

Teachers' positioning in the early stages of STEAM-based school reform

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This qualitative case study in Finland examined how teachers position themselves toward STEAM education during the early stages of a whole-school reform. Data was collected from primary and secondary subject teachers (N=30) using a questionnaire with open-ended questions and SWOT matrices. Through content analysis with a positioning lens and triangulated themes, we identified five narrative positions: resource-critical realists, cautious reflectors, support-seeking beginners, collaborative enablers, and developer-innovators. Teachers may adopt overlapping positioning when they negotiate their agency and ownership towards the STEAM education approach in their school. Teachers valued STEAM's potential for student engagement, transdisciplinary learning, and strengthening the school's brand and profile, but highlighted time, material resources, suitable spaces, and curriculum or assessment alignment as key constraints. Participants without prior experience requested low-threshold entry, concrete models, and mentoring, while experienced teachers emphasised peer support, leadership recognition, and opportunities to co-design and scale practices. Findings suggest that successful STEAM reform in schools requires bottom-up acknowledgment, strategic leadership, reserved time for co-planning, and scaffolded professional development that builds a shared vision. We conclude that reforms should deliberately recognise and accommodate all positions, using them to facilitate support and pathways from STEAM's potential to everyday practice.

Keywords: STEAM, in-service teacher, positioning, schools, reform

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1 Introduction

The integration of science, technology, engineering, arts, and mathematics (STEAM) education into school systems continues to draw growing interest worldwide. One core challenge is how to make STEAM education meaningful, motivating, and relevant not only for students but also for teachers in a rapidly changing society (Belbase et al., 2022). In this context, STEAM is increasingly seen as a way to support students' development of transversal skills (e.g., creativity, collaboration, and problem-solving) while helping them understand the wide range of future study and career possibilities in STEAM fields. However, implementing STEAM in practice requires significant changes and professional



development at the school and teacher levels, involving pedagogical transformation and new forms of collaboration (Conradty & Bogner, 2020). This study is situated within the Finnish educational context, characterised by strong teacher professionalism and trust, and where large-scale school reforms are rare. National curriculum reforms are conducted approximately every decade, though the last reform was in 2014 (Finnish National Agency for Education, 2016). The national curriculum is complemented with national strategies and priorities such as the STEM Strategy and Action Plan (Ministry of Education and Culture, 2023). Individual school reforms are very rare in Finland, where the core educational philosophies are research-based and school cultures centralized, though much autonomy is left to municipality, school and teacher levels on how to interpret and implement the curriculum. However, reforms do not rely solely on top-down implementation; rather, its success depends on teachers' agency, ownership, and opportunities to meaningfully participate in designing and enacting change (Datnow, 2020).

Research indicates that successful and lasting innovations depend not just on what is taught, but how teachers are involved in designing, enacting, and sustaining change (Pieters et al., 2019). Teachers must navigate the demands of curricula, available support, their beliefs about learning and instruction, and the meaning or value of pedagogical innovations, such as STEAM. When implementing new practices, teachers are not passive recipients of top-down reforms; rather, their sense of ownership and agency are critical in determining the outcomes and means of carrying out the reform (Biesta et al., 2015; Poulton, 2020). Moreover, teachers' sense of agency is also closely connected to their perceived capacity to participate in school development work (Reinius et al., 2024). Top-down reforms tend to face pushback, particularly in educational cultures with strong teacher autonomy such as Finland (Toom et al., 2021). When new curricula or programs are imposed without considering teachers' expertise, experience, and professional perspectives, implementation can falter or result in mere surface compliance or brand-talk (Gouëdard et al., 2020). Conversely, approaches that explicitly encourage teacher participation in curriculum co-design, collaborative inquiry, and peer learning enhance ownership, agency, and support deeper change (Drew et al., 2016; Voogt et al., 2015). STEAM education includes issues related to the nature of integration, teacher readiness, institutional constraints, and classroom-level implementation (Belbase et al., 2022), while recent reviews also highlight the need for clearer guidance on curriculum integration and assessment (Yim et al., 2025).

On these grounds, the present study aims to explore Finnish teachers' experiences and perceived challenges, as well as the opportunities associated with a school-wide educational reform focused on developing the school's STEAM pedagogy. While teachers' attitudes and aptitudes towards school reforms have been studied before, this study concentrates on the early stages of a specific pedagogical initiative that seeks to integrate STEAM approaches across all grade levels and subject areas. The research is part of a continuing research-practice partnership between the participating school and the

authors of this paper that supports the school's STEAM-related pedagogical development and provides empirical insights into the dynamics of a sustained pedagogical reform.

1.1 Teacher Agency and Ownership in Educational Reform

School curriculum reform is understood as a socially situated and negotiated process rather than a linear implementation of externally defined goals. Research on educational change consistently shows that reforms succeed or fail largely through how teachers engage with, interpret, and enact them in practice (Datnow, 2020). In this context, teacher agency and ownership function as key dynamic mechanisms through which curriculum reforms are translated from policy or strategy into everyday pedagogical practice.

Agency has been conceptualised in multiple ways, ranging from an individual capacity to a variable shaped by social structures and approaches that understand agency as a result of personal, social, and material interaction dynamics (Cathcart et al., 2026). This study aligns with a perspective in which agency can be achieved and realised through active engagement with one's context, rather than residing solely within individuals (Biesta & Tedder, 2007). In the educational context, agency refers to how teachers act purposefully and constructively direct their professional growth and teaching-learning environments (Lipponen & Kumpulainen, 2011). Moreover, agency extends beyond individual autonomy: it involves teachers' ability and professional discretion to make informed choices, reflect on and revise their practices, and collectively shape instructional methods in response to student needs, policy, school, and societal change (Allen & Penuel, 2015; Biesta et al., 2015; Eteläpelto et al., 2013; Konopasky & Sheridan, 2016). A strong sense of agency toward the pedagogical innovation is indicated when successes and setbacks are interpreted by teachers as arising from their own actions rather than linked to external factors (Marshall & Drummond, 2006).

Ownership complements agency by describing the subjective sense of commitment, identification, and investment teachers experience towards new practices or innovations. When teachers feel that an initiative is "theirs"—not just administratively required—they are more willing to dedicate effort, adapt ideas to local needs, and collaboratively develop practices that yield sustainable results (Ketelaar et al., 2012). Ownership evolves through participation, voice in decision-making, opportunities for co-construction, and recognition of teachers' existing knowledge (Breiting, 2008; Pierce et al., 2001).

A lack of agency and ownership can manifest as resistance, minimal compliance, or burnout, particularly when change is rapid, poorly resourced, or supported (Schleicher, 2018). Conversely, meaningful engagement in the design and implementation of the renewal reinforces teachers' professional identity and supports a deeper commitment to renewal. For example, professional learning communities that focus on peer-driven inquiry, coaching, or action research promote agency and collective sense-making (Vangrieken et al., 2017).

School context, collegial support, and leadership practice all interplay in shaping agency and ownership (Stevenson et al., 2016). Distributed leadership, flexibility in

organising working time, and opportunities for co-design across curricular boundaries bolster teachers' will and ability to adapt to new pedagogical approaches, such as STEAM (Cook et al., 2025). Recognising and developing teachers' existing practices and expertise, rather than replacing them, is key, especially when implementing complex, interdisciplinary models.

Agency and ownership are not static traits but develop as part of professional development and learning trajectories (C. Day & Gu, 2010; Toom et al., 2021). Teachers may experience varying degrees of autonomy and involvement depending on the stage of reform, existing school culture, or personal motivation (Datnow, 2020). Innovation diffusion is thus inseparably linked to the quality of teacher engagement, opportunities for reflective practice, and support for bottom-up, context-sensitive solutions. In addition, recognising potential barriers (e.g., resource gaps, time constraints, lack of shared vision) and supporting collaborative, context-sensitive design processes increase the likelihood of meaningful and sustainable reforms (Gouédard et al., 2020).

1.2 STEAM Education reform

STEAM education (Science, Technology, Engineering, Arts and Mathematics) extends the STEM framework by explicitly emphasising creativity, design thinking, interdisciplinarity, and real-world problem-solving (e.g., Henriksen, 2014; Quigley et al., 2017). The "A" in STEAM represents approaches that value the arts as sources of innovation and meaning making, as well as the broadening of learning outcomes beyond theoretical proficiency to include creativity, critical thinking, and collaboration (Yakman & Lee, 2012).

The rationale for STEAM education is often viewed as twofold. First, to respond to labour market needs and prepare students for complex, unpredictable futures that require creative and innovative solutions. Second, to make science and technology learning more engaging, equitable, and accessible for all students (Kim et al., 2024). Moreover, to an increasing extent, the integration and contribution of the arts in STEAM are viewed not only as a means of supporting traditional STEM disciplines but also as sources of distinct art-based epistemologies and outcomes (Graham, 2025; Perignat & Katz-Buonincontro, 2019). At the same time, STEAM has evolved into a diverse and expanding field encompassing multiple interpretations, implementation models, and complementary educational approaches. Despite their conceptual differences, these approaches broadly share an emphasis on interdisciplinary learning, authentic real-world problems, creativity, collaboration, and the development of future-oriented competencies. Although its real-life applications vary considerably, STEAM has been associated with increased student motivation, deeper conceptual understanding, positive attitudes towards science, and broader participation, especially for groups underrepresented in traditional STEM disciplines (Kang, 2019; Liao, 2016). Furthermore, integrative STEAM learning builds on authentic projects and contexts that cut across subject boundaries, connecting school content to students' everyday lives (Herro & Quigley, 2017).

Despite continuing interest in STEAM education, its integration in practice remains fraught with challenges. Harris and De Bruin (2018) highlight that teachers often lack experience or confidence in interdisciplinary planning, particularly when their professional background is rooted in traditional, subject-specific instruction. Schools may also face limitations in resources, access to suitable learning environments, and time allocated to collaborative planning (Belbase et al., 2022; Hughes et al., 2022). Moreover, implementation exposes tensions between curricula, assessment practices, and the sustainability of the educational innovation (Thomas & Huffman, 2020). Teachers may also find it difficult to balance creativity, technical skill development, and curriculum requirements within integrative project work (Belbase et al., 2022).

Recent research in STEAM professional development highlights that effective programs recognise and build on teachers' existing expertise, provide hands-on and collaborative learning experiences, and situate change within authentic school contexts (Conradty & Bogner, 2020). Peer- or expert-facilitated co-design has been identified as a successful approach for increasing pedagogical competence and perceived ownership (Milara et al., 2020). Moreover, school leadership and external partnerships (e.g., with universities or industry) are recognised as important facets, often providing the contextualisation, support, and resources needed for deeper learning (Cook et al., 2025; Kang, 2019).

Kim and Na (2022) found that teachers' confidence and openness to educational change emerge as critical strategies for fostering positive attitudes toward STEAM, while collaboration and expertise development serve as supportive, indirect pathways. This summarises the theoretical perspective adopted in this study; collaboration, professional learning, and expertise development do not function as isolated drivers of reform but as enabling conditions that cultivate agency and ownership over time. Moreover, sustainable curriculum change depends less on the formal introduction of new structures or content and more on supporting teachers' perceived capacity to act, their sense of influence in reform processes, and their willingness to commit to pedagogical renewal within their specific school contexts.

International policy frameworks increasingly emphasise future-ready competencies that require teaching approaches that cross traditional subject boundaries (European Commission, 2020; OECD, 2018). In Finland, these directions align with the National Core Curriculum, which foregrounds broad-based competences and multidisciplinary learning, and in the STEM Strategy and Action Plan (Ministry of Education and Culture, 2023). However, subject-based education struggles to meet such demands, as structures hinder collaboration and real-world application. This policy-practice gap has raised interest in STEAM in Finland, as research on STEAM education highlights its capacity to merge creativity with disciplinary depth, offering a pedagogically coherent response to these expectations. Finland's strong teacher autonomy, professional trust, and well-established learning environments offer solid opportunities to implement STEAM reforms in ways that are context-sensitive, sustainable, and educator-driven (Finnish National Agency for Education, 2016; Toom et al., 2021).

2. Methodology

2.1 Research design and research question

This study applied a qualitative case study approach (Yin, 2018) to explore teachers' perspectives on experiences, challenges, and opportunities associated with a STEAM-focused school reform in a Finnish school. The case comprised a school-wide STEAM reform situated within a specific organisational, curricular, and leadership context. A case study approach was considered appropriate because the aim was to develop an in-depth cross-sectional understanding of teachers' positioning within a naturally occurring school reform situated in a bounded educational context (Merriam & Tisdell, 2016). The study extended beyond describing teachers' views of STEAM by examining how perspectives were constructed, negotiated, and justified in relation to opportunities, constraints, responsibilities, participation, and future development within the reform process. The focus was on context-sensitive insights into the organising, planning, implementation, suitability, and sustainability of STEAM practices within the early stages of a school-wide reform and an adjacent research-practice partnership. The following research question guided the study:

- What kinds of positions emerge through teachers' self-reported perspectives on the early stages of STEAM-based school reform?

2.2 Context, Data Collection, and Participants

The study was conducted in a private, K–12 school operating across three cities in Finland. Although privately governed, the school follows the Finnish national core curriculum while fostering bilingualism and biculturalism as central elements of its educational practices. At the time of the study, the school had initiated early development of its whole-school reform to integrate STEAM pedagogy across all subjects and grade levels, with strong support from the school's leadership. At the time of data collection, the school had formally decided to adopt STEAM as a strategic pedagogical development focus. The reform was in its initial implementation phase, characterised by teacher consultations, vision building, professional development planning, and exploration of possible STEAM practices across grade levels and subjects. School-wide STEAM structures, routines, and practices had not yet become established, making the reform particularly suitable for examining teachers' initial reactions, expectations, concerns, and perceived support needs. The reform work was carried out in collaboration with a research group specialising in STEAM and teacher education. Overall, the initiative strongly aligned with the national-level STEM Strategy and Action Plan (Ministry of Education and Culture, 2023), which aims to strengthen competencies in natural sciences, mathematics, and technology at all levels of education.

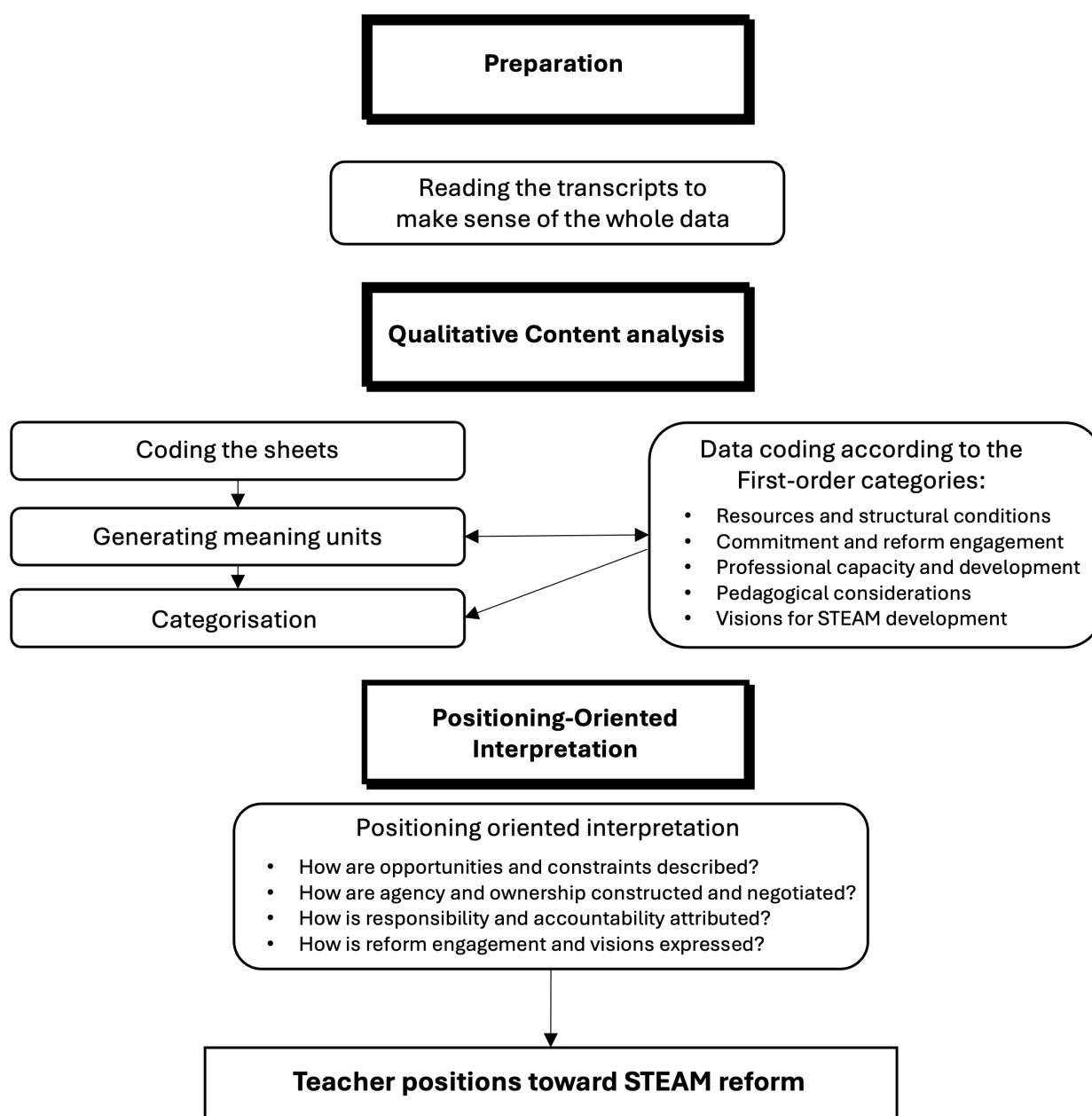
The data was collected through an electronic questionnaire distributed to the teaching staff of the participating schools in March 2024. The questionnaire included both

structured items and open-ended questions. While structured items were collected to support the school's internal development work and provide contextual information regarding teachers' experiences, they were not included in the present analysis. The focus of this study was exclusively on teachers' responses to six open-ended questions. The open-ended questions invited teachers to narrate and reflect on (1) perceived strengths, weaknesses, and limitations related to STEAM implementation at both personal and school levels, (2) opportunities and threats associated with STEAM integration, (3) future visions for the school's STEAM education, and (4) desired forms of collaboration within and outside school. The average response lengths varied between 40 to 357 words.

The participant group represented a broad cross-section of the school's teaching staff across the entire K–12 continuum. Class teachers worked with learners approximately aged 6–13 years, and subject teachers in lower secondary, and upper secondary education with learners aged 14–19 years. As participation included most of the school's teaching staff, subject areas represented within the dataset reflected the full breadth of the Finnish curriculum, including national languages (Finnish and Swedish) and literature, foreign languages, mathematics, environmental studies, biology, geography, physics, chemistry, history, social studies, religion and ethics, music, visual arts, crafts, physical education, health education, and home economics. This breadth was considered particularly relevant in the context of a whole-school STEAM reform, as the initiative sought to engage teachers across disciplinary traditions rather than focusing on some subjects. Completed responses (n=30) were collected from class teachers (n=8), subject teachers (n=19), teachers with dual roles as class and subject teachers (n=4), and special education teachers (n=1), ensuring representation across grade levels and roles. In the Finnish education system, class teachers typically teach all or most of the subjects in primary grades (years 1–6), whereas subject teachers specialise in particular subjects and mainly teach in lower and upper secondary education. Special education teachers provide pedagogical support for learners with diverse educational needs. These professional roles differ in terms of pedagogical responsibilities, curriculum organisation, and opportunities for interdisciplinary collaboration, which may influence how teachers perceive and engage with educational reforms.

2.3 Data Analysis

Data analysis was conducted iteratively and combined inductive qualitative content analysis with a positioning-oriented interpretive reading (Figure 1). After transcribing the teachers' questionnaire responses, two authors undertook first-level coding of the open-ended answers. Coding focused on identifying recurring meaning units and grouping them into emergent categories. Through comparison and discussion, the two coders refined category boundaries and resolved discrepancies by returning to the original responses until a shared interpretation was reached.

Figure 1. Data analysis phases.

The first phase of analysis produced five first-order categories describing different dimensions of teachers' relationship to STEAM reform. The categories captured how teachers discussed resources and structural conditions, their commitment and reform engagement, professional capacity and development, pedagogical considerations, and visions for STEAM development. Together, these categories reflected the opportunities, constraints, responsibilities, and future possibilities through which teachers negotiated agency, ownership, and participation in the reform process. Rather than constituting the final findings, the categories served as descriptive analytical tools that informed the construction of narrative positions. Table 1 illustrates the analytical trajectory through which first-order categories informed the development of narrative positions.

Table 1. Example of data analysis and contribution to final narrative position of Resource-critical realist.

First-order category	Illustrative meaning unit(s)	Positioning interpretation	Contributing to final narrative position
Resources and structural conditions	Teachers do not have enough time for joint planning.; Lack of materials/equipment.	Teachers locate barriers primarily in organisational and material conditions rather than in lack of willingness or their proficiency	<i>"This position emphasises barriers such as lack of facilities, materials, and planning time..."</i>
Commitment and reform engagement	There should be a long-term commitment to implementing this.	Teachers question whether reform efforts can be sustained over time and resist short-lived initiatives.	<i>"...and is concerned that limited resources and structural constraints hinder STEAM development."</i>
Professional capacity and development	Does not really know very much about STEAM education yet.	Teachers position themselves as requiring additional expertise and support before taking ownership of STEAM implementation.	<i>"...express concern that meaningful educational development requires sufficient expertise and support."</i>
Pedagogical considerations	STEAM should not be implemented for the sake of STEAM itself; A STEAM project may take an unreasonable amount of time away from subject-specific content.	Teachers position themselves as pedagogically responsible professionals whose primary concern is educational quality.	<i>"Realist often highlight risks that such initiatives may remain superficial or reduce the time available for core teaching and learning."</i>
Visions for STEAM development	STEAM would be a natural part of teaching and have adequate resources.	Teachers support STEAM's long-term potential when implemented under appropriate conditions.	

To interpret how teachers constructed their relationship to the reform beyond topical themes, the analysis was subsequently informed by a positioning lens (Day & Kjaerbeck, 2013). In line with (LaPointe, 2010) positioning was treated as a narrative process through which respondents described and made sense of their current situation in relation to school-level STEAM integration. Positioning was further approached as a discursive process through which teachers negotiated, accepted, and resisted roles (Davies & Harré, 1990). One author conducted this interpretive narrative analysis by examining how the coded categories were articulated in teachers' narratives, for example how constraints and opportunities were located, how responsibility was attributed, and how agency and ownership were expressed (Deppermann, 2013). On this basis, the author drafted descriptive narrative positions. Rather than emerging directly from individual responses, narrative positions were developed through examining recurring combinations, emphases, and relationships among the coded categories. For example, narratives of resource constraints and implementation challenges were mostly interpreted within the

resource-critical realist position, whereas narrative parts emphasising collaboration and collective development contributed to the collaborative enabler position.

The preliminary set of narrative positions, their defining features, and supporting data extracts were then discussed within the author team. Three authors reviewed the draft position descriptions, focusing particularly on the boundaries and overlap between positions, the adequacy of the labels in capturing teachers' orientations, and the fit between interpretations and the data. Revisions were made until agreement was reached regarding the final set and naming of positions. The resulting five narrative positions—resource-critical realist, cautious reflector, support-seeking beginner, collaborative enabler, and developer-innovator—are presented as interpretive orientations that may co-occur within a teacher's responses depending on the aspect of reform being addressed; accordingly, the prevalence of positions was not quantified or identified back to individual participants. Finally, illustrative quotations were selected to demonstrate how each position was grounded in teachers' accounts and to provide transparency regarding the link between the data and the analytical interpretations

2.4 Ethical Considerations

The study was conducted in accordance with the ethical guidelines of the University of Eastern Finland and the Finnish National Board on Research Integrity. Participation was voluntary, responses were collected anonymously, and no identifying information was included in the reporting. Respondents were informed that the data may be used for development and research at the school, and they gave their consent by answering the questionnaire. Because some professional categories were represented by very small numbers of participants, quotations were selected carefully and reporting focused on narrative positions rather than individual trajectories. In the school, all professional roles had more than one person employed, though in some cases only one participated in the research. Professional role identifiers were retained only when considered necessary for interpretation, and no additional identifying information (e.g., subject taught, grade level, school location, age, or years of experience) was reported in findings. In addition, at the early stages of school reform, it was important not to try to fix different positions back to teachers. Some positions might be more negative-oriented than the others and putting a mark on some teachers might have unwanted effects on the reform.

3. Findings

We identified five narrative positions that emerged through our analysis: *Resource-critical realist*, *Cautious reflector*, *Support-seeking beginner*, *Collaborative enabler* and *Developer-innovator* (Figure 2).

Figure 2. Teacher positions in early-stage STEAM school reform.

These positions should not be read as fixed teacher profiles or tied to individual participants. Positions were treated as interpretive narrative orientations rather than mutually exclusive participant categories. Individual teachers often expressed multiple positions. Rather, they render visible a set of varying perspectives and overall orientations that appeared in relation to different aspects and contextual conditions of the studied school reform. As such, an individual teacher could adopt different positions depending on the issue at hand; thus, the prevalence of each position has not been quantified. Taken together, the positions outline a spectrum of orientations towards a STEAM-based school reform. The positions are presented as a set of related narratives that highlight different ways teachers negotiated agency, ownership, and reform-related conditions (Table 2). The ordering does not imply linear progression but serves as an analytical approach that illustrates how different structural conditions, professional experience, and support mechanisms shape teachers' engagement during the early stages of school reform. It is important to note that early scepticism or caution is not resistance, and confidence and innovation are outcomes of support, collaboration, and time. In addition, the quotations were selected because they exemplified the dominant narrative logic associated with a

particular position, although individual extracts could potentially partly resonate with more than one position.

Table 2. Teachers’ positions toward STEAM reform implementation.

Position	Narrative
Resource-critical realist	This position emphasises barriers such as a lack of facilities, materials, and planning time, and is concerned that limited resources and structural constraints hinder STEAM development. Realist often highlights risks that such initiatives may remain superficial or reduce the time available for core teaching and learning.
Cautious reflector	A cautious reflector sees opportunities and risks in STEAM pedagogies through reflecting critically on how projects align with curriculum goals and being aware of initiatives that might disrupt foundational skills or become unsustainable. Cautious reflector calls for systematic integration and careful planning to ensure long-term benefits.
Support-seeking beginner	This position is interested in STEAM but feels uncertain or inexperienced. Clear models, mentoring, practical tools, and external support are needed to get the beginner started. Support-seeking beginner is open to learning but needs low-threshold pathways and concrete guidance to strengthen confidence and agency in STEAM teaching.
Collaborative enabler	This position focuses on the importance of collegial collaboration and the sharing of expertise. Collaborative enabler values teamwork, flexible ways of working, and the integration of multiple subjects. According to the position, believing in a strong, supportive community and co-creation processes are the keys to successful STEAM implementation.
Developer-innovator	This position approaches STEAM with enthusiasm and openness, recognising that many of its elements are already present in their current teaching practice. Developer-innovators see STEAM as a natural continuation of pedagogical development, are willing to try new pedagogical approaches, and believe in the benefits of innovation for students and the school’s reputation.

3.1 Resource-critical realist

Resource-critical realists show a broader perspective on pedagogical trends. They tend to perceive STEAM education as introducing specific resource-related challenges and express concern that they may compromise meaningful educational development work. The following data excerpt describing a teacher’s biggest concerns regarding implementing STEAM in their own teaching illustrates this:

“The lack of devices and tools, busy schedules, lack of enthusiasm on the teachers’ part...Staffing resources are an area of concern (both for planning and implementation), as well as whether the tools and materials are sufficient for the work to be meaningful.” (Classroom teacher)

Furthermore, resource-critical realists argue that novel educational initiatives often fail to progress beyond trivial tinkering when desired equipment or materials are unavailable. They emphasise that the most pressing challenge is securing sufficient time for collaborative planning and ensuring that STEAM projects do not risk diminishing the time allocated to core teaching activities. The following participant comment captures an example of these concerns:

“One threat is that if there isn’t enough energy or time to plan STEAM activities properly, these projects may end up being of no use to anyone, merely consuming valuable time that could otherwise be devoted to learning basic skills and knowledge.” (Special education teacher)

On these grounds, resource-critical realists emphasise that for STEAM initiatives to be successfully implemented, adequate resources and sustained partnerships with other organisations must be secured. This is essential to ensure the work evolves beyond superficial activities or activities carried out merely for their own sake.

3.2 Cautious reflector

Cautious reflectors acknowledge that STEAM integration involves many possibilities and risks, noting that not all projects can be meaningfully connected to curricular objectives. Moreover, they emphasise that overly large endeavours often take time away from learning basic skills.

“The risk is that the core work gets sidetracked by [these] projects. For example, if a student is studying the Middle Ages in history classes, the entire study period cannot be spent building a scale model of a medieval castle. The project needs to be aligned with broader content entities, and the pedagogies need to remain transversal, versatile and high quality.” (Classroom teacher)

Cautious reflectors are also wary of the long-term significance of STEAM initiatives and of whether the excitement is short-lived, especially when they must make difficult choices about how to use the available time and resources.

“We often participate in many things, and while we now begin with enthusiasm, it may be that a year or two from now, we have already forgotten about it and are about to start yet another new thing. So, this should be a long-term commitment.” (Subject teacher)

That said, cautious reflectors also note that when adequately planned, STEAM integration can enhance the versatility of teaching without compromising core learning.

3.3 Support-seeking beginner

Support-seeking beginners show curiosity and motivation to learn more about STEAM approaches and how to integrate them into their teaching. They want to start safe and build their confidence with concrete support.

“I am interested in the possibilities of STEAM pedagogies, but I need concrete guidance and low-threshold support.” (Subject teacher)

Support-seeking beginners feel that getting started requires several small steps and support from colleagues and an outside partner, such as a university.

“For instance, I would need some mentoring to get a good start, for example, guests, online content and material sharing.” (Subject teacher)

Moreover, support-seeking beginners acknowledge that pedagogical guidance and well-functioning practical templates could help make STEAM integration part of the school’s everyday practices, as the following data excerpt illustrates:

“[I would need] guidance in how to put STEAM projects into practice as a part of the school’s everyday practices and help with classroom plans and acquiring devices.” (Subject teacher)

For support-seeking beginners, peer support and concrete examples are essential, especially when integrating STEAM pedagogy with younger learners, where there is a risk that project ideas become overly ambitious and excessively burden everyday school practices.

“[Need for] good ideas how to implement STEAM with younger learners.” (Classroom teacher)

This position represents latent reform potential; when scaffolded through collegial support and external partnerships, support-seeking beginners can gradually strengthen their confidence and commitment to STEAM as part of everyday practice.

3.4 Collaborative enabler

Collaborative enablers acknowledge that a small school community and strong team spirit enable authentic collaboration among colleagues and with external organisations.

“We’ve already carried out similar projects here before, so the way of working feels familiar. Sharing ideas among colleagues works well.” (Classroom teacher)

“There’s a strong sense of team spirit among the teachers.” (Classroom teacher)

Moreover, these teachers view collaboration and knowledge sharing as major assets and note that, in STEAM pedagogy in particular, collegial support is key, as the following remarks about their colleagues and larger school community illustrate:

“Good and versatile STEAM pedagogy should not take resources from the core work (e.g., learning materials).” (Classroom teacher)

“[Our] staff is hard-working and skilled! [...] Teachers are pedagogically creative!” (Classroom teacher)

However, collaborative enablers acknowledge the importance of collaboration with external organisations and therefore hope for closer interaction with, for example, universities. They note that peer support and co-development efforts also encourage students to experiment with new ways of learning.

3.5 Developer-innovator

Developer-innovators are consistently curious about new pedagogical approaches and innovations. Some even acknowledge that they had incorporated STEAM principles or aspects of them before the term “STEAM” was formally introduced, as the following teacher statement reflects:

“I have been implementing STEAM pedagogy in my teaching for 20 years. It just wasn’t called STEAM back then.” (Classroom teacher)

Developer-innovators tend to view the STEAM approach as valuable for its versatility and its capacity to create meaningful, engaging learning tasks for students. They argue that the approach can foster commitment to learning across all age groups and advocate for STEAM to become an authentic, integrated part of everyday schoolwork. They see STEAM as a pathway to teacher and learner interest and motivation. The following excerpt illustrates these perspectives:

“[The ideal would be that] STEAM becomes a natural part of the school’s pedagogical work, with adequate resources to support it, and that it extends beyond classrooms so students and their guardians can use makerspaces after school to create and make things.” (Subject teacher)

Developer–innovators see the advantages of a small and flexible working community, making it easier to cross subject boundaries and experiment with new approaches. They hope teachers’ enthusiasm will also inspire and engage the students.

These identified narrative positions illustrate how teachers make sense of the newly initiated STEAM reform by simultaneously articulating possibilities for pedagogical development and concerns related to school-level conditions. Across positions, teachers generally expressed confidence in their own professional capacity and willingness to engage with STEAM, while locating the most significant constraints at the institutional level (e.g., resourcing, time, organisational structures, and the sustainability of change). Moreover, positions showed that the reform posed more threats at the school level than at the personal level. This was explained through strong professionalism and resilience, as well as concerns about the school’s reputation and care for colleagues. Overall, the

positions agree on STEAM reform as a collective school development process that requires coordinated support, leadership, and shared sense-making rather than individualised solutions.

4 Discussion

The results of this study highlight the complex, multi-layered ways teachers negotiate STEAM education in the early stages of their school reform. At the early stages of reform, teachers express multiple positions and therefore quantifying prevalence would risk oversimplifying the complexity of teachers' meaning-making processes. Similarly, it is not worthwhile to fix positions back to teachers at the early stages of reform when trying to understand a school-level reform. The narrative position analysis revealed orientations ranging from resource constraints to optimistic development, with most teachers negotiating between pragmatism and enthusiasm. These positions demonstrate how teachers' perceived capacity to influence reform processes (agency) and their sense of commitment and identification with STEAM (ownership) are simultaneously constructed and constrained during the early stages of school-level reform. The identified positions correspond well to international findings that agency and ownership are decisive factors for successful and lasting change (Biesta et al., 2015; Cook et al., 2025; Y.-H. Kim & Na, 2022). The narrative positions show, as prior research has suggested (Henriksen, 2014), that when teachers can co-design and further see or imagine the future outcomes of the design, ownership and, thus, the likelihood of sustained practice, increase.

The position labelled "Resource-critical realist" restricts rapid or symbolic implementation but can play an important corrective role in reform processes. By foregrounding material conditions, time, and sustainability, this position showed agency through professional realism, prompting consideration of whether reform ambitions are adequately resourced and strategically aligned. From an ownership perspective, commitment remained conditional, yet such positioning can help prevent superficial adoption of the reform (Biesta & Tedder, 2007; Ketelaar et al., 2012).

For the position of a cautious reflector, agency was constructed as reflective autonomy, expressed through careful evaluation and accommodation of STEAM within curriculum coherence and pedagogical quality. Ownership emerged through selective identification with the reform (Pierce et al., 2001), contingent on its alignment with core educational values rather than enthusiasm alone. In reform terms, this position moderated pace and scope, helping safeguard sustainability and curricular integrity. Such positioning aligns with research emphasising sense-making and professional judgment as central to sustainable reform (Datnow, 2020; C. Day & Gu, 2010).

For the position we labelled "Support-seeking beginner", agency was emerging and dependent on opportunities for learning through early successes (Marshall & Drummond, 2006), guided accommodation, and scaffolding (Ketelaar et al., 2012). Ownership was expressed as a willingness to support STEAM ideas and recognise a need for change, even

though confidence and competence were still developing (Breiting, 2008). When conditions are met, this position represents significant reform potential, as agency and ownership can grow through participation and professional development (Eteläpelto et al., 2013; Toom et al., 2021).

The collaborative enabler constructed agency through shared autonomy and a strong sense of control arising from joint planning and co-design (Allen & Penuel, 2015; Konopasky & Sheridan, 2016). Ownership was experienced as shared, reflected in active support of design processes and sustained collective effort (Breiting, 2008). According to this position, STEAM can become everyday school practices, beyond individual classrooms through co-design, peer support, and collegial professional development (Vangrieken et al., 2017).

Finally, the developer–innovator constructed agency as proactive and expansive, drawing on high autonomy and confidence built through accumulated successes (Allen & Penuel, 2015; Marshall & Drummond, 2006). Ownership was strong, characterised by deep identification with the reform and readiness to invest sustained effort (Pierce et al., 2001). In reform, this position functions as a driving force, pushing STEAM development forward and articulating future-oriented visions when organisational conditions are supportive.

While teachers widely recognised the potential and opportunities of STEAM (e.g., increased student engagement, improved interdisciplinary learning, and the strengthening of the school's image), these were consistently tempered by concerns about resources, time, and sustainability of the educational reform. From an agency perspective, these structural constraints limit teachers' opportunities to meaningfully shape STEAM practices, while from an ownership perspective, they weaken teachers' willingness to fully commit to reform goals perceived as insufficiently supported. For example, resource-critical realists felt pushed down by structural or material realism, while developer–innovators and collaborative enablers promoted more positive values, emphasising collegiality, flexibility, and pedagogical renewal. They did not perceive resource limitations as restricting their vision of the reform. Nonetheless, even the most optimistic positions took resource constraints seriously. Time for shared planning, access to suitable spaces and equipment, and clarity about the strategic integration of STEAM into the curriculum repeatedly emerged as prerequisites for moving from potential to practice. Cautious reflectors highlighted risks that are also well known in other STEAM contexts (Belbase et al., 2022), such as the danger of STEAM projects remaining isolated, being overly labour-intensive, or diverting attention from foundational skills. This reflects on the importance of aligning instructional and pedagogical innovations with school structures and professional identities.

Although professional role differences were not the focus of analysis, it is plausible that class teachers, subject teachers, and special education teachers encounter different opportunities and constraints when engaging in STEAM reform. Professional roles may also shape opportunities for STEAM participation, as class teachers often work across disciplinary boundaries more naturally than subject teachers, while subject teachers may

face stronger curriculum-specific constraints. Future research could examine role-specific experiences and the position shift over time more systematically.

The findings also highlight the mediating role of school-level structures and leadership in shaping teachers' agency and ownership during the early stages of STEAM reform. Teachers' positions suggest that opportunities for participation, co-design, and collective reflection are closely tied to how leadership allocates time, resources, and recognition for STEAM-related work. This aligns with studies proposing that teacher agency is supported not only by autonomy but also by authentic involvement in collaborative school development (Allen & Penuel, 2015; Konopasky & Sheridan, 2016). Distributed leadership practices, visible strategic commitment, and protected time for collaborative planning appear particularly important for enabling teachers to move from cautious or support-seeking positions toward stronger ownership and more agentic engagement. Rather than directing reform through prescriptive measures, school leadership functions as a key enabling condition that legitimises experimentation, supports professional learning, and aligns STEAM development with broader school goals. This reinforces the view that teacher agency and ownership are not solely individual phenomena but are actively produced within organisational cultures and leadership practices during school reform.

Educational reform rarely progresses through the influence of a single position. Rather, reform emerges through interaction between different forms of teacher engagement and participation. Consistent with relational understandings of agency (Biesta & Tedder, 2007; Eteläpelto et al., 2013), the positions in this research suggest that teachers contribute to reform in different ways at different moments of the change process. Resource-critical realists and cautious reflectors may encourage reflection on feasibility, sustainability, and pedagogical coherence, while collaborative enablers and developer-innovators may facilitate experimentation and the development of new practices. Support-seeking beginners highlight the importance of participation opportunities, mentoring, and collaborative professional learning in extending ownership across the teaching community. From this perspective, sustainable STEAM reform may depend less on reducing differences between positions and more on creating conditions in which these complementary perspectives can contribute to collective sense-making and school development (cf. Datnow, 2020; Pieters et al., 2019). From a practical perspective, the identified positions may help school leaders, STEAM coordinators, and reform teams recognise differing support needs within teaching communities. Resource-critical realists may require reassurance regarding resources and planning conditions, while support-seeking beginners may benefit from mentoring and structured entry points into STEAM implementation. Collaborative enablers and developer-innovators may act as facilitators of peer learning, co-design, and experimentation. Recognising these differences may help schools target professional development, leadership support, and collaboration structures more effectively.

Finally, the supportive role of external facilitators and stakeholders (e.g., teacher education universities) is particularly important, as they provide research-based models,

mentoring, and practical resources. Several teachers explicitly requested regular interaction and concrete collaboration, positioning the university not simply as a disseminator of information but as an active partner in professional development. This aligns with research on collaborative professional development and research–practice partnerships, which emphasises that external facilitation can strengthen pedagogical competence and perceived ownership when embedded in authentic school contexts (Milara et al., 2020; Voogt et al., 2015). Taken together, the findings suggest that early-stage STEAM reform is not a matter of only technical implementation or one of teacher readiness or resistance, but a negotiated process between teachers, school culture, perceived benefits or challenges, and the realities of everyday practice (C. Day & Gu, 2010; Gouëdard et al., 2020; Reinius et al., 2024). The positions show that even in a relatively small and collegial context, realising the full potential of STEAM requires careful orchestration of bottom-up motivation, resources, and strategic leadership to understand all the different positions teachers can take upon the early stages of a large school reform (cf. Datnow, 2020).

4.1 Limitations and future directions

While the study provides insights into teachers' positioning towards a whole-school STEAM education reform, certain contextual and methodological limitations should be considered. As with most qualitative research, especially case studies, the data, and, consequently, the findings were inevitably shaped by the specific context and the participating teachers. Moreover, because the data relied on self-reported perceptions from voluntary participants, the results were influenced by their willingness and ability to reflect on and articulate their experiences. Nevertheless, the chosen methodology enabled a nuanced, situated understanding of how teachers view STEAM-focused reform in a Finnish school context, offering valuable insights that can inform future research and practical efforts to support educational change. These insights can also be used to frame future research, detailed interviews, or questionnaire structuring. Reporting detailed positioning is important for teachers' ongoing professional development and reflection, enabling them to recognise their personal positions and how they might affect their attitudes towards reform and school development going forward. While the scope of this study was more on the school reform with STEAM context, future studies could examine how teacher positions emerge and evolve in relation to other STEAM-related developments, including transdisciplinary learning models, equity-oriented approaches, culturally responsive pedagogies, and the growing role of AI literacy in school reforms. Future studies could also investigate whether similar narrative positions emerge in different schools, educational systems, and national contexts, and how cultural, organisational, and policy conditions influence the development of teacher positions during STEAM-oriented reform.

Conclusions

This study examined the positions teachers express regarding the early stages of a whole-school STEAM reform in a Finnish school. In a context where positioning analysis has rarely been used, this approach captured variation, overlap, and movement in teachers' orientations of how pedagogical reforms are negotiated in practice through different teacher positions, particularly in terms of agency, ownership, and school-level conditions. The methodological contribution demonstrates how positioning analysis can be used to study teachers' self-reported accounts during the early stages of school reform. Rather than treating teachers' responses simply as attitudes for or against STEAM, the study shows how rich open-ended questionnaire data can be analysed to reveal overlapping narrative positions through which teachers negotiate agency, ownership, and reform-related roles.

Teachers relate to early-stage STEAM reform through multiple, overlapping positions ranging from resource-critical realism to optimistic developers, with most teachers navigating between enthusiasm for pedagogical potential and harbouring pragmatic concerns. These positions highlight that teacher agency and ownership are not uniform or fixed but are continuously negotiated in relation to school structures, professional experience, and available support, considering reflections on the past, engagement in the present, and expectations for the future. Recognising these positions helps schools and reform leaders identify constraints and developmental pathways that are essential for translating STEAM from an aspirational idea into sustained everyday practice.

STEAM school reform is not primarily about introducing new pedagogical ideas but about developing existing professional knowledge and practices. Teachers who position themselves as developer–innovators or collaborative enablers often recognise STEAM as an extension of what they were already doing rather than a radical departure. In contrast, cautious-reflectors or support-seeking positions highlight the need for scaffolding, concrete models, and mentoring. This suggests that sustainable STEAM development benefits from approaches that build on teachers' pedagogical and contextual expertise and professional identities rather than replacing them with externally defined models.

Understanding teacher positions makes visible both challenges and resources that are otherwise difficult to capture. The identified positions illuminate not only needs and uncertainties but also strong professional values, commitment to students' learning, and motivation for pedagogical renewal. From a school development and continuous professional development perspective, recognising these positions can help leaders and reform designers tailor support, differentiate professional learning opportunities, and create pathways that strengthen collective agency and shared ownership.

Overall, the study underscores that early-stage STEAM reform is a negotiated, relational process. Teachers' motivation, willingness, competence, and perceived needs do not align automatically; rather, they develop through supportive school structures, leadership practices, and collaborative learning opportunities. Addressing teachers'

positions offers a practical and theoretically grounded way to support meaningful and sustainable STEAM reform.

Research ethics

Author contributions

All authors contributed to the study conception and design. Data collection was planned and implemented by AS, LE, PL, KS and SK. Data preparation and analysis were performed by AS, AP and PL. The first version of the manuscript was drafted by AS. Manuscript was from then on commented, developed, and finalised by all authors. All authors approved the final manuscript.

Artificial intelligence

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Institutional review board statement

According to instructions of the Committee of Research Ethics of University of Eastern Finland and the Finnish National Board on Research Integrity, there is no need for an additional ethical review.

Informed consent statement

Informed consent was obtained from the participants. Permissions to conduct the research were secured from the school administration.

Data availability statement

The data of this study cannot be made publicly available due to ethical and legal restrictions. According to the research plan and consents, data can only be accessed by the research team. De-identified data excerpts supporting the findings are contained within the manuscript. Additional anonymised data may be made available from the corresponding author upon reasonable request and with appropriate ethical approval.

Conflict of interests

The authors declare no conflicts of interest or competing interest.

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