## Examining The Role of Head Teachers in Promoting STEAM Education at Elementary Level School Larkana

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### Abstract

This qualitative study explores the role of head teachers in promoting STEAM (Science, Technology, Engineering, Arts, and Mathematics) education at the elementary level in Larkana. The study highlights STEAM education as a framework for enhancing innovation, problem-solving and critical thinking. The research examines how head teachers promote STEAM education its implementation using their leadership strategies, management, and support to teachers. The research was conducted with five head teachers from elementary school Larkana. The Onion Model of research methodology was followed, and a phenomenological approach used to collect data. The interview from head teachers involved 20 semi-structured questions interviews with five head teachers from the Larkana district. Thematic analysis was used to interpret the data, to interpret the leadership strategies and practices supporting STEAM education are often influenced by contextual challenges such as rigid curriculum, insufficient resources, lack of workshop for head teachers and inadequate teacher training. The findings highlight the importance transformational leadership style and transactional (effective management) support in promoting STEAM education. The study offers further recommendations for leadership development, policymaking, and resource allocation to empower head teachers in promoting integrated, critical and creative school management.

**Key words**: STEAM, Head teachers, Leadership, teacher support, Elementary level, Larkana

### Introduction

In the modern evolving educational context of the 21st century, STEAM (Science, Technology, Engineering, Arts, and Mathematics) education has become crucial for preparing students with the competencies needed for the future workforce readiness. By blending creative and critical disciplines, STEAM enhances the development of critical thinking, innovation, and problem-solving skills from a beginning age. At the elementary level, where key skills and attitudes begin to take shape, effective implementation of STEAM is heavily influenced by school leadership (Quaisley et al., 2023).

Head teachers play a central role in shaping the school's vision, mission, curriculum, context, culture and overall leadership strategies. Their leadership style and management practices impact how leadership competencies are integrated into school systems in promoting STEAM education. Various policies and curriculum reforms aimed at enhancing STEAM education, its adoption and execution differ considerably among schools. There remains a lack of meaning full understanding regarding the methods head teachers either support or hinder the promotion of STEAM education. While  promoting

steam education head teachers faced many challenges, like lack of resources, lack of professional training and lack of roles and responsibilities of head teachers.

**Background of the study**

STEAM education has seen considerable implementation in urban schools, its integration in rural schools like Larkana faces significant challenges. Rural schools often lack basic resources, clearly defined roles and responsibilities for head teachers, lack of teacher training, and the infrastructure necessary for successful STEAM instruction. Teachers in rural areas frequently faced many challenges such as limited professional development opportunities, insufficient approach to instructional materials, and minimal technological support. Additionally, socio-cultural and economic barriers negatively impact student participation and academic achievement (Ahmed, 2024). The Sindh Education Sector Plan (2019–2024) acknowledges these issues, emphasizing the need for inclusive and equitable STEAM education.

Identifying these barriers is essential for designing effective, context-specific interventions. However, despite initiatives like the STEAM Pakistan program and the STEAM Muqabla competition, rural educators continue to face shortages in training and resources, hindering the successful implementation of STEAM approaches (STEAM, 2024). This study focuses on the challenges head teachers encounter while promoting STEAM education in elementary schools in Larkana, particularly examining resource limitations, budget constraints, instructional strategies, and the impact of socio-cultural dynamics.

**Research Objectives**

1. To explore how leadership practices, contribute to the promotion and integration of STEAM education at the school level.
2. To identify the key challenges head teachers, encounter in implementing STEAM education.
3. To examine the resource support and infrastructural needs of head teachers for effectively promoting STEAM education.

**Research Questions**
1: How do school leaders perceive the importance of STEAM education, and how does this perception influence their leadership practices?
2: What are the challenges you face in implementing STEAM education in your school?
3: What kinds of resources (e.g., technology, materials, professional development) do you need to effectively implement STEAM education in your school?

**Significant of the study**
This qualitative research study contains importance not only for head teachers and educational policymakers but also for teacher educators, institutions, additionally it enhances on leadership practices and strategies that facilitate the integration and promotion of STEAM education at elementary schools in Larkana. It shows the ongoing communication surrounding educational leadership and curriculum implementation at the elementary level.
The study aims to explore the qualitative aspects of head teachers' roles In advancing STEAM education in elementary schools by analyzing their leadership strategies, roles responsibilities, resource management, and support mechanisms. It pursues to offer precious insights into how head teachers efficiently can lead and promote STEAM initiatives.

Additionally, it investigates the challenges they encounter and the types of support necessary to power their leadership skills within educational institutions.

Importance of preparing students for a evolving changing world, integrating STEAM education is necessary. The basic objective of this research is to examine the challenges teachers in Larkana face in promoting STEAM education. This includes exploring their efforts to implement effective pedagogical skills and the influence of resource allocation, professional development, opportunities, socio-economic and cultural barriers. The study also aims to identify practical strategies to enhance the quality of STEAM education for students.

## Literature Review

(Leithwood & Louis, 2005) argue that leadership is the second most influential school-related factor affecting student learning, following classroom instruction. Within the context of STEAM education, effective leadership involves creating a supportive environment for interdisciplinary learning, encouraging collaboration among teachers, and ensuring the availability of essential resources (Koch et al., 2013).

STEAM, which broadens the scope of STEM by incorporating the Arts, is recognized as a comprehensive educational approach that nurtures both analytical thinking and creativity. (Yakman & Lee, 2012) emphasizes that blending the arts with science and technology disciplines enhances students' problem-solving abilities and adaptability. At the elementary level, this integration demands a departure from traditional, subject-centered teaching toward more collaborative, project-based learning models—an evolution that relies heavily on leadership to support curriculum innovation and teacher development.

The success of STEAM initiatives frequently depends on the head teacher's role as an instructional leader. (Fullan, 2001) notes that meaningful school transformation is achieved when leaders cultivate a shared vision, inspire staff, and provide consistent support. However, schools in low-resource contexts often struggle with obstacles such as inadequate funding, insufficient professional development opportunities, and resistance to change (Marginson, 2013)

Furthermore, international evidence from countries such as South Korea, Finland, and Singapore demonstrates that strong leadership is a key factor in successful STEM/STEAM implementation (Yoh et al., 2021) Leaders in these contexts are actively involved in data-driven decision-making, curriculum design, and engaging with the wider community. Conversely, in many developing nations, head teachers are overwhelmed with administrative responsibilities, which limits their ability to focus on instructional leadership (Childress et al., 2020)

## Key theories or concepts

This study is grounded in a variety of educational theories that provide insight into the challenges head teachers encounter in promoting STEAM education, especially in rural elementary schools in Larkana. These theoretical foundations offer a comprehensive perspective on the pedagogical, technological, and contextual factors that influence the implementation of STEAM teaching and learning. The theoretical framework guiding this research integrates multiple educational perspectives to better understand the complexities and barriers head teachers face in this context.

## Leadership Strategies

Transformational Leadership Theory:

Head teachers who utilize collaborative approaches and promote interdisciplinary teaching practices exemplify the principles of transformational leadership, which plays a vital role in driving successful STEAM integration.

The establishment of informal STEAM groups or clubs within schools reflects distributed leadership in action, where leadership roles and responsibilities are shared among staff members to support STEAM initiatives.

**Resource Dependence Theory:**
Challenges in accessing STEAM-specific materials point to a reliance on external resources, highlighting the necessity for innovative resource management strategies and external partnerships.

**Key Elements of Effective Head Teacher Leadership Include:**
**Goal setting:** Establishing clear objectives for both teachers and students.
**Teacher Development**: Prioritizing continuous professional learning to enhance teaching practices.
**Collaboration:** Creating an environment where staff work together toward shared goals.

**GAP**
The educational landscape in Larkana presents distinct challenges and potential opportunities. Although awareness of the value of STEAM education is increasing, systemic issues—including limited teacher training, inflexible curricula, and poor infrastructure—continue to hinder progress. Rehman and Tariq (2020) emphasize the necessity of transformational leadership in addressing these challenges. Head teachers who adopt a forward-thinking vision, promote innovative practices, and invest in building teacher capabilities are more likely to successfully integrate STEAM education into routine classroom instruction.

**Policy Gap**
While initiatives like "STEAM Pakistan" aim to improve educational standards, their implementation varies significantly between urban and rural areas (STEAM, 2024). These studies underscore the importance of conducting localized research to better understand how these challenges manifest in specific contexts, such as Larkana. The difficulties faced by STEAM teachers in rural Sindh, particularly in Larkana, are rooted in systemic issues that affect rural education both locally and globally. To provide a comprehensive understanding of the topic, this literature review incorporates research on STEAM education, rural schooling, and teaching strategies in resource-limited environments.

**Inadequate Infrastructure:**
Many schools operate in dilapidated buildings or open spaces, lacking basic necessities such as furniture, restrooms, and instructional materials. These conditions create a demotivating environment for both teachers and students (Mujahidin Muammar et al., 2023)

**Teacher Shortages:**
In rural schools, a single teacher often manages multiple classrooms, resulting in overburdened educators who struggle to provide effective instruction or give individual attention to students.

**High Dropout Rates:**
Factors such as child labor, cultural expectations, and socio-economic challenges contribute to high dropout rates, particularly among girls (Mujahidin Muammar et al., 2023)

**STEAM Education in Rural Settings:**
STEAM education, which is intended to foster critical thinking, creativity, and problem-solving skills, faces significant implementation challenges in rural areas due to their unique circumstances.

**Resource Limitations:**
Rural schools often lack the necessary resources for hands-on learning, including science labs, experimental materials, and reliable internet access (Indian STEM Foundation, 2024).

**Teacher Competency:**
Many STEAM teachers and head teachers in rural areas are undertrained and need specialized training to effectively teach STEAM subjects. This is particularly problematic in rural settings where teachers are already stretched thin with their existing responsibilities.
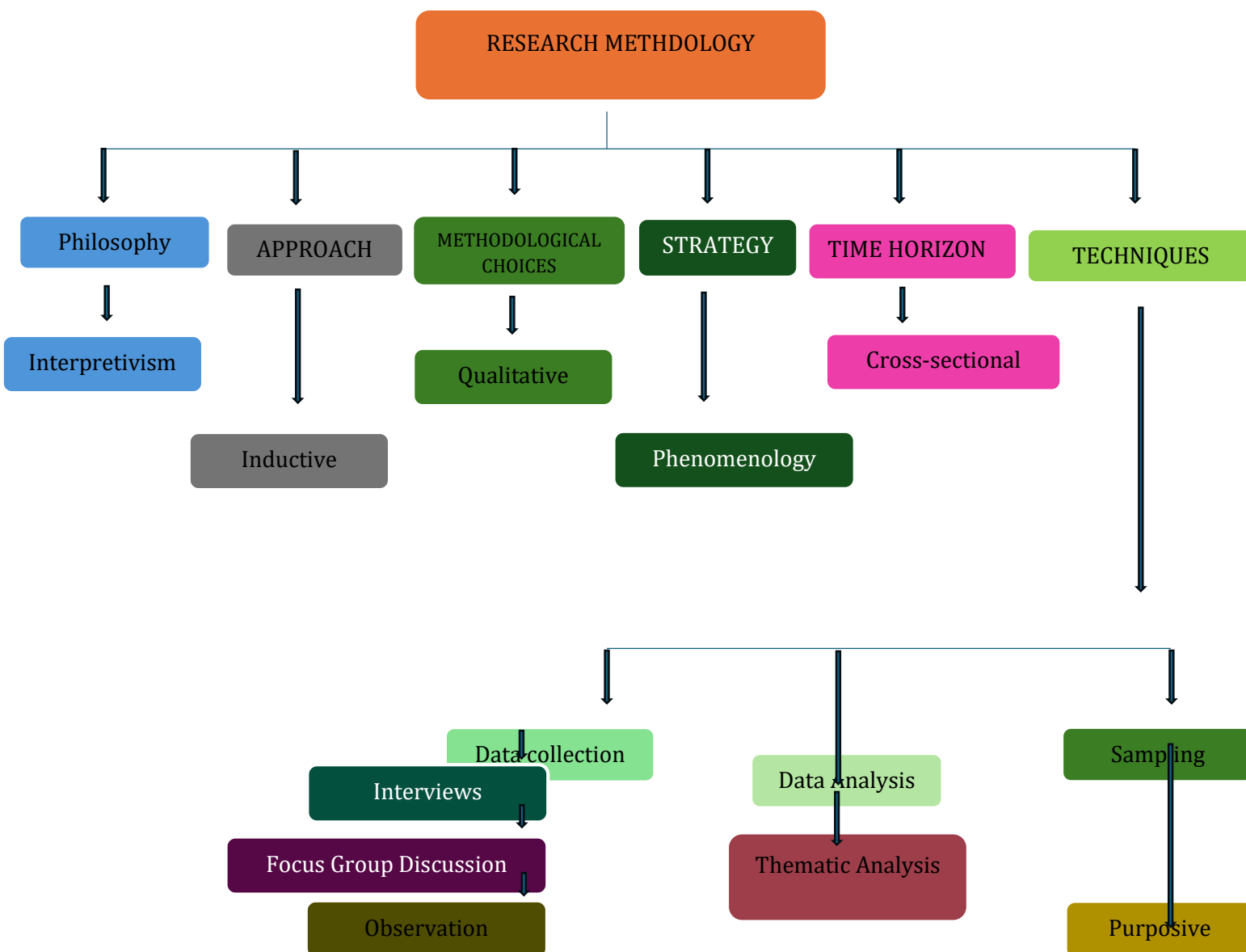


This study follows a **qualitative research design** to examine the role of head teachers to promoting STEAM education in elementary schools in Larkana.

The methodological framework is based on the Onion Model by Saunders et al. (2007), guiding the systematic selection of research philosophy, strategy, approach and data collection tools and techniques.

**Research Philosophy:**
This study is grounded in interpretivism, which seeks to understand the subjective, lived experiences and perspectives of head teachers within educational organizations.

**Research Approach:**
An inductive approach is employed, focusing on theory generation through data collection rather than testing pre-established hypotheses, as is common in quantitative research.

**Methodological Choice:**
Qualitative methods are used, focusing on non-numerical data, such as words, meanings, and personal experiences.

**Sampling Selection:**
Purposive sampling is applied, selecting five head teachers from elementary schools in Larkana who are involved in promoting STEAM education, particularly in relation to the "Muqablo 2025" initiative.

**Data Collection Method:**
A mono-method qualitative approach is used.

**Data collection tool**:  data collection tool was self-developed 20 semi-structured interviews to gather in-depth, detailed data from head teachers about promoting steam education.

**Strategy:**
Phenomenology is the chosen strategy, designed to explore the lived experiences of individuals and provide deeper insights into their perspectives.

**Time Horizon:**
The study uses a cross-sectional time horizon, collecting data over a set period to capture the current state and explore changes and developments.

**Data analysis technique:**
The data collected through semi-structured interviews with five head teachers were analyzed using thematic analysis, a method suitable for identifying, analyzing, and reporting patterns (themes) within qualitative data. The analysis followed Braun and Clarke's (2006) six-step process: (1) Familiarization with the data by reading interview transcripts multiple times, (2) Generating initial codes by highlighting meaningful phrases and statements, (3) Searching for themes by grouping related codes together, (4) Reviewing themes to ensure they accurately represented the data, (5) Defining and naming themes to reflect the core message of each category, and (6) Producing the final report .

The analysis was done manually to retain the context and richness of participants' responses. Common themes that emerged included leadership and vision, resource management, teacher motivation, and collaboration with stakeholders. These themes provided insights into how head teachers contribute to the implementation and promotion of STEAM education at the elementary level in Larkana.

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**Reliability and validity**

In qualitative research trustworthiness and credibility words used, instead of reliability and validity In this qualitative, interpretivist study, trustworthiness and credibility were established through multiple strategies aligned with the nature of phenomenological research. Data triangulation was employed by cross-verifying information gathered from five head teachers to identify consistent themes and diverse perspectives. The use of 20 semi-structured interviews allowed for in-depth exploration of individual experiences while maintaining flexibility in responses, enhancing both credibility and authenticity.

To further ensure dependability, a clear audit trail was maintained throughout the research process, including documentation of decisions made during data collection and analysis. The study also employed methodological triangulation, combining the Onion Model's layered approach with phenomenological methods to explore the lived experiences of head teachers within their specific contexts.

Thick description was used in presenting the data to convey not just the findings but also the context in which they emerged, allowing readers to understand the meaning participants assigned to their experiences. This supports transferability, enabling other researchers or practitioners to assess the relevance of the findings to similar educational settings.

Through these measures, the study establishes a high level of trustworthiness, ensuring that its findings about the role of head teachers in promoting STEAM education in Larkana elementary schools are both credible and meaningful.

Policy recommendations for g leadership styles and skills, technology integration, roles and responsibilities of head teachers and teacher workshops for promoting STEAM education in elementary schools Larkana.

**Results and Findings**

Analysis of the interview transcripts identified five key themes:

**Awareness and Understanding of STEAM:**

Most head teachers displayed a fundamental understanding of STEAM, generally focusing more on science and mathematics than on arts and engineering. However, those who had undergone professional development showed a more comprehensive, integrated view of STEAM education.

**Leadership Strategies:**

Effective head teachers utilized collaborative decision-making, encouraged cross-disciplinary teaching, and allocated time for teacher collaboration. Some had even established informal STEAM teams or clubs within their schools to foster integration and innovation.

**Resource Management:**

Access to STEAM-specific resources was a common challenge. Some head teachers creatively managed by utilizing low-cost resources, digital tools, and forming partnerships with external organizations or government programs to overcome resource limitations.

**Teacher Development:**

Support for teacher training in STEAM varied across schools. While some had sent teachers to STEAM workshops, others faced challenges due to a lack of funding or opportunities. Head teachers who prioritized teacher development witnessed more active and consistent STEAM implementation in their schools.

**Barriers to Implementation:**
Several obstacles to implementing STEAM education were identified, including rigid curricula, pressure from exams, lack of awareness among staff, and insufficient infrastructure. Head teachers expressed a strong need for policy support and greater autonomy to innovate.

## Discussion

**Awareness and Understanding of STEAM:**
The study shows that head teachers' comprehension of STEAM differs, with some emphasizing science and math more than the arts. However, those with professional development experience demonstrated a more well-rounded understanding of STEAM, indicating the importance of specialized training for head teachers.

**Leadership Strategies**:
Head teachers employing collaborative leadership strategies foster cross-disciplinary teaching and provide time for teachers to collaborate. Some also promoted innovation by establishing informal STEAM teams or clubs within schools.

**Resource Management:**
Limited access to STEAM-specific materials remains a major obstacle. However, resourceful leaders overcome this by using low-cost resources, digital tools, and forging partnerships with external organizations.

**Teacher Development**:
The support for teacher training in STEAM is inconsistent. Head teachers who prioritize professional development enable greater integration of STEAM in their schools.

**Implications:**
**Professional Development**:
Tailored training for head teachers and teachers is critical for the successful integration of STEAM education.

**Resourcefulness:**
Encouraging creative approaches to resource management can mitigate limitations in resource availability.

**Collaboration**:
Promoting collaboration among teachers and with external partners can enhance the effectiveness of STEAM education.

## Conclusion
The findings suggest that while head teachers acknowledge the importance of STEAM education, their ability to implement it effectively is highly influenced by contextual factors and leadership style. Those adopting a transformational leadership approach were more successful in promoting STEAM initiatives. Additionally, a significant gap in understanding the "A" (Arts) component of STEAM indicates the need for clearer conceptual clarity in both teacher and leadership training. Furthermore, systemic constraints, such as rigid curricula and lack of resources, limit the ability of head teachers to drive significant change in STEAM education. These results align with global literature, which

emphasizes the critical role of school leadership in curriculum innovation and underscores the need for supportive policies, continuous professional development, and decentralized decision-making.

**Summary of Key Findings**
**Professional Development**:
Develop leadership training programs specifically tailored to STEAM education and the promotion of interdisciplinary teaching methods.

**Policy Support:**
Empower schools with increased autonomy and financial resources to encourage innovation and flexibility in implementing STEAM initiatives.

**Infrastructure Development:**
Ensure schools are equipped with essential STEAM laboratories and digital technologies to support hands-on learning.

**Community Engagement**:
Actively involve parents and local community members in STEAM programs to create a more encouraging and collaborative educational environment.

The study underscores the major challenges faced by head teachers in promoting STEAM education in elementary schools in Larkana. These challenges stem largely from systemic issues, including poor infrastructure, insufficient training for head teachers, lack of educational resources, and limited communication channels.

**Contribution for the field:**
According to findings of the study, various future directions are recommended to further enhance the role of head teachers in promoting STEAM education at the elementary level in Larkana. There is a need for professional development programs for head teachers based on transformational and instructional leadership styles, detect the needs of head teachers promoting STEAM education.

Policymakers consider revising the federal and provincial curriculum to enhance greater flexibility for promoting STEAM education and learning, highlights schools to adapt more creative teaching approaches.

Adequate funding and provision of teaching resources, laboratories, and ICT tools must be prioritized to enhance STEAM education implementation, especially in under-privilege schools.

Regular and context-specific professional training or workshops for head teachers and teachers enabling them to promote STEAM education.

Establishing professional learning environment and networks among head teachers and teachers that can facilitate and communicate of STEAM practices, innovation and challenges, in STEAM education.

 Monitoring and evaluation should be highlights to detect the impact of head teachers' leadership on STEAM education to inform data-based decision-making policy.

**Future Research**: Further studies with larger samples across urban and rural contexts can help generalize findings with quantitative research and explore additional areas, such as student engagement and community involvement in promoting STEAM education.

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