and dissemination across schools requires significant "transformational leadership" to challenge traditional norms regarding teacher collaboration, assessment practices and the efficient use of time and space in schools.

Originality/value – This paper presents a structured model of deeper learning based on ten distinct but interlocking quality criteria tested within a network of 26 schools. The model has demonstrated transformative

effects on participating schools, albeit primarily observed in smaller substructures of large secondary schools. Teachers who previously worked independently have begun to collaboratively design learning experiences, resulting in "hybrid" classrooms where physical and digital spaces merge and extend to include maker spaces and out-of-school learning environments. Traditional summative assessments have been replaced by various forms of embedded formative assessment. However, these innovations are currently driven by small groups of intrinsically motivated teachers. The research provides insights into the type of school leadership necessary for comprehensive scaling and system-wide dissemination of deeper learning.

Introduction: beyond knowledge transmission: the case for leading schools towards deeper learning

The 21st-century world is undergoing rapid changes, necessitating schools to actively adapt and reshape their practices to equip students for successful life paths. However, a significant number of schools continue to adhere to a traditional logic of learning inherited from the industrial age, emphasizing lockstep knowledge transmission and acquisition. The development and sustainability of a new "grammar of schooling" (Tyack and Tobin, 1994) that aligns with the demands of the 21st century have not received adequate research attention (Mehta and Datnow, 2020, p. 491). The conventional school system, given the economic and technological evolution, no longer aligns with the requirements of today's digital knowledge society. While the development of practical skills remains crucial for problem-solving and creative work (Stern and Grabner, 2012), there is a need for education to refocus on nurturing student competencies for thriving in a "glocalized" and digitized society. Competencies such as conceptual knowledge, in-depth understanding of vital subject-related concepts, metacognitive and procedural knowledge and critical thinking gain significance, signaling the necessity of a paradigm shift.

This research examines the characteristics of a "new grammar of schooling" that effectively meets the demands of the 21st century. Rather than solely transmitting declarative knowledge, schools should prioritize teaching students not only to master critical concepts but also to apply their knowledge to solve authentic problems in real-world contexts. Sustainable learning requires an active approach that empowers student agency, co-agency and well-being (Cavagnetto *et al.*, 2020; OECD, 2019; Salmela-Aro, 2017; Vaughn, 2020), while also emphasizing the acquisition of essential 21st-century skills known as the "4Cs": communication, collaboration, critical thinking and creativity (Trilling and Fadel, 2009). The integration of these skills with subject-matter knowledge is vital and necessitates the development of new forms of "situated" learning, where knowledge acquisition is systematically linked to the acquisition of 21st-century skills (Sliwka and Klopsch, 2022, p. 12). This paper argues for the necessity of a deeper learning model to align the traditional transmissive model of knowledge acquisition through teaching (Voss *et al.*, 2011) with a constructivist understanding of learning (Hartinger *et al.*, 2006), which views students as self-regulated actors driving their learning process.

Deeper learning "combines the pedagogical principles of knowledge transmission and co-construction, previously perceived as opposites, into a productive synthesis" (Sliwka and Klopsch, 2022, p. 36). This model acknowledges that successful learning involves both teacher-provided structure, explanations, modeling and illustrations, as well as phases where learners independently engage with knowledge (Sliwka, 2018). By integrating processes of instruction, acquisition, co-construction, co-creation and authentic performance, this model addresses how learners can acquire substantial subject knowledge and actionable skills for creative problem-solving (Deeper Learning Initiative, 2022).

Deeper learning enables subject-specific learning within traditional school subjects while also providing avenues for addressing complex interdisciplinary questions and challenges. It expands the learning space by integrating extracurricular and virtual learning environments, creating

hybrid learning environments that enhance versatility and relevance. In the context of deeper learning, the digital and physical realms are fully integrated, enriching learning experiences across various stages: knowledge acquisition through access to multimedia resources, co-construction and co-creation through the use of digital tools to support problem-solving and creative processes and authentic work through the diverse possibilities that creativity offers.

Literature review: building a culture of deeper learning: leadership strategies for the educational transformation of schools

Designing and realizing deeper learning is a challenging process that can be effectively managed through collaborative team efforts (Mintrop *et al.*, 2022). Teachers form teams with complementary personalities and expertise to design teaching units that consider subject-matter knowledge, 21st-century skills and students' prior learning and needs (Quinn *et al.*, 2020; Reigeluth and An, 2021). To break free from traditional patterns and limitations, teachers explore innovative design ideas (Burgstahler, 2015; Sliwka and Klopsch, 2020). The initial phase involves a joint brainstorming session, where all ideas are recorded without evaluation or restrictions. Possibilities such as cross-grade student teams, digital learning opportunities and diverse, authentic forms of products/performances are considered (Brown and Green, 2020; Kalantzis and Cope, 2010; Laurillard, 2012; Yong, 2018). External experts and students can also contribute valuable inspiration. Once ideas are collected, the subsequent phases of the deeper learning unit are designed by teacher teams with careful planning, selection of differentiated materials and tasks and preparation of a hybrid learning environment (Bellanca, 2021; Clark, 2022). Balancing structure and freedom is essential to cater to students' personalized learning pathways (Crosslin, 2021). After the design phase, teachers involve students and proceed with the three-phase implementation of a deeper learning unit on a joint theme/topic mostly chosen from the school curriculum (Bovill *et al.*, 2011, 2016; Wu *et al.*, 2021).

Phase I: instruction and acquisition–building foundational knowledge

The initial phase focuses on enhancing students' understanding of key subject matter (Reusser, 2021). Teachers, as subject-matter experts, or authentic external experts provide instruction (Stockard *et al.*, 2018). Learners utilize digital platforms to access materials and assignments that cater to different levels of prior knowledge (Adamina, 2014). By the end of this phase, all students should have acquired essential subject concepts and a fundamental knowledge base (Marzano, 2004). Ensuring that all learners possess this foundational knowledge before progressing to the co-constructive and co-creative phases is crucial. Rather than relying on graded tests, formative and dialogic processes such as quizzes or concept maps can be employed to assess students' knowledge gaps. Teachers can then make instructional adjustments based on identified gaps.

Phase II: Co-construction and co-creation - applying and developing in-depth knowledge

In the second phase, students work autonomously, usually in small teams and follow predefined pathways, allowing for varying levels of self-regulation. They apply their acquired knowledge analytically and creatively while also developing 21st-century skills (Amabile and Pillemer, 2012; Reimers, 2021; Sterel *et al.*, 2018, 2022; Vollmer, 2020). The principle of "Voice and Choice" is integral during this phase, empowering students to actively participate in their learning process and make decisions regarding their pathways and learning approaches (Cook-Sather, 2020; Miliband, 2006; Mötteli *et al.*, 2022; Schaaf *et al.*, 2022). Teachers transition from instructors to coaches, providing flexible and adaptive support (Allen *et al.*, 2016; Beck *et al.*, 2008; Brühwiler, 2014; Corno, 2008; Parsons *et al.*, 2018). They scaffold individual learners and teams, asking questions, encouraging reflection,

providing formative feedback and assisting students in achieving their individual and group learning goals (Schmidt, 2020; van de Pol *et al.*, 2010).

Phase III: authentic performance–creating real-world products/performances

Deeper learning units culminate in authentic products or performances (James and Lewis, 2012; Yong, 2018). This phase moves away from traditional class tests and focuses on aligning assessments with real-world tasks (Tay, 2015; Tan *et al.*, 2015). By engaging students with relevant target groups or audiences, they experience the relevance of their work beyond the classroom. The specific format of the authentic performance, whether prescribed by teachers or allowing student choice, depends on the theme and learners' capabilities. After presenting their work, students engage in critical reflection, aided by formative and summative feedback, including rubrics and taxonomies (Dickhäuser and Rheinberg, 2003; Leenknecht *et al.*, 2021; Shute, 2008; Yong, 2018).

The full three-phase implementation module of a deeper learning unit is shown in Figure 1.

Deeper learning and its quality criteria

Deeper learning can be understood as a complex construct linked to the idea that learning for multiple and complex outcomes in the 21st century requires a deliberate process of design taking into account multiple criteria (Mintrop *et al.*, 2022). It thus stands out as a distinctive

Phase	(Co-)Design by teachers	Instruction and acquisition	Co-construction and co-creation	Authentic performance
Process	Preparing a **deeper learning unit** and its respective phases (usually in professional teams) Designing a **hybrid learning environment** Selecting appropriate **educational materials/media** Classifying materials/media according to **level of difficulty** Where appropriate: involving external experts and learning spaces	**Substantial input** by experts • Compact lectures/ presentations/ demonstrations by teachers and other experts • Personalised access to educational media on a digital learning platform	**(Co-)agency** of learners **Self-regulated work** on complex tasks (teamwork, individual work, mixed formats) **4C / 21ˢᵗ century skills:** communication, cooperation/collaboration, critical thinking, creativity **Voice & choice** by means of personalisation and co-construction **Dialogic learning development** by means of formative feedback	**Authentic contributions and learning outcomes** presented or implemented within the school or in public **Reflection** of learning processes and learning outcomes
Students' learning goals		Deep understanding of **key concepts** Focus on conceptual knowledge Acquisition of a solid **knowledge base**	Development of capacity to act and **deep subject-matter knowledge** • Conceptual knowledge • Declarative knowledge • Procedural knowledge • Metacognitive knowledge	Achievement of **learning goals** and demonstration of **learning outcomes** (knowledge and competency gains) **Metacognitive reflection**
Teachers' roles	Teachers as **designers** of deeper learning settings	Teachers as **facilitators of the construction of cognitive structures** among learners	Teachers as **adaptive experts** (acting flexibly and situationally) • Demonstrating • Coaching • Scaffolding • Encouraging thinking out loud • Providing formative feedback • Taking a step back where appropriate • Guiding reflection processes	Teachers as **providers of feedback that supports learning** • **SOLO-taxonomy** for subject-matter competencies • **Rubrics** for interdisciplinary and 4C competencies Teachers as **documenters** and **evaluators** of students' learning outcomes and competency gains

Figure 1.
Phase model of deeper learning

Source(s): Sliwka and Klopsch (2022, p.26)

approach to education compared to less complex concepts such as constructive learning, problem-solving learning and collaborative learning, which can all be seen as components of the more complex deeper learning model. Its distinctiveness arises from its adherence to quality criteria that collectively embody its transformative potential (Sliwka and Klopsch, 2022). Design, in this context, refers to the intentional and thoughtful creation of learning experiences that promote deeper understanding and skill development (Bellanca, 2021; Mintrop *et al.*, 2022). Design for learning specifically focuses on the deliberate planning and organization of various instructional and pedagogical components–as embodied in the quality criteria–to optimize learning outcomes (Brown and Green, 2020; Laurillard, 2012; Crosslin, 2021; Reigeluth and An, 2021).

Deeper learning units developed by the network schools adhere to ten key quality criteria (Sliwka and Klopsch, 2022). These criteria collectively embody the transformative potential of deeper learning:

(1) Team teaching design: Teachers collaborate in a cooperative manner, leveraging their expertise to co-create and implement deeper learning sequences.

(2) Hybrid learning environment: Students engage in a blended learning environment, accessing knowledge and communication channels through multimedia platforms.

(3) Three distinct phases: Each deeper learning unit consists of three phases: instruction and acquisition, co-construction and co-creation and authentic product/performance.

(4) Knowledge architecture: Teachers plan the unit's knowledge foundation, focusing on core subject-matter concepts, declarative and procedural knowledge and explicit metacognitive scaffolding.

(5) Acquisition of 21st-century skills: Deeper learning processes support students in acquiring essential 21st-century skills through collaborative and authentic work.

(6) Voice and choice: Students actively participate in their learning process, making decisions within an appropriate framework tailored to their age, prior knowledge and self-regulation ability.

(7) Agency and co-agency: Students experience themselves as active agents, empowered to interact self-determinedly with their environment and engage in collective problem-solving with their peers.

(8) Dialogical performance development: Students receive adaptive support and formative feedback throughout the learning process, fostering authentic and effective performance development.

(9) Authentic products/performances: Deeper learning units culminate in diverse and relevant products or performances that reflect the world beyond the classroom.

(10) Adaptive expertise: Teachers flexibly assume various roles during deeper learning units, providing knowledge structuring, instruction, coaching, scaffolding and formative feedback as needed.

By integrating these quality criteria, deeper learning promotes an engaging and transformative educational experience.

In the pursuit of fostering deeper learning environments, the present study builds upon the previously established ten quality criteria and investigates their practical implementation within educational institutions. Specifically, a cohort of 26 schools undertook the task of developing and integrating deeper learning units, guided by the aforementioned criteria.

In order to comprehensively examine the facilitative role of leadership in this implementation process, empirical data was collected and analyzed to shed light on the types of leadership and activities employed by leaders that effectively supported the successful integration of deeper learning practices within these schools. This research aims to contribute to the growing body of knowledge on transformational leadership and its impact on advancing deeper learning experiences in educational settings.

Transformational leadership for deeper learning

Transactional and transformational leadership are two independent styles often applied in organizations, and their practices are viewed as complementary in school settings (Adams *et al.*, 2018; Bass and Avolio, 1995; Felfe, 2006; Harazd and Van Ophuysen, 2011; Leithwood and Jantzi, 2005; Tyssen *et al.*, 2014). Transactional leadership focuses on managing daily routine to maintain the system rather than improving it (Bass, 1990; Lussier and Achua, 2015; Sergiovanni, 1990), while transformational leadership inspires staff to improve their tasks, fosters innovation, develops a shared vision and builds trust and collaboration (Leithwood, 1994; Hubbard and Datnow, 2020; Tyssen *et al.*, 2014; Ytterstad and Olaisen, 2023). Transformational leadership aims to lead effective second-order change through dimensions such as building vision and goals, providing stimulation and support, symbolizing professional practices and developing participatory structures (Hallinger, 2003; Leithwood and Jantzi, 2000; Woods *et al.*, 2019).

Leadership for deeper learning as described by Richardson *et al.* (2021) can be seen as a form of transformational leadership because it shares several key characteristics and objectives with the transformational leadership style. Deeper learning enhances student learning experiences in complex ways (Richardson *et al.*, 2021). Leadership for deeper learning therefore requires an intentional, authentic and durable approach that goes beyond traditional leadership practices (Richardson *et al.*, 2021, p. 150). Richardson *et al.* (2021) present a "Portrait of a Deeper Learning Leader" with components such as living the vision, authenticity and agency in learning, trusting teachers as professionals, openness to new approaches, over-communicating change, restlessness toward equity and courage to challenge norms (p. 151). These leaders focus on intentionality, authenticity and depth to promote deeper learning (Richardson *et al.*, 2021, p. 152). They balance impatience for immediate change with patience to sustain efforts and support teacher creativity (Richardson *et al.*, 2021, pp. 153–154). Effective leaders also create structures of possibility, provide resources and foster connections to enable innovative work in schools (Richardson *et al.*, 2021, p. 156). Transformational Leadership practices challenge the existing grammar of schooling and are essential for educational improvement (Hubbard and Datnow, 2020, pp. 503–504).

Methods: research questions, methodology, sample, instruments
Research question and sample
The study investigates the challenges faced by school leaders in implementing deeper learning within and across schools, analyzing their experiences in relation to their understanding of leadership for deeper learning. The theoretical framework distinguishes between transformational and transactional leadership, leading to the research question: How does the self-perception of school leaders as "transformational leaders" versus "transactional leaders" influence their understanding of the requirements for implementing deeper learning?

Context of the study
In the context of this research paper, the leadership actions of school principals within a foundation-funded innovation network of 26 public secondary schools in Germany dedicated

to implementing deeper learning are examined. The professional learning of these principals was orchestrated through a structured framework of interactions taking place over one school year. In this time frame, the principals convened four times, with a deliberate balance between virtual and in-person engagements. Two of these gatherings took place online, leveraging digital platforms to overcome geographical barriers, while the remaining two were immersive two-day workshops held at a conference center. During three of the meetings, the school principals were accompanied by their respective teams of teachers who were actively involved in the implementation of deeper learning strategies. One exclusive in-person meeting was designated solely for the principals, enabling focused discussions on strategic leadership and coordination.

The nature of these gatherings was characterized by an interactive workshop format, curated to facilitate meaningful collaboration. This design allowed the school principals and their teacher teams to delve into the nuances of deeper learning, exchange insights and co-create innovative ideas tailored to their individual school contexts. Importantly, these engagements not only enabled the dissemination of theoretical knowledge but also encouraged practical learning by drawing from the collective experiences gained during the implementation of deeper learning methodologies within their respective schools. To further amplify the knowledge-sharing, a digital platform was used. This platform served as a virtual hub for the network, fostering a dynamic space for the schools to disseminate ideas, share educational materials and showcase their innovative practices.

At the end of the first year, the school principals were invited to participate in an online survey. A total of 25 principals took part. In a second step, five of these school leaders who were identified as "transformational leaders" based on the analysis of the survey data were interviewed as experts.

Methodology and instruments
This study, which centers on the role of principals, is based on a larger dataset that also includes information on teachers. It was designed using a nested mixed methods approach (QUAL/quan). The nesting serves as a method triangulation, combining different methodological approaches to provide a comprehensive analysis (Jick, 1983, p. 136). The quantitative approach complements the qualitative research through the use of questionnaires and expert interviews.

The digital questionnaire included open-ended questions and scales to measure transformational and transactional leadership. The leadership aspects in both surveys were specifically targeted at school leaders, and all items were assessed on a four-level Likert scale (never–rarely - mainly–always). The items were adapted from a survey conducted with school leaders in the state of Hamburg (Institut für Bildungsmonitoring und Qualitätsentwicklung, 2017), which drew from previous empirical studies (Bass and Avolio, 1995; Felfe, 2006; Harazd and Van Ophuysen, 2011). Participants responded to statements assessing their leadership style. Scales were derived from these responses, allowing for conclusions to be drawn about the constructs of transformational or transactional leadership style.

A two-factor analysis of variance demonstrated that the data set supports the differentiation between transformational and transactional leadership. Both scales used in this study demonstrated reliability ($\alpha_{transactional} = 0.7$; $\alpha_{transformational} = 0.9$) and showed statistical significance ($p = 0.001$). The achieved reliability is considered acceptable for the present cohort.

The qualitative data from the questionnaire and interviews were analyzed using Mayring's content analysis (Mayring, 2010). The intercoder reliability of the developed categories was $K = 0.958$, indicating "almost perfect" agreement (Landis and Koch, 1977,

p. 265). In the analysis of qualitative data, the selection of quotations was based on their status as prototypical quotes, representing the respective category under analysis. These selected quotations were deemed to encapsulate the essential themes and characteristics within each category, providing a representative snapshot of the data and contributing to the comprehensive understanding of the research findings.

In addition to specific qualitative and quantitative analyses, data triangulation was employed by combining information from different data sources (Denzin, 2007, p. 301). The purpose of triangulation was not to achieve complete agreement but to enhance the breadth and depth of the analysis through diverse data sources (Flick, 2007, p. 520).

Findings: insights from the survey and expert interviews on principals' role in implementing and scaling deeper learning

All participating school principals offered nuanced insights into their encounters with deeper learning through the written survey. They openly discussed both challenges and favorable outcomes. Initially, this section delves into the difficulties encompassing teacher and parent engagement and assessment. Subsequently, the aspirations linked to deeper learning are outlined, primarily focusing on the students, while also encompassing broader implications for the entire school system.

Challenges encountered in implementing deeper learning
In examining the challenges faced by school principals in the broader implementation and scaling of deeper learning, a recurring issue identified is the current understaffing of schools. This problem depletes the strength and power required for school development, as one principal laments, "I know that every school development process needs strength and power, which is used up to some extent by the shortage of teachers".

Even if there is enough staff, the implementation of deeper learning poses challenges in gaining support from all teachers and parents. The inclusion of the entire teaching staff in embracing change is described as arduous and clear communication is deemed essential to persuade parents of the benefits and worthiness of deeper learning. A principal emphasizes the need for consistent involvement of parents from the outset, stating, "Parents must be consistently brought on board from the beginning".

In examining the data, it becomes apparent that principals identify teacher attitudes as the primary obstacles to the broader implementation and scaling of deeper learning. They question whether all teachers within their schools are prepared for collaborative teamwork and the additional hours required to design deeper learning units, particularly in the face of significant teacher shortages. Furthermore, their statements highlight barriers and limiting factors stemming from the structural and organizational framework of schools, aptly referred to as the "grammar of schooling" by Tyack and Tobin (1994). These factors present considerable challenges to effecting meaningful change within the education system.

Another significant barrier to the widespread adoption of deeper learning is the assessment regulations that hinder its integration. State governments impose concise regulations on the number of written assessments, primarily graded tests, at each grade level. However, assessing interdisciplinary content knowledge and 21st-century skills, such as the "4Cs," is perceived as "difficult to assess" objectively and fairly. As one principal expresses, "Teachers want reliable answers on how to assess student learning according to the legal requirements", a quote underscoring the challenge faced by educators in assessing the holistic nature of deeper learning within the confines of existing assessment regulations.

Potential positive impacts of deeper learning
Regarding the expectations surrounding a change in the culture of learning, school leaders involved in the school network anticipate several positive impacts of deeper learning on their respective schools. Firstly, they hope that deeper learning will enhance learners' competencies and self-efficacy, fostering more engaged and productive ways of acquiring knowledge. One principal articulates this expectation, stating, "I hope for an additional gain in student competence through deeper and more productive engagement with content. I also hope for a positive effect on learners' self-efficacy". Another principal highlights the need for breaking away from one-dimensional thinking prevalent in teaching distinct subjects, emphasizing the value of networked thinking across broader and more complex themes.

Secondly, school leaders aspire for students to perceive their learning as personally relevant and sustainable, leading to the long-term retention of acquired knowledge and understanding. They anticipate that tailored learning experiences will contribute to students' perception of being "successful" learners in schools. One principal expresses this hope, stating, "I hope that our students will receive more learning tailored to their needs and thus be more successful and sustainable learners".

Thirdly, school leaders anticipate changes in student attitudes and motivation to learn through the adoption of deeper learning. They believe that deeper learning can bring about positive shifts in both students and teachers. As one principal states, "I think deeper learning is positive because it also leads to an attitude change in students and teachers". Students become more actively involved in their own learning journey, embracing a sense of ownership and curiosity. This shift in engagement fosters an attitude change, as students transition from passive recipients of information to proactive seekers of knowledge. Similarly, the participant's observation about an attitude change among teachers underscores the reciprocal nature of the deeper learning process. Educators who facilitate deeper learning experiences often need to adopt a more facilitative and guiding role, encouraging students to explore, collaborate and construct their own understanding. This shift demands a departure from traditional instructional models and requires teachers to be open to experimentation and adaptability.

Lastly, implementing deeper learning is seen by some school leaders as an opportunity to effect broader changes within a stagnant school system. They view deeper learning as having transformative potential. One principal remarks, "Deeper learning has tremendous explosive power and the potential to lift the German education system to another level". The metaphor of "explosive power" serves to underscore the participant's view that deeper learning has the capacity to drive substantial and even rapid positive changes, reflecting an aspiration for a transformative shift that could bring about enhanced learning experiences and outcomes for both students and educators in Germany. However, perspectives on the transformative impact of deeper learning vary among school leaders, with some expressing confidence in its catalytic role in school change, while others remain skeptical because of traditional teacher mindsets rooted in conventional teaching methods, concerns about implementation challenges leading to disruptions, reservations about resource allocation and skepticism about alignment with assessment regulations and accountability measures.

Leadership style and deeper learning implementation
Assessments of leadership scales revealed that eleven school leaders self-perceived their leadership style as transformational. Interestingly, none of the school leaders surveyed were classified solely as transactional leaders. However, among the fourteen principals whose leadership styles did not clearly align with transformational leadership, strong indications of transactional behavior were evident, resulting in a categorization of a "mixed leadership style" for these individuals.

The principals demonstrating more transformational traits reflected a broader perspective, recognizing that the main challenges lie in reshaping teacher attitudes and perceptions, and in some cases, even parental attitudes, while also addressing structural barriers within the school system. In contrast, school leaders with a mixed leadership style showed significantly less emphasis on whole-school sustainable and systematic change. School leaders adopting a mixed leadership style demonstrated a diminished focus on instituting far-reaching, sustainable and systematic shifts. The data underscores that these leaders placed comparatively less emphasis on orchestrating comprehensive changes at the whole-school level, instead directing their attention toward individual teachers, suggesting a more cautious approach to transformation.

Overall, these findings highlight the varying leadership styles among school principals, with some adopting a predominantly transformational approach, while others exhibit a mixed leadership style combining transactional and transformational elements. The latter group's perspective appears to be more confined to individual classrooms and subgroup-level changes, suggesting a limited recognition of the potential for deeper learning to drive comprehensive school transformation.

Exploring leadership dynamics in deeper learning

The study then utilized the findings obtained from the survey data as a foundation for conducting semi-structured expert interviews with five leaders characterized as "transformational" to gain a more profound understanding of the kind of leadership required to scale and disseminate deeper learning within and across schools. These interviews provided valuable qualitative evidence to examine the initiation and shaping of the transformation process towards deeper learning.

Initiating a transformation process toward deeper learning

The principals highlighted the importance of creating conducive conditions for deeper learning by empowering teachers and utilizing their power and authority to effect top-down changes. One principal metaphorically described their role as creating a "greenhouse" for the flourishing of educational initiatives: "Ultimately, as a principal, you create some kind of greenhouse so that the plants can flourish. That would be my metaphor. A mixture of top-down and bottom-up development". The quote emphasizes the principal's role as a nurturing and protective facilitator of educational growth, creating a controlled environment where deeper learning ideas, akin to delicate plants, can develop and flourish under the principal's guidance and support.

Moreover, the principals acknowledged the need to find an appropriate pace of development and embrace an evolutionary transition to avoid overstraining the system. They recognized that abrupt disruptions were not feasible and that sustainable transformation requires time. As one principal stated, "I think it's very important to find one's own pace so that one doesn't overstrain oneself because ultimately we have no chance of creating a rupture, but rather we have to find an evolutionary transition". The metaphor of the "greenhouse" aligns with the concept of an "evolutionary transition" by emphasizing a controlled and nurturing environment for growth. Both concepts reflect an understanding that sustainable progress requires careful cultivation, protection and adjustment, allowing innovations to mature and thrive in a controlled manner, much like plants in a greenhouse. Just as a greenhouse shields plants from sudden shocks, the evolutionary transition approach shields the educational system from abrupt disruptions, ensuring a smoother and more sustainable shift towards deeper learning practices. In essence, these school leaders advocate for leadership practices that demonstrate a delicate interplay of empowerment, collaboration and measured progress.

Fostering collaborative structures
Establishing collaborative structures within and across school subjects was unanimously identified as essential for the sustainable implementation of deeper learning. One principal expressed this viewpoint, stating, "To start the implementation process, most important are the establishment of team and cooperation structures across the school". Another principal underscored the importance of forming teams that amalgamate diverse subject expertise among teachers: "I believe organizational development prerequisites at the level of cross-subject teams are essential. That's what you really need because otherwise, you can't develop the projects in a meaningful way". Cross-subject teams are thus seen as essential for deeper learning, as they facilitate interdisciplinary collaboration, enabling a holistic approach that enhances project development and nurtures comprehensive understanding among students.

Adjusting assessment practices and regulations
The principals additionally emphasized the necessity of purposefully shifting assessment practices and the associated legal regulations to align with the principles of deeper learning, highlighting a disparity between existing assessment methods and the tenets of this pedagogy. They acknowledged the need for policy-level interventions to modify the foundational legal framework governing assessments, a task that extends beyond their direct influence. This viewpoint is encapsulated by one principal's statement: "Current testing formats employed in schools essentially undermine the core principles of deeper learning." Recognizing that policy-level adjustments in assessment regulations hold the potential to enhance the congruence between assessments and deeper learning principles, the principals conveyed an awareness of the broader systemic changes required for effective implementation.

Reimagining time and space in schools
Regarding the utilization of time and space within their schools, the principals considered more fundamental changes to be of secondary importance during the initial stages of the transformation process, with intentions to address them at a later point. They were of the view that by making better use of already existing structures, ample opportunities could be created to cultivate meaningful student learning experiences. Addressing the aspect of time, one principal remarked, "While eventually we may adjust our lesson timings, we can commence by leveraging our current 90-min lessons." In terms of spatial adaptations, another principal commented, "While having a dedicated maker space is advantageous, classrooms and technology rooms within our current structures offer ample resources." Recognizing potential limitations within the existing school infrastructure, the principals underscored the significance of creative resource utilization and careful planning.

Navigating the broad impacts of deeper learning
As they envisioned a more systematic transformation encompassing all aspects of the "grammar of schooling" (Tyack and Tobin, 1994; Hubbard and Datnow, 2020) through the lens of deeper learning as a long-term objective, principals recognized the need for a gradual process within each individual school. They remained steadfast in their belief that the integration of deeper learning principles would inevitably influence every aspect of schooling. Stressing the importance of enduring changes across multiple domains to achieve comprehensive transformation, one principal articulated this perspective, stating, "I firmly believe that the process of implementing deeper learning touches upon ALL school structures and resources. It encompasses staff development, time allocation, spatial utilization, equipment provisioning and ultimately pertains to every operational facet, particularly

educational outcomes, assessment practices and curricula. These changes must unfold in a sustainable manner, in my opinion."

In simple terms, the insights from these principals reveal the many changes needed to make deeper learning a core part of education, touching every aspect of how schools function. The data show that the transformation is complex, and they highlight the strong leadership commitment needed to facilitate a substantial and enduring shift toward deeper learning principles.

Facilitating transformation by means of tailored leadership strategies

To facilitate the process of transformation, principals cited a range of tailored leadership strategies they utilized within their unique school environments. These approaches encompassed the establishment of shared visions, exemplifying change, curriculum design, stakeholder engagement, cultivation of professional growth, enabling experimentation, network formation and the creation of supportive atmospheres. One principal described his leadership strategies this way: "For me, the key concept would be agile transformation management. At the operational level, this translates to adopting the motto 'I do it my way'." In this context, "agile transformation management" refers to a method of guiding change and innovation with flexibility and adaptability. It entails swiftly navigating evolving situations, adjusting strategies as necessary and utilizing personalized approaches that address the needs and contexts of various stakeholders. In essence, this concept recognizes that successful integration of deeper learning principles demands a dynamic and highly adaptive leadership style.

Cultivating effective communication practices for change

Leadership practices that fostered sharing and communication were identified as crucial for the change process towards deeper learning. Principals emphasized the importance of increasing acceptance and understanding of the new pedagogy, negotiating shared visions around it and engaging different stakeholders in the transformation process. They recognized the need for open communication and information dissemination at all levels to gain acceptance for deeper learning principles and mobilize collective efficacy. As one principal stated, "Communication and information must be provided at all levels in order to achieve acceptance, but ultimately also to bring along all energies". Another principal emphasized the strategy of establishing forums for discussions and exchanges among students, parents and teachers, aimed at jointly envisioning learning in the 21st century and facilitating the collaborative development of a meaningful and effective deeper learning framework tailored to our complex era.

Nurturing professional growth

Regarding professional development, principals primarily concentrated on modeling the desired change, cultivating avenues for professional growth and fostering experimentation. They underscored the significance of school-based training, teacher collaboration and soliciting external expertise to nurture professional learning. One principal stressed the necessity for enhanced group-based exchange formats and experimentation, stating, "There's a need for more in-house training, and I would aim to create groups to establish an exchange format, enabling individuals to experiment and engage in discussions." Additionally, another principal highlighted the approach of collectively sending teachers to training courses to enhance collective professional development. Robust professional development becomes even more pertinent when we consider that today's teachers were once students themselves, experiencing a significantly different approach to learning in schools. Recognizing this generational gap, a crucial objective is to empower educators with the tools

to seamlessly bridge the divide between their personal learning experiences and the emerging landscape of schooling. This readiness ensures that they can adeptly guide their students toward deeper learning, even if they themselves did not undergo schooling based on the principles of deeper learning.

Pushing boundaries: experimentation for transformation

One principal underscored the importance of pushing the limits of established systems and adopting a flexible interpretation of legal regulations to foster experimentation and to exploit the full potential of the transformation process. They noted, "Embracing a culture of error-tolerance and the audacity to experiment may even entail a touch of audacious rule-breaking – a willingness to venture into uncharted territory – all in the pursuit of unlocking the process's complete potential." This approach recognizes that traditional norms and regulations might limit the full exploration of deeper learning principles. By embracing a certain level of calculated rule-breaking, the principal aims to empower educators to think creatively, challenge conventional norms and fully exploit the potential of the transformation process to achieve deeper and more impactful changes towards deeper learning.

Revamping curriculum design

Redesigning the school curriculum was viewed as a promising pathway for implementing deeper learning. Principals recognized the need to break down the curriculum and focus on specific age groups and diverse student learning needs, ensuring that structured teaching and suitable rubrics supported the goals of deeper learning. As one principal explained, "We decided to redesign the school curriculum. Collectively, we broke it down to focus on the different grade levels. We had to do this because we need rubrics to structure our teaching". The emphasis on redesigning the curriculum stems from recognition of the critical role that curriculum plays in shaping the educational experience and facilitating the effective integration of deeper learning principles. By redesigning the curriculum, schools might be better positioned to align instructional content, deeper learning principles and methodologies and assessment strategies with the developmental needs and capacities of students at each stage of their education. This focused approach might enable educators to craft more targeted and engaging learning experiences and to create more cohesive and purposeful educational journeys for students to thrive in complex, real-world contexts.

Promoting and sustaining deeper learning transformation in schools

In conclusion, the qualitative evidence from the expert interviews supports the rationale that collaborative structures, changes in assessment practices and leadership strategies are essential for the initiation and transformation process toward deeper learning. The principals emphasized the importance of creating conducive conditions, establishing collaborative structures, reconsidering assessment practices and employing a range of other transformational leadership strategies tailored to the specific school context. By empowering teachers, encouraging stakeholder involvement, fostering professional capacity building and leading and modeling change, principals played a critical role in shaping the perception and implementation of deeper learning. These findings aim to contribute to a more comprehensive and analytical understanding of the strategies and approaches necessary to promote and sustain the transformation of schools towards deeper learning.

Limitations and future research

This study has a limitation that warrants consideration. The sample size was relatively small, which may restrict the transferability of the findings. Future studies would greatly benefit

from a larger and more diverse sample, particularly as deeper learning initiatives continue to scale and involve a broader range of teachers and principals. Such an approach would strengthen the evidence base and enhance the transferability of the study's findings.

Moreover, to deepen our understanding of transformational leadership in relation to deeper learning, and to explore the challenges and barriers encountered by school principals during the implementation process, a longitudinal study with multiple measurement times would be highly valuable. This approach would provide insights into the dynamics of transformational leadership over time and allow for a comprehensive analysis of implementing deeper learning. By investigating the long-term effects and contextual factors influencing leadership for deeper learning practices, future research can make significant contributions to advancing the field of leadership for school transformation.

Summary: the power of transformational leadership in advancing deeper learning

The findings of the study highlight the close alignment between transformational leadership practices and the implementation of deeper learning (Richardson *et al.*, 2021). Notably, none of the school leaders examined in this study perceived themselves as merely transactional leaders. We found that the school principals viewed themselves predominantly as transformational leaders. They recognize the critical role of leadership in challenging traditional notions of schooling, navigating the shift to new educational approaches and sustaining change over time (Hubbard and Datnow, 2020). They actively promote the educational rationale of deeper learning and regard it as a timely and overdue process of change (Hubbard and Datnow, 2020). This finding is not surprising, considering the typical mindsets and attitudes of innovators and early adopters (Cuban, 2020; Hubbard and Datnow, 2020).

These transformational leaders engage in systemic analysis, addressing "cultural" barriers such as teacher attitudes toward collaborative professionalism and "structural" obstacles, including curriculum, assessment regulations and the use of time and space in schools. However, their responses and doubts suggest that achieving broader implementation and scaling of deeper learning will require significant reculturing and restructuring of contextual factors within the education system (Fullan, 2015). It is essential to gradually incorporate these changes into the school structure and involve teachers and administrators in their pursuit. Some surveyed and interviewed leaders suggest that school leaders alone cannot bring about the transformation; their efforts must be supplemented with significant policy initiatives that address the entire rationale and culture of learning (Fullan, 2020).

While the implementation of deeper learning is still in its early stages and lacks widespread adoption, the study emphasizes the need for skilled leadership practice to disrupt the traditional grammar of schooling (Tyack and Tobin, 1994; Hubbard and Datnow, 2020). The findings suggest that only leaders with a clearly transformational leadership style, who consider systemic factors, are likely to have the foresight necessary to drive this change. If their assessment proves correct that deeper learning cannot become a "normal" part of 21st-century schooling through isolated changes in classrooms, the consequences are significant: For a wider scaling of deeper learning practices in schools, policymakers would have to prioritize recruiting more transformational leaders into formal leadership positions and reforming leadership training programs to emphasize and train for transformational leadership (Hubbard and Datnow, 2020). These actions might be essential prerequisites for the broader dissemination of deeper learning across entire schools and throughout the education system.

In conclusion, empowering and investing in transformational school leaders who adopt a whole-school approach, challenge both cultural barriers – such as many teachers still being "lone fighters" – as well as structural barriers resulting from curriculum and assessment regulations and are supported by major policy initiatives, holds great potential for scaling

deeper learning within and across schools (Darling-Hammond and Oakes, 2019; Fullan and Langworthy, 2014; Mintrop *et al.*, 2022; Watkins *et al.*, 2018).

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