INVESTIGATING THE ELEMENTARY SCHOOL MANAGEMENT PRACTICES IN STEAM EDUCATION: A CORRELATIONAL STUDY OF ELEMENTARY SCHOOLS OF UPPER SINDH, PAKISTAN

Hatim Ali[*1], Hafsa Lakho[2], Dr. Sayyed Tanweer Ahmed Shah[3]

*[*1,2,3]MPHIl Education in Leadership and Management in Sukkur IBA University*

[*1]Hatim.mphils25@iba-suk.edu.pk, [2]hafsa.mphils25@iba-suk.edu.pk, [3]tanweer.ahmed@iba-suk.edu.pk

Abstract

In the era of digital revolution and interdisciplinary knowledge, STEAM Education emerges as a pivotal pedagogical approach to impart 21st century skills among students. This quantitative study investigates that how elementary school management practices enhances the STEAM education. This study is guided by Quantitative and positivist approach and correlational research design. Additionally, the study surveyed 96 headteachers and teachers from public and private institutions using Stratified random sampling. A structured questionnaire was used for collecting the data and analyzed using SPSS v27.

The findings of the study revealed a statistically significant and strong positive correlation between effective management practices, including resource allocation, teacher training, policy adaptation, and collaborative planning, and the successful implementation of STEAM initiatives. Additionally, this study finds that school where management was informed and active reported higher level of students' engagement, multidisciplinary learning, and critical thinking development. However, there are some hurdles like inadequate resources and untrained staff, the study highlights the enabling role of school management in promoting STEAM education.

The research contributes theoretically to educational management literature and offers practical insights for policymakers, school administrators, and teacher educators. It underscores the need for targeted training, policy reform, and resource support to scale STEAM efforts effectively across educational settings.

INTRODUCTION

The introduction section deals with the background of the study, including understanding management, management versus leadership, Elementary school management, its role, and its impacts on STEAM education. The objectives, questions, and hypotheses show the area of the study. Furthermore, the nature of the study is a quantitative survey of elementary schools. At the end, the Introduction chapter is concluded in summary.

1.1. Background

Management plays a vital role in every aspect of life, whether it is academia, business, or personal sphere. It is crucial in maintaining values and is instrumental in planning, organising, budgeting, coordinating, and monitoring (Algahtani, 2014) in providing services to the community and managing organizations. Generally, management sets goals, and strategies in multiple ways for achieving the goals through continuous

monitoring and communication, resulting in maximum results. Management has widely been accepted as synonymous with leadership as both influence others, however, they differ significantly in skills, behaviour, and outlook. (Wajdi, 2017). Leadership involves visionary ideas and creates different ways to achieve the goals. In contrast, the management systematically handles the existing resources to get output efficiently (Wajdi, 2017). Furthermore, Management emphasizes formal instructions, ensuring to achievement of targets for improving quality. Research shows that successful management primarily depends on three skills: specific in one direction, utilizing humans effectively and incorporating ideas succinctly. (Wjidi, 2017)

In the contemporary and evolving education landscape, the role of management in educational settings is of utmost importance for ensuring overall students' achievements, supporting teachers, and helping society in the attainment of the aims of education (Joseph et al., 2018). Additionally, it is widely accepted that schools' overall success primarily depends on the management of the institution. However, many researchers are also of the view that management in education faces hindrances like managers in schools are unaware of their job description, lacking management skills and knowledge (Shah, 2024). Many school heads are powerless to hire other staff for the maintenance of daily work. (Dahri, 2018). Despite facing all these hindrances, school management can uplift the teaching and learning process with the improvement of 21st-century skills and multidisciplinary teaching pedagogies like STEAM approach (Science, Technology, Engineering, Arts, and Mathematics) by providing resources and setting clear goals (Khaki, 2006).

Globally, multiple studies stress that interdisciplinary pedagogies are vital for the uplifting of skills for 21st century (Anggraeni & Suratno, 2020) that include digital literacy, creativity, cooperation, collaboration, problem-solving skill, leadership, ethical and social responsibility, adaptability, and cultural awareness (Abbas et al., 2024). However,

traditional teaching methods only stress rote memorization, limiting students' critical thinking skills (Kiran & Sabah, 2024). STEM (science, technology, engineering, and mathematics) is an evolving theme in education (Hali et al., 2020) with the integration of Arts as a basis for creativity development (Monkeviciene et al., 2020). STEAM is a new approach that promotes innovative problem-solving skills among students (Kiran & Sabah, 2024). Additionally, this approach is also providing students with hands-on experiences that enhance critical thinking skills (Land, 2013). In the same vein, many school leaders agree that the STEAM approach can uplift students' critical thinking skills and teamwork (Rehman et al., 2024)

Therefore, elementary school management must enhance STEAM education to uplift students' 21st-century skills. Identifying the global importance of STEAM education, Pakistan has taken initiatives to foster creativity, and interdisciplinary thinking alongside digital literacy (Abbas et al., 2024). The Ministry of Federal Education and Professional Training (MoFEPT) has initiated a program named STEAM Pakistan to uplift STEAM education in Public schools, focusing on Girls. By 2027, this program aims to boost the professional improvement of one lac teachers and five million students will be aided in improving steam learning outcomes. In Sindh, Youth Steam Learning Festival was organized with the collaboration of Thar Education Alliance, Sindh Education and Literacy Department and UNICEF, where students from different schools presented 650 creative projects. Despite these initiatives, several challenges hinder the full incorporation and implementation of STEAM education into the school system in Pakistan (Hali et al., 2021) including poor budget for education, quality teachers and managerial issues of the institutions. In Pakistan, STEM/STEAM education is an overlooked subject (Aslam et al., 2022). Amidst these hindrances, very meagre research has explored how elementary school management can effectively enhance STEAM education. This study purposes to fill out this gap

by investigating the role of management in enhancing STEAM education in the region.

1.2. Problem Statement

In the 21st century, education systems worldwide are under increasing pressure to equip students with skills that go beyond traditional literacy and numeracy. As global economies become more innovation-driven, the demand for creativity, critical thinking, collaboration, and technological literacy has intensified. STEAM education; a holistic integration of Science, Technology, Engineering, Arts, and Mathematics, has emerged as a transformative approach to preparing students for this dynamic future (Yakman & Lee, 2012; Margot & Kettler, 2019). It encourages interdisciplinary thinking and problem-solving, offering students the tools to address real-world challenges with both analytical and creative capabilities.

However, despite its global recognition and growing adoption, the successful implementation of STEAM education at the elementary school level remains uneven, particularly in developing countries like Pakistan (Kiran & Sabah, 2024). While national initiatives such as the STEAM Pakistan program aim to introduce inquiry-based learning and digital skills to classrooms (MoFEPT, 2024), the on-ground success of such efforts heavily depends on how effectively schools are managed. School management plays a pivotal role in translating policy into practice through leadership, planning, teacher support, and resource allocation (Bush, 2020; Leithwood et al., 2020).

Existing research highlights that schools with strong management practices—such as professional development planning, strategic supervision, and collaborative culture—are more successful in adopting innovative educational models like STEAM (Beers, 2011; Abbas et al., 2024). Conversely, weak school management often leads to inconsistent implementation, lack of teacher motivation, and underutilization of learning resources (Aslam et al., 2022; Hali et al., 2021). While systemic issues such as budget constraints and infrastructure limitations exist, effective management can mitigate their impact

through adaptive leadership and local innovation (Pont et al., 2008).

In Pakistan's elementary schools, the capacity of school management to support STEAM education has not been extensively researched. The current literature tends to focus either on general STEM integration or on top-down policy interventions, without examining the operational and managerial factors within schools that facilitate or hinder STEAM enhancement (Kiran & Sabah, 2024). This creates a knowledge gap concerning how school management practices— such as instructional leadership, team coordination, resource mobilization, and support for inquiry-based learning—impact the effective implementation of STEAM education at the grassroots level.

Therefore, this study examines a critical gap between elementary school management practices and the enhancement of STEAM education by investigating the relationship in between. it seeks to move beyond a deficit perspective that focuses solely on challenges and instead highlight the enabling role of school management in fostering 21st-century learning. Understanding this relationship is vital for scaling STEAM initiatives, informing leadership training, and guiding policy at the school and district levels.

1.3. Research Objectives

• To examine the key practices of elementary school management that contribute to the enhancement of STEAM education.

• To evaluate the impact of elementary school management practices on the effectiveness of STEAM education.

1.4. Research Questions

• What are the essential management practices implemented in elementary schools to support STEAM education?

• How do elementary school management practices influence the enhancement of STEAM education?

1.5. Research Hypothesis

• H_o= There is no statistically significant relationship between elementary school

management practices and the enhancement of STEAM education.

- H_a= There is a statistically significant relationship between elementary school management practices and the enhancement of STEAM education.

1.6. Summary

In conclusion, there is a significant gap in content, knowledge and context in this context. This research focuses on STEAM education being pivotal for future leaders and the interdisciplinary knowledge of students. STEAM can uplift students' critical thinking skills and problem-solving abilities through providing hands-on experiences to the students. However, STEAM education, particularly in the context of upper Sindh faces multiple issues that hinder its full integration into schools including quality teachers, resources and management. Aligning with multiple factors that affect STEAM education, Elementary school management is yet to be explored. Therefore, School management is of utmost importance in enhancing STEAM education. Hence, this study purposes to investigate the role of elementary school management in enhancing STEAM Education.

LITERATURE REVIEW

The researcher has reviewed ten years of literature from research papers, review papers, thesis papers, books and national and international reports. This chapter consists of five themes such as an overview of School Management, A Look at STEAM Education, Role of School Management in Enhancing STEAM Education, Connection between STEAM Education and Students' Skills, and Challenges faced by School Management in enhancing STEAM Education.

2.1. An Overview of School Management

Management is a complex procedure which includes multiple forces, such as human and material resources, to achieve goals and objectives efficiently. In education, school management encompasses organisation and overall administration, ensuring a quality learning experience through the effective use of various resources, including teachers, infrastructure, and equipment within an academic institution (UNESCO, 2017). Many studies define school management differently based on varying contexts. Therefore, theoretical frameworks for management vary in definition, particularly within educational contexts. Classical approaches, such as Frederick Taylor's scientific management, stress the need for systematic planning to optimise output. In contrast, Henri Fayol's administrative management theory highlights the significance of hierarchy and centralised control for maintaining efficiency and order (Mariyadas & AR, 2022). Additionally, Max Weber's bureaucratic management focuses on clear rules and guidelines to improve effectiveness in organisations. Besides these classical perspectives, behavioural theories of school management promote motivation and a human-centred approach. Elton Mayo's Human Relations theory stresses the value of social relationships in creating a productive school culture, while Hierarchy of Needs by Maslow addresses the needs of both students and teachers. Furthermore, McGregor's Theory X and Theory Y illustrate opposing perspectives on management styles, ranging from authoritarian to participative, demonstrating the dynamic nature of leadership in educational settings with stakeholders. Similarly, school management focuses on how educational institutions operate to ensure effective academic processes through the use of human and physical resources. This comprises supervision, planning, strategy, and the execution of the educational system. Furthermore, school management integrates diverse management principles to develop methods for achieving educational goals (Nzoka & Orodho, 2014). It impacts various aspects of a school, including the teaching and learning process, quality of education (Mustoip et al., 2023), societal expectations, and students' overall progress. It plays a crucial role in attaining educational objectives (Nzoka & Orodho, 2014). According to Joseph, Iheoma, and Chijioke (2018), the role of management in schools is to transform concrete policies into actionable steps to achieve educational aims. Notably, the abilities

of school managers also shape actions and overall performance. Nzoka & Orodho (2014) assert that effective management enhances educational quality by improving cognitive skills and student attendance; school management serves as a guide for students, teachers, and the entire community (Mustoip et al., 2023). Over time, school management has evolved to address various issues, including the implementation of new strategies and the integration of technology to improve institutional effectiveness. In light of the above discussion, it is concluded that management coordinates resources and utilises them efficiently to maximise output. Specifically, school management refers to the body that handles all matters related to the school, including its budgeting, coordination of all teaching and non-teaching staff, and the entire learning process to maximise the academic and other than academic performance of students and institute.

2.2. A Look at STEAM Education

The advent of technology and socioeconomic changes has transformed every sector of life. This emergence of technology demands innovative approaches and new trends to keep pace with the modern world, necessitating the introduction of novel methods in education to equip students with 21st-century skills, including creative and critical thinking, cooperation, and communication skills. To bridge this gap, diverse and cohesive methodologies are employed in contemporary education, utilizing integrated approaches like STEM education to foster multidisciplinary abilities among students. STEAM is a strategy that combines various sciences to help students acquire abilities needed in this century (Nguyen et al., 2025). The concept of STEM originated in the United States in the 1990s with the support of the National Science Foundation. STEM merges numerous disciplines to improve learning from various perspectives. STEAM education promotes critical thinking, creativity and problem-solving skills, developing a skilled workforce, which is important for the prosperity of Pakistan's economy and development (Hashmi & Surani, 2024). When

students participate in STEAM activities, they stay involved, learn about science, build important thinking skills and begin to feel responsible. That point is made clear in the research by Asrizal, Dhanil & Usmeldi (2023) which points out that STEM is a way to teach students how to address problems, use their minds and find creative solutions (Asrizal, Dhanil & Usmeldi, 2023). In addition, Baran (2023) talks to STEAM experts who point out that including STEAM education is crucial for developing students' overall understanding and is necessary to foster skills required in the 21st century. Meanwhile, STEM, when incorporating the Arts, becomes STEAM (Science, Technology, Engineering, Arts, and Mathematics). Including the Arts in STEAM education boosts students' creativity, aesthetic abilities, and imagination. Baran (2023) emphasises the importance of the arts in STEAM education, advocating that art enhances students' creativity and aesthetic sense, including design skills. In the Pakistani context, some challenges in implementation hinder the full incorporation of STEAM education in schools, including a lack of resources, a lack of trained teachers, and the absence of a proper STEAM-oriented curriculum for schools (Hali, Aslam, Zhang, & Saleem, 2020). However, despite the increasing importance of STEAM education worldwide, some scholars question its effectiveness and the ambiguity surrounding it. The studies by Gordillo (2020) and Perales & Aguilera (2020) highlight the vagueness within STEAM and raise concerns about ethical considerations. Additionally, this notion is also supported by the study of Asrizal et al. (2023) that the usage of the STEAM approach has no impact on students' learning as it includes multiple knowledge and a lot of facilities; students' interests also vary in learning styles (Asrizal, Dhanil & Usmeldi, 2023). In light of the above discussion, it is concluded that STEAM education is a multidisciplinary approach to education that fosters diverse learning experiences, promotes critical thinking skills and boosts aesthetic skills through the arts. It is a buzzword, used widely worldwide in the educational landscape. In Pakistan, STEAM

education is not fully incorporated due to different issues.

2.3. Role of School Management Practices in Enhancing STEAM Education

Incorporating Science, Technology, Engineering, Arts, and Mathematics (STEAM) into educational curricula has become a central focus in contemporary education, promoting interdisciplinary knowledge, problem-solving skills, and creativity. STEAM education in schools prepares students for a 21st-century skilled workforce and helps them become informed citizens in a high-tech world (Hammad & Khan, 2024). The integration of STEAM education depends on various supportive factors. In this context, the role of school management emerges as a crucial element in the successful implementation of STEAM education (Abbas et al., 2025). School management holds a critical position and impacts the overall environment of schools, students' learning, and policy implementation. Further, it bridges the gap between policy and practice. School management plays an essential role in effectively executing and enhancing STEAM education by providing resources and opportunities. Most school leaders believe that STEAM helps students develop skills needed in the 21st century, for example, technology and social literacy, critical thinking and leadership (Abbas et al., 2024). Among the duties of school management are making sure the curriculum is implemented, training teachers, making sure resources are plentiful and establishing policies. Advancing STEAM initiatives also depends on understanding STEAM education, its approaches and how well they work in practice. It is important for school management to be aware of STEAM education first. A good grasp of STEAM allows school leaders to make decisions and introduce STEAM approaches more successfully. The work by Hammad & Khan (2024) agrees that having background information is important for school leaders when it comes to STEAM education. This study also shows that understanding of STEAM helps school leaders guide STEAM-related projects effectively, pointing out that teacher

training on STEAM subjects is important. In the same way, Kang et al. (2021) found that school management can help by arranging training sessions which guide teachers on how to solve problems when teaching STEAM. Hammad and Khan (2022) noted that school management encourages students to take part in STEAM Education by offering them useful materials and teaching them with skills. Understanding and practising the STEAM curriculum is necessary for making STEAM education better. The belief is also emphasised by the study of Pandey et al., (2024) argue that how school management understands STEAM-based integrated curricula plays a key role in the success of their implementation. In addition, the skills and talents of management or headteachers are key to making any initiative that needs interdisciplinary knowledge a success. Communication, collaboration, critical thinking skills, and digital literacy are of utmost importance for school managers and leaders in the evolving educational landscape (Banoglu, 2022). In light of the above discussion, it is concluded that school management plays a significant role not only in academic matters but also in extracurricular activities, fostering a positive environment for learning and growth in schools. School management shapes policies, provides resources, and builds a learning environment that encourages innovation and multidisciplinary knowledge.

2.4. Connection between STEAM Education and Students' Skills

STEAM education, a model of a multidisciplinary approach, has gained significant appeal worldwide. STEAM (Science, Technology, Engineering, Arts, and Mathematics) is an integrated approach designed to enhance students' skills and broaden their understanding to solve issues from multiple dimensions. A World Bank report (2024) points out that students gain more knowledge by learning in the STEAM framework (WB, 2024). In 1990, researchers recommended that becoming skilled in STEM would be crucial in the 21st century (John et al., 2018). In the same vein, Liu (2024)

found that STEAM education with an interdisciplinary method helps students become creative, more curious and skillful in solving tough problems. Moreover, this study shows that STEAM Education involves several subjects to make learning more appealing to students. When students connect different subjects, they can relate several kinds of knowledge to their uses in daily life. So, learning in the STEAM way gives students a comprehensive view of the subject (Liu, 2024). Monkeviciene et al., (2020) show that beginning STEAM education in early childhood helps students stay motivated and discover careers related to STEAM. Addressing worldwide problems requires students to understand modern skills and scientific and technological information. Moreover, STEAM Education is equally helpful for the world's economy. The World Economic Forum reports (in 2020) that STEAM education could lead to the creation of 97 million jobs worldwide by 2025. In addition, Abbas et al. (2024) highlight that STEAM skills help a workforce think creatively and, in turn, support both industry and the country's economy. Today's students should gain skills from a variety of areas so they can address the problems they face both in their studies and in life. STEAM Education helps our learners find a link between education and the working world by opening doors to various job markets (Hacioglu & Gulhan, 2021). In addition, by following a STEAM curriculum, schools teach students to think critically; a major 21st-century skill. Additionally, Different study showed that STEAM learning helps build analytical skills for elementary school children. This idea is also highlighted in the research of Wahid et al., (2022) that STEAM education enhances creativity and uplifts ideas out of the box and enriches critical thinking skills among students. In the same vein, STEAM Education emphasises the importance of critical thinking skills among students; making connections between education and real-world problems with solutions (Hacioglu & Gulhan, 2021). The review by Sahito & Wassan (2024) also highlights STEAM's role in enhancing students' skills through inquiry and various activities. In light of the above discussion,

it can be concluded that STEAM is an integrated approach that combines multiple disciplines to enhance students' 21st-century skills. Additionally, the STEAM education approach promotes creativity, communication, collaboration, and critical thinking skills among students through activities and engagement.

2.5. Challenges faced by School Management in enhancing STEAM Education

STEAM Education is widely recognised as a multidisciplinary approach that fosters creativity and enhances the multidimensional knowledge of students. However, the full incorporation of STEAM Education into mainstream education still faces challenges in Pakistan. School management is the foundation that implements policies at the ground level, yet it continues to struggle with advancing STEAM Education in elementary schools. It is clear from research that there are many challenges for elementary school administration in supporting STEAM Education. It is in school leaders' and managers' hands to help students gain high skills and creative minds. This is endorsed by the study of Hammad & Khan (2020), showing that such methods need active and flexible leadership within organisations for successful application in schools. Aslam et al. (2022) and Matsuura et al. (2020) suggest that the research trend related to STEAM Education has fallen in South Asia. Kiran and Hashmi (2024) carried out an action research study that found that Pakistan's current system is not fully ready for combining STEAM Education. Another difficulty for management comes from the fact that many teachers in schools are not trained (Kiran and Hashmi, 2024). STEAM Education has not fully started in schools in Pakistan yet. According to Aslam et al. (2022), STEAM Education is not widely studied because its importance is poorly understood. Insufficient knowledge in education among teachers and headteachers, together with bad curriculum conditions, make it harder for STEAM Education to be fully implemented (Aslam et al., 2022). Likewise, the administrative team is unhelpful because they haven't learned about the STEAM approach. The authors point out that many

institutional leaders in Tunisia do not have concrete goals and visions for STEAM Education. Young found problems, too, including inadequate training and workshops, jam-packed classrooms and not enough trained teachers using the STEAM approach (Sahito & Wassan, 2024; Kiazai et al., 2020). In addition, the management at schools does not have the staff or resources available to use STEAM successfully. Another factor missing for staff in schools is professional development since most teachers are not aware of the STEAM Education approach (Susilo & Sudrajat, 2020; Sahito and Wassan, 2024). In a number of schools in Pakistan, school heads deny Science Teachers freedom and make them follow the orders from management (Malik, 2017). In light of the above discussion, it can be concluded that the school management of elementary schools lacks an understanding of the principles of STEAM Education, teachers are deficient in pedagogical skills, and there is a significant lack of resources for integrating STEAM Education into the mainstream educational system. Although the Ministry of Education has taken initiatives to establish various schools and provide them with resources, management-related issues remain unaddressed. The study of Hammad and Khan (2020) also recommended that school management create STEAM activities to enhance students' curiosity and analytical skills.

CHAPTER 03: RESEARCH METHODOLOGY

This chapter outlines the methodological approach adopted to investigate the relationship between elementary school management practices and the enhancement of STEAM education. It discusses the research design, philosophical stance, research approach, population and sampling strategy, data collection methods, and data analysis techniques used to address the study objectives effectively (Creswell, 2014; Abbas et al., 2024).

3.1. Design of Research

For this study, quantitative research with a survey-based correlational design is adopted. Using quantitative research helps you measure and study features, as the results are numerical so they can be used to form generalized conclusions (Creswell, 2014). A broad sample can be reached through surveys, allowing the researchers to apply statistics to see how good management relates to the advancement of education in STEAM at the elementary level (Pandey et al., 2024).

3.2. Philosophical Stance

This study depends on the positivist way of thinking which believes reality is objective and measurable with observation. Positivists pay attention to accuracy, reliability and objectivity and recommend using formal instruments to gather numerical results (Bryman, 2016; Creswell, 2014). Johnson and Onwuegbuzie (2023) mention that positivism is ideal for studying relations among different variables and creating repeatable results. This way of thinking explains the need to adopt a survey method and apply data analysis.

3.3. Research Approach

In this study, a correlational quantitative approach is being used. The descriptive aspect reveals about practices of school management. While, the correlational component analyses the link between school management and the growth of STEAM education. Using this approach, researchers can discover the direction and strength of natural relationships in variables without manipulating them, as it is hard to conduct experiments in educational environments (Hammad & Khan, 2024).

3.4. Population and Sampling

For this study, the population is headteachers and teachers from elementary school in district Khairpur, Sindh, Pakistan, including both private and public. Addition of private schools with public schools ensures a systematic understanding of management practices in elementary schools. For this study, those schools are selected where STEAM education concepts are either implemented or known, hence it is confirming relevance to the research objectives. Using stratified random sampling process to confirm

representation across different district, different Taluka, types of schools demographically (Haer & Becher, 2012). In this technique, people are grouped by school type, either public or private and then individuals are randomly picked from each group (Creswell, 2014). By using stratified random sampling, researcher can obtain results that are relevant in general and make sure that both kinds of schools are equally represented (Teddlie & Yu, 2007). There were 48 schools in the sample (each having one public and one private school) and from each school, one headteacher and one teacher participated in the study, comprising total 96 participants. Anyone who participated had, at the very least, a year of teaching or library work in elementary school and was familiar with STEAM or interdisciplinary teaching. By following this criterion, participants participated with ample knowledge and relevant background to give valuable responses (Abbas et al., 2024; Rehman et al., 2024). A sufficient number of participants was chosen using the Krejcie and Morgan (1970) table to reach statistical adequacy.

3.5. Data Collection Method and Procedure

Data were obtained using a questionnaire that was adopted from established instruments found in related literature (Hammad & Khan, 2024; Pandey et al., 2024). Demographic background, school management practices and STEAM education enhancement were the three sections of the questionnaire. The main sections were evaluated using a 5-point Likert scale so that participants could agree or disagree with every item.

A group of ten people participated in a pilot study to ensure reliability and consistency and then removed from the main study. According to their opinions, some small adjustments were carried out on the questionnaire. The last stage of data collection was completed with visits to schools and with online questionnaires, as the schools and respondents preferred. All the participants involved gave their consent and the required permissions were received from school leaders and district officials (Abbas et al., 2024).

3.6. Data Analysis and Limitations

The analysis of the data was done using SPSS Version 27 (Zeki Coşkuner et al., 2023). To explain the main trends and characteristics, descriptive statistics were applied and the Pearson's correlation method helped us study the link between school management practices and enhancing STEAM education.

The research questionnaire was provided in three languages, including English, Urdu and Sindhi, so that all participants could understand it. This way, people could access more easily and get more precise answers.

Even so, there are some constraints in the methodology. It is possible that respondents interpret STEAM differently, so this could lower the faith in their replies. This means that respondents may answer questions to look good or may forget some details. Even though stratified random sampling was chosen, the findings apply only to Khairpur district because the study was restricted to its schools. Finally, since there are not many well-developed STEAM programs in rural areas, there could be fewer details describing how advanced STEAM practices are being applied (Aslam et al., 2023). In spite of these problems, the study shows useful information about how school management can support introducing STEAM and similar education models. It includes the findings that demonstrate what leaders and the environment of organisations can do to encourage STEAM learning in early schools in Pakistan.

DATA ANALYSIS

The purpose of analyzing the data is to find out how school management practices enhance STEAM education among elementary schools. The study mainly examines the support management gives for teaching across multiple subjects, provides necessary resources, supports teacher training, encourages team effort and changes policies to match the needs of the current age. This aspect also works to test the hypothesis that these management strategies influence the effective use of STEAM material, student passion and involvement in different projects. It also looks at how strong or weak

management support in schools is related to their STEAM outcomes. As emphasized in the literature, effective school management plays a crucial role in creating an enabling environment for STEAM by promoting collaboration among teachers, integrating arts in STEM, and linking lessons to real-life applications, which enhances students' creativity, problem-solving skills, and motivation (Singh & Gupta, 2024; Khan et al., 2023). The literature also highlights the need for continuous evaluation of STEAM initiatives and active involvement of parents, teachers, and administrators to sustain and improve STEAM education in schools (Ahmed & Khan, 2022). This research draws attention to the importance of awareness among parents and the wider school community regarding STEAM activities, encouraging them to support and participate in the learning process. Regular monitoring and assessment of STEAM activities are recommended to ensure their quality and relevance in fostering 21st-century skills.

4.1 Reliability Statistics

The reliability of the questionnaire was assessed to determine the internal consistency of the items. As shown in Table 01, the Cronbach's alpha value obtained was 0.888, which indicates a high level of reliability according to standard thresholds (Nunnally, 1978). This suggests that the instrument items are consistent and reliable for measuring the constructs of school management practices and STEAM education enhancement. Based on this strong reliability coefficient, the tool is considered suitable for data collection from the targeted sample in this study. Additionally, the validity of the instrument was ensured through consultation with language and field experts. The questionnaire was revised three times following their recommendations, after which it was finalized for use in the field data collection.

Table 01: Reliability Statistics

| Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.888	.886	13

Source: Author's own work

4.2. Participation Statistics

As per graph 1, the numbers of respondent Teachers and Headteachers are 96 with male column show number of male respondents and female column represents female respondents of

Elementary school from Khairpur using Morgan sampling table (Krejcie & Morgan, 1970). And graph 2 shows the institution representation, 65 participants were from public institutions and 31 participants were from private institute.
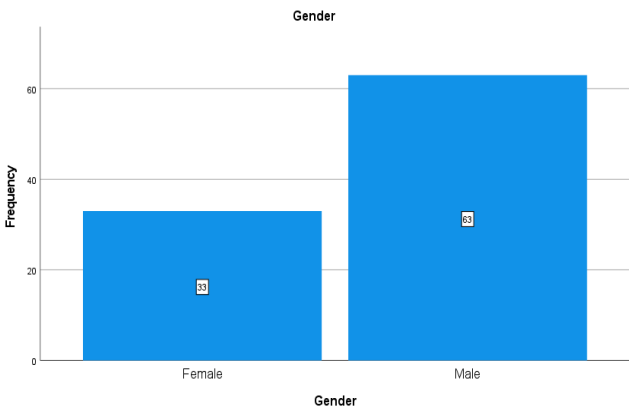
Graph 01
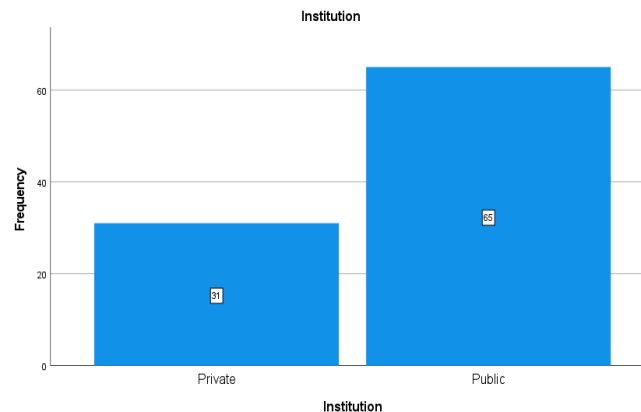
Graph 02

Source: Author's own work

4.3. Results of Normality

For checking the normality of the data, the Shapiro-Wilk test was run as shown in Table 02. The results indicate that the data for School Management Practices (p = 0.094) and STEAM Enhancement (p = 0.118) are normally distributed. Since the significance values for both variables are greater than 0.05, the assumption of normality is met for this dataset. This allows the use of parametric tests such as Pearson's correlation to examine the relationships between variables.

Table 02: Tests of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
School Management Practices	.099	96	.020	.977	96	.094
STEAM Enhancement	.076	96	.200[*]	.979	96	.118
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Source: Author's own work

4.4. Descriptive analysis

The descriptive analysis of this study reveals that, shown in table 3, the group mean score for **School Management Practices** is (M = 3.3767, SD = 0.84785), which falls under the moderate level of mean range. On the other hand, the mean score for **STEAM Enhancement** is (M = 3.8199, SD = 0.63356), which is considered under the high level of mean range as per the Hassam et al. (2015) table of mean specification. These results indicate that respondents have a moderately positive perception of school management practices and a higher level of agreement regarding the enhancement and implementation of STEAM education in elementary schools.

Table 03: Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
School Management Practices	96	1.00	5.00	3.3767	.84785
STEAM Enhancement	96	2.29	5.00	3.8199	.63356
Valid N (listwise)	96				

Source: Author's own work

4.5. Results of Correlations

As shown in Table 04, the Pearson correlation coefficient is calculated to examine the relationship between **School Management Practices** and **Enhancement of STEAM Education**. The results show a statistically significant positive correlation (r = 0.698, p < 0.01), indicating a strong relationship between the two variables. This suggests that as school management practices improve, the enhancement and integration of STEAM education are also likely to increase. The significance value (p = .000) confirms that the relationship is not due to chance and is meaningful within the study context, supporting the hypothesis of the study. Therefore, it can be concluded that there is strong and positive relation between school management practices and enhancement of STEAM education. Hence, the alternative hypothesis of this study is accepted and the null hypothesis is rejected.

Table 04 Correlations Analysis

Correlations			
		SchoolManagementPractices	STEAMEnhancement
SchoolManagementPractices	Pearson Correlation	1	.698[**]
	Sig. (2-tailed)		.000
	N	96	96
STEAMEnhancement	Pearson Correlation	.698[**]	1
	Sig. (2-tailed)	.000	
	N	96	96
[**]. Correlation is significant at the 0.01 level (2-tailed).			

Source: Author's own work

DISCUSSION

This study aims to examine how elementary school management practices enhances the STEAM education in elementary schools in Khairpur, Sindh. This study stresses on the revealing important management practices which supports enhancement of STEAM activities, training of teachers, allocation of resources, updating policy and working collaboratively on curriculum development. Furthermore, this study investigates that how these practices impact the effective integration of STEAM education and students skills.

The findings of the study show that there is a positive and significant relation between school management practices and the STEAM enhancement. In some schools STEAM implementation demonstrated stronger and positive where management provide adequate resources, uplifting multidisciplinary approaches and provide training for teachers, STEAM implementation. This idea is also emphasized by the study of Akhtar et al., (2023) that leadership plays important role in implementing innovative pedagogies and creating conducive environment for multidisciplinary skills. Specifically, teachers feel ownership and encouragement for engaging

in STEAM approach when school management actively engage them in decision-making.

Furthermore, the study highlights that updating school policies for aligning it with modern educational needs also significantly impacts the STEAM enhancement. This findings echoes the study conducted by Mahmood et al., (2024) that dynamic policies are the need of the hour, reflecting evolving nature of knowledge in the digital age. Updating policies aligning with STEAM education is uplifting the STEAM enhancement.

Student performances also proved that school management has a good effect on STEAM education. Teachers noticed that students were more excited, interested and active in working on various projects. In activity-based lessons, students spent more time solving problems within creative activities because the school administrators encouraged this approach. The results agree with previous studies that well-structured STEAM programs play a significant role in students' development and improve both their studies and important life skills (Bashir, 2021; Mahmood et al., 2024).

At the same time, the analysis pointed out a number of difficulties that stop STEAM integration from reaching its full potential. Even though a lot of school leaders were willing, there were not enough funds and plan-like training opportunities for teachers. Many teachers pointed out that a lack of resources, less chance to learn professionally and ups and downs in management prevented them from achieving their best. This shows a larger problem experienced by a lot of schools in underserved communities that struggle with educational innovation due to insufficient facilities (Farooq & Rizvi, 2022). These obstacles should be resolved to have equal opportunity in studying STEAM subjects.

5.1. Implications of Findings
5.1.1. Theoretical Implication
The research adds to the theory of educational leadership by highlighting how school leaders can implement STEAM and similar approaches in schools. It points out that leadership must consist of teamwork, empowering teachers and making sure the curriculum meets needs of the 21st century (Duan, 2024). The inclusion of STEAM education allows for exploring ways in which management decisions can impact education in developing situations. It helps strengthen the notion that adaptive leadership work with teachers and keep improving policies can lead to better student involvement and academic achievement in difficult areas.

5.1.2. Practical Implication
In real terms, the research gives suggestions that are useful for school administrators, policymakers and those involved in teacher education. It is advised for school leaders to focus on learning new approaches to teaching STEAM, help curriculum, team work together and supply the needed materials for STEAM-related projects. Besides, the research shows that including teachers in decisions encourages them to feel responsible and stay engaged. Using this way of working, STEAM lessons are improved and teachers gain confidence and better abilities to teach different subjects together.

At the policy level, Department should plan and budget for proper infrastructure and training in science, technology, engineering, arts and mathematics, mainly for Khairpur and those who are most in need. Improving the school managers' knowledge will give them what they need to effectively initiate STEAM programs. Also, regular review of policies that accounts for new educational trends and input from teachers' helps schools adjust to changes in students' learning requirements.

5.2. Strength and Contribution
This study is strong because it looks at elementary schools from a rural area, since not many studies have focused on this theme. The study addresses an important issue by presenting observations from Khairpur on how leadership helps schools use more STEAM approaches. The quantitative method made it possible to identify the correlation between management role and better interdisciplinary learning.

Besides, this research considers many aspects, including supplies, teacher education, policy reviews, and teamwork and teacher feedback, to provide a full picture of school management. Because it addresses many areas, the research gives useful tips to educators and policy makers who want to reproduce successful efforts elsewhere. The study shows why flexible, equal and well-resourced management in schools is necessary for successful STEAM education.

5.3. Limitations of the Research

Despite its contributions, this research has several limitations. The use of self-reported surveys to collect data from teachers and school management may introduce biases such as social desirability or inaccurate self-assessment. Respondents might have overestimated their practices or the effectiveness of STEAM implementation. Additionally, the study's scope was limited to public elementary schools in Khairpur, which restricts the generalizability of findings to other regions or private institutions where management structures and resource availability differ significantly.

The cross-sectional correlational design limits the ability to infer causation. While strong associations were found between management practices and STEAM enhancement, longitudinal studies are needed to understand the directionality and long-term effects of these relationships. Moreover, some qualitative aspects of management, such as leadership style and school climate, were not explored but may influence STEAM integration.

5.4. Recommendations for Future Research

Future research should extend to a wider range of schools across various socio-economic and cultural contexts to build a more comprehensive understanding of how school management impacts STEAM education nationally. Employing mixed-methods designs that include interviews, observations, and case studies can provide richer insights into the lived experiences of teachers and leaders implementing STEAM. Longitudinal studies are particularly recommended to track the progress of STEAM

initiatives over time and evaluate the sustainability of management practices. Investigating how specific leadership styles or school cultures interact with resource provision and teacher collaboration would also be valuable. In the end, investigating how students' creativity, critical thinking and learning results depend on management techniques will contribute more strongly to evidence used in education policies.

5.5. Conclusion

All in all, it is clearly shown in this study that managing elementary schools positively contributes to STEAM education in public schools. Practices such as involving different subjects in teaching, offering necessary resources, training teachers, encouraging teamwork in lesson planning and keeping school rules updated are very helpful for introducing STEAM activities in schools (Akhter et al., 2023). Schools with proactive management tend to see higher involvement from students, more motivation and the growth of important thinking and creativity.

Despite efforts, difficulty in getting enough resources and reliable training is still a big problem, especially in places such as Khairpur. For students to get the best out of STEAM education, it is important for school leaders, policymakers and teacher educators to work together and support such innovations.

This study proves that schools should treat management as leadership, meant to inspire change and guide students for the future they will face. When schools, teachers and administrators join efforts to improve how they manage schools, STEAM learning becomes inclusive, well-equipped and actively engaging for students.

REFERENCES

Algahtani, A. (2014). Are leadership and management different? Journal of Management Policies and Practices, 2(3), 71–82.

Wajdi, B. N. (2017). The differences between management and leadership. Sinergi: Jurnal Ilmiah Ilmu Manajemen, 7(1).

Bentil, J. (2018). Study habits of students: Keys to good academic performance in public junior high schools in the Ekumfi District of Ghana (Master's thesis, University of Cape Coast). University of Cape Coast Institutional Repository.

Bloom, N., Lemos, R., Sadun, R., & Van Reenen, J. (2014). Does management matter in schools? (NBER Working Paper No. 20667). National Bureau of Economic Research. https://doi.org/10.3386/w20667

Khaatoon, A., Dahri, K. H., & Dahri, A. J. (2018). Role of emotional intelligence in secondary school teachers leading to children's development. Asian Journal of Management Sciences & Education, 7(2), 68–74.

Khaki, J. E. A. (2006). Effective school leadership: Can it lead to quality education?

Anggraeni, R. E. (2021, March). The analysis of the development of the 5E-STEAM learning model to improve critical thinking skills in natural science lesson. In Journal of Physics: Conference Series (Vol. 1832, No. 1, p. 012050). IOP Publishing.

Abbas, Q., Hussain, S., Rehman, M., Tabassum, S., & Mehdi, M. (2024). 21st century skills through STEAM education: Analysis of school leaders' perspectives. Journal of Asian Development Studies, 13(3), 464–471.

Hashmi, K., & Maqsood, S. (2024). STEAM education: A pathway to enhance critical thinking in dynamic elementary classrooms. Sukkur IBA Journal of Educational Sciences and Technologies, 4(1), 25–44.

Hali, A. U., Zhang, B., Al-Qadri, A. H., & Aslam, S. (2021). A collaborative teacher training approach in different cultures in the era of technology. International Journal of Instruction, 14(4), 21–32.

Monkeviciene, O., Autukeviciene, B., Kaminskiene, L., & Monkevicius, J. (2020). Impact of innovative STEAM education practices on teacher professional development and 3–6 year old children's competence development. Journal of Social Studies Education Research, 11(4), 1–27.

Land, M. H. (2013). Full STEAM ahead: The benefits of integrating the arts into STEM. Procedia Computer Science, 20, 547–552.

Rehman, N., Huang, X., Mahmood, A., Zafeer, H. M. I., & Mohammad, N. K. (2025). Emerging trends and effective strategies in STEM teacher professional development: A systematic review. Humanities and Social Sciences Communications, 12(1), 1–23.

Aslam, S., Saleem, A., Kennedy, T. J., Kumar, T., Parveen, K., Akram, H., & Zhang, B. (2022). Identifying the research and trends in STEM education in Pakistan: A systematic literature review. SAGE Open, 12(3), 21582440221118545.

Yakman, G., & Lee, H. (2012). Exploring the exemplary STEAM education in the US as a practical educational framework for Korea. Journal of the Korean Association for Science Education, 32(6), 1072–1086.

Margot, K. C., & Kettler, T. (2019). Teachers' perception of STEM integration and education: A systematic literature review. International Journal of STEM Education, 6(1), 1–16.

Ministry of Federal Education and Professional Training. (2024, June 11). Federal foundational learning policy 2024. Government of Pakistan.

Bush, T. (2020). Turnaround leadership in education: A restatement of heroic leadership or a flawed concept. Educational Management Administration & Leadership, 48(1), 3–5.

Leithwood, K., Sun, J., & Schumacker, R. (2020). How school leadership influences student learning: A test of "The four paths model." Educational Administration Quarterly, 56(4), 570–599.

Beers, S. (2011). 21st century skills: Preparing students for their future.

Pont, B., Nusche, D., Moorman, H., & Hopkins, D. (2008). Improving school leadership (Vol. 1, p. 578). OECD.

UNESCO. (2017). Education for sustainable development goals: Learning objectives. United Nations Educational, Scientific and Cultural Organization. https://unesdoc.unesco.org/ark:/48223/pf0000247444

Mariyadas, S., & Saravanakumar, A. R. (2022). Applications of management theories by principals to peaceful school administration. Journal of Positive School Psychology, 6(4), 398–408.

Nzoka, J. T., & Orodho, P. J. (2014). School management and students' academic performance: How effective are strategies being employed by school managers in secondary schools in Embu North District, Embu County, Kenya? International Journal of Humanities and Social Science, 4(9), 86–100.

Mustoip, S., Al Ghozali, M. I., As, U. S., & Sanhaji, S. Y. (2023). Implementation of character education through children's language development in elementary schools. International Journal of Education and Curriculum Application, 6(2), 91–100. https://doi.org/10.31764/ijeca.v6i2.14192

Owan, V. J., Nwannunu, B. I., & Madukwe, E. C. (2018). Problems of school management and students' academic performance in secondary schools in Calabar Education Zone, Cross River State, Nigeria. International Journal of Research and Innovation in Social Science, 2(10), 120–127.

Nguyen, T. H. V., & Nguyen, T. H. (2025). The current state of STEM education in selected lower secondary schools in Hanoi: Challenges and opportunities in implementation. GPH-International Journal of Educational Research, 8(3), 249–261. https://doi.org/10.5281/zenodo.15290426

Asrizal, A., Dhanil, M., & Usmeldi, U. (2023). The effect of STEAM on science learning performance: A meta-analysis [Meta-analysis]. Jurnal Penelitian Pendidikan IPA, 9(4), 1650–1657. https://doi.org/10.29303/jppipa.v9i4.3108

Baran, E., & AlZoubi, D. (2023). Design thinking in teacher education: Morphing preservice teachers' mindsets and conceptualizations. Journal of Research on Technology in Education, 55(4), 1–17. https://doi.org/10.1080/15391523.2023.2170932

Baran, E., AlZoubi, D., & Bahng, E. J. (2023). Using video enhanced mobile observation for peer-feedback in teacher education. Journal of Digital Learning in Teacher Education, 39(2), 102–113.

Gordillo, L. D., Domínguez, B. M., Vega, C., De la Cruz, A., & Angeles, M. (2020). Educational marketing as a strategy for the satisfaction of university students. Journal of Educational Psychology–Propositos y Representaciones, 8, e588.

Aguilera, D., & Perales-Palacios, F. J. (2020). What effects do didactic interventions have on students' attitudes towards science? A meta-analysis. Research in Science Education, 50(2), 573–597.

Asrizal, A. (2023). Development of STEM-integrated static fluid e-modules to improve students' creative thinking and science process skills. Jurnal Eksakta Pendidikan (JEP), 7(2), 171–1784.

Kang, J., Kim, H., & Lee, Y. (2021). Principal behavior and organizational factors in teacher psychological empowerment: Evidence from low-SES schools. Social Sciences, 11(11), 523.

Pandey, S., & Sayed, S. (2024). Impact of teachers' mental health in classroom transactions: A narrative review of literature. International Journal of Indian Psychology, 12(3), 2605–2608. https://doi.org/10.25215/1203.252

Banoğlu, K., Vanderlinde, R., Çetin, M., & Aesaert, K. (2023). Role of school principals' technology leadership practices in building a learning organization culture in public K-12 schools. Journal of School Leadership, 33(1), 66–91.

World Bank. (n.d.). Towards a competency-based Science, Technology, Engineering, and Mathematics (STEM) curriculum reform in Armenia (World Bank Technical Report No. P167562). World Bank.

Liu, D. (2024). Potential impact of STEAM education on the outcomes of music teacher training. Scientific Journal of Polonia University, 66(5), 94–102.

World Economic Forum. (2020). The future of jobs report 2020. World Economic Forum.

Hacıoğlu, Y., & Gülhan, F. (2021). The effects of STEM education on the students' critical thinking skills and STEM perceptions. Journal of Education in Science, Environment and Health, 7(2), 139–155. https://doi.org/10.21891/jeseh.771331

Abdulwahid, N. O., Fakhfakh, S., & Amous, I. (2022). Simulating and predicting students' academic performance using a new approach based on STEAM education. Journal of Universal Computer Science, 28(12), 1522–1538.

Hacıoğlu, Y. (2021). The effect of STEM education on 21st century skills: Preservice science teachers' evaluations. Journal of STEAM Education, 4(2), 140–167.

Sahito, Z., & Wassan, S. H. (2024). Literature review on STEM education and its awareness among teachers: An exploration of issues and problems with their solutions. SAGE Open, 14(1), 21582440241236242.

Matsuura, T., & Nakamura, D. (2021). Trends in STEM/STEAM education and students' perceptions in Japan. Asia-Pacific Science Education, 7(1), 7–33.

Solihah, P. A. S., Kaniawati, I., Samsudin, A., & Riandi, R. (2024). Need analysis of STEM-ESD-based development on teaching materials and instrument test. Jurnal Penelitian Pendidikan IPA, 10(3), 1124–1133.

Hammad, S. (2020). School leaders' perceptions about STEAM education to develop STEAM schools in Pakistan. LC International Journal of STEM, 1(4), 155–165.

Soomro, T. R., & Malik, S. (2025). An analysis of STEM education competencies: Assessing knowledge and attitudes among teacher trainers and teacher trainees. Pakistan Social Sciences Review, 9(2), 495–505.

Ishtiaq, M. (2019). Book review: Creswell, J. W. (2014). Research design: Qualitative, quantitative and mixed methods approaches. English Language Teaching, 12(5), 40.

Gupta, R., Gangmei, E., & Singh, V. (2021). Upgrading learning process through an online interactive STEAM curriculum. International Journal of Computer Science and Technology Research, 9(2), 30–35.

Khan, S. A., Nadim, M. A., & Poletti, G. (2025). Towards a new paradigm of STEAM in primary education as a 21st century skill. In INTED2025 Proceedings (pp. 750–758). IATED.

Abdulwahid, N. O., Fakhfakh, S., & Amous, I. (2022). Simulating and predicting students' academic performance using a new approach based on STEAM education. Journal of Universal Computer Science, 28(12), 1522–1538.

Nunnally, J. C. (1978). An overview of psychological measurement. In Clinical diagnosis of mental disorders: A handbook (pp. 97–146).