School Leaders Perceptions on STEAM as a Pedagogical Approach in School Education in Nepal

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Abstract

In Nepal, there is a growing enthusiasm for the expansion of STEAM education within the school system, aiming to equip students with the skills necessary to navigate an increasingly challenging world and address complex problems. However, the implementation of STEAM in school education poses significant challenges for educators, teachers, and other stakeholders, requiring a comprehensive understanding of the necessity of integrating STEAM into the curriculum. This study seeks to investigate how school leaders perceive STEAM education and recognize its importance in the educational landscape. Employing a qualitative research design, the study utilizes narrative inquiry to gain insights into the perspectives of school leaders, who hold a pivotal role in the successful integration of STEAM in schools. The research delves into various perceptions of school leaders regarding STEAM as an integrated approach to teaching and learning activities. The findings reveal that there is a lack of sufficient awareness among school leaders about STEAM, emphasizing the need for a deeper understanding of its pedagogical significance. The study highlights the importance of regular engagement with leaders, teachers, and stakeholders to foster an awareness of the necessity of STEAM as a pedagogical approach. Despite recognizing the need for STEAM, school leaders express the allure of continuous support for both leaders and teachers to effectively understand and implement STEAM in Nepalese schools. In light of the study's results, it is recommended that further research be conducted to delve into this subject in more detail. Additionally, there is a call for the continuous expansion of workshops and training programs targeted at school leaders and teachers to enhance their understanding and ensure the sustainable implementation of STEAM in schools throughout Nepal.

Keywords: STEAM Education, Perception of School Leaders, Creativity, Sustainability, Implementing

Introduction

STEAM (Science, Technology, Engineering, Arts, and Mathematics) is an emerging pedagogical approach to education that empowers teachers in the classroom. There is a growing enthusiasm for STEAM education, recognizing its role in preparing students for an increasingly complex and competitive global environment (Boice et al., 2011). STEAM encourages teachers to utilize project-based, inquiry-based, and hands-on learning activities, fostering an inclusive and integrative learning environment where all students can engage and contribute productively. It serves as an access point for students' inquiry, creativity, critical thinking, and inclusive dialogue while teaching various subjects in an integrated form. STEAM education uses science, technology, engineering, arts, and mathematics as guiding sources for students to engage in dialogues, inquiry, and critical thinking (Riley & Solic, 2017).

Furthermore, STEAM assures students' engagement in creative work through group collaboration, resulting in innovative outcomes. The STEAM curriculum is learner-centric, incorporating instructional pedagogies such as inquiry-based, project-based, art-based, and research-based learning, with teachers serving as facilitators rather than direct problem solvers. Herro et al. (2018) suggest that these learning opportunities foster innovative thinking and creativity in solving authentic problems.

The use of the STEAM approach has become indispensable in school education, emerging as one of the latest and most influential teaching tools for the democratic and meaningful participation of students in the learning process through various activities, projects, and practical experiences. Hammad and Khan (2021) argue that implementing STEAM in school education engages students with cognitive tools and complex reasoning skills, involving them in scientific research, philosophy, and ethics. Integrating STEAM into teaching and learning activities in the classroom helps build 21st-century core skills, preparing students for growth and progress.

However, the current education system often neglects the teaching of problem-solving skills and collaboration. To address this, schools need to transition from traditional rote learning to a holistic interdisciplinary approach like STEAM (Lanthan, 2017). STEAM is considered an interdisciplinary to transdisciplinary approach to teaching and learning (Liao, 2016). Despite its potential, the execution of STEAM in school education remains limited, with school leaders holding different perspectives on how to conceptualize STEAM based on purpose, the nature of discipline integration, and their roles.

The awareness and perception of school leaders regarding STEAM play a significant role in its implementation in the teaching and learning process. The challenges lie in interpreting and enacting STEAM in classrooms, as leaders and teachers may not be sufficiently familiar with STEAM principles. Proactive and committed school leaders are essential to promoting high-quality education using STEAM instruction, given the inherent challenges. This is influenced by teachers' preparedness, attitude, and willingness. School leaders need to focus on motivating all stakeholders for STEAM implementation, and understanding leaders' perceptions of STEAM as pedagogical tools. Therefore, it is essential to investigate how school leaders perceive STEAM as a pedagogical approach and understand their views on its implementation, addressing the what, how, and why of their perspectives.

Problem Statement

The understanding of the STEAM pedagogical approach by school leaders is crucial for its effective implementation in classrooms. The growing demand for STEAM education at the school level emphasizes the need for learners to develop creativity and innovation by comprehending science, technology, and arts. Consequently, the leadership's skills, knowledge, and understanding become pivotal for the successful integration of STEAM into teaching and learning activities. However, the extent to which school leaders are aware of STEAM and their role in supporting teachers for its effective implementation remains uncertain. Through interactions with other school leaders, it has been observed that a significant number are unaware of STEAM. Thus, there is a pressing need to equip school leaders with the necessary knowledge and understanding through professional development strategies to enhance their capacity for STEAM implementation.

Purpose of the Study

The primary aim of this study is to enhance the perception of school leaders regarding STEAM as a pedagogical approach to education. The study seeks to analyze how leaders recognize and define the direction of STEAM education. Specifically, it explores leaders' perceptions of STEAM as a pedagogical approach and aims to provide recommendations for further steps to ensure the effective and meaningful integration of STEAM in school education.

Research Question

i) How do school leaders perceive STEAM Education?

Significance of the Study

This study holds significant importance in extracting the knowledge, understanding, and skills of leaders concerning STEAM as a pedagogical approach. It helps readers comprehend the role of school leaders in creating an environment conducive to STEAM activities. Additionally, the study conducts interviews with school leaders to understand their perceptions of STEAM and how, if at all, they are implementing it. Given that STEAM is a valuable tool for fostering problem-solving, creativity, and innovative skills in students, this research aids school management in integrating the STEAM approach into teaching and learning activities. The study also recommends policy changes in schools to incorporate the STEAM approach. Recognizing that teachers are key players in STEAM implementation, the study also explores the need for a STEAM professional development program for both school leaders and teachers.

Literature Review

In this section, I have reviewed various scholarly articles and journals related to STEAM in education. The literature indicates a global trend of increasing implementation of STEAM in schools worldwide. STEAM, an integrated pedagogical approach, represents a paradigm shift in learning methodologies, fostering innovation, creativity, and practicality in study. It amalgamates Science, Technology, Engineering, Arts, and Mathematics, engaging students actively in addressing real-world problems (de la Garza, 2021). This approach aims to equip

students with the knowledge, attitudes, and skills necessary for problem-solving, designing, and explaining natural phenomena (Harris & Bruin, 2018).

STEAM emerges as a powerful pedagogical approach, emphasizing interactive and activity-based learning, project-based learning, research-based learning, and innovative learning. Notably, STEAM enhances students' capacity to innovate (Taylor, 2016), making it an optimal educational tool. The linchpin for transforming traditional education to the new STEAM approach is the school leader, responsible for reshaping the vision and mission of academic success for all students. The perception of school leaders plays a pivotal role in promoting the high quality of STEAM as a pedagogical approach (Lewis, 2015).

However, my interactions with school leaders reveal a lack of clear understanding regarding STEAM and its transformative impact on students' creativity, critical thinking, and innovation. Many leaders remain unaware of STEAM, even those who have implemented it express limited knowledge. In Nepal, there is a growing interest in STEAM implementation, but leaders need to comprehend its importance in education.

Research indicates a significant gap between leaders' perceptions and actual STEAM practices in education (Byun et al., 2016). Therefore, leaders' professional development is crucial to bridge this gap in Nepal. Most school leaders are unconscious of the need to implement STEAM in education.

Moreover, the collaborative effort of teachers from various disciplines is vital for understanding and implementing STEAM effectively (Jho et al., 2016). Teachers should engage in collaborative work to develop interdisciplinary instruction and communicate effectively. Challenges in implementing STEAM include considering social and emotional perspectives of learning and adapting to ever-changing pedagogy and technology (Luitel et al., 2020).

However, resistance to change persists among some leaders and teachers who prefer traditional teaching methods. Young, self-motivated teachers are eager for change but face challenges such as insufficient time and a lack of educational materials for STEAM implementation (Lee & Shin, 2014).

Therefore, leaders' professional development based on STEAM becomes crucial. Cook and Bush (2018) emphasize the role of school leaders in setting a vision and mission that focuses on the research and integration of the STEAM approach. This shift from system leadership to instructional leadership supports school leaders in recognizing the need for STEAM to enhance student engagement and foster creativity.

Kim (2014) argues that sustainable professional development for leaders should involve designing courses and lesson plans based on content and the integration of the STEAM approach in school education. The government of Nepal, through its National Education Policy 2076, aims to integrate STEAM education into the curriculum at all levels (NEP, 2076). However, challenges related to infrastructure, the readiness of leaders, and the realization of this commitment remain to be addressed.

Theoretical Review

In the exploration of issues related to leaders' perceptions and attitudes toward the STEAM approach and its implementation in schools, two distinct theoretical perspectives were employed in this research study. To elucidate these issues effectively, the study drew upon the Person Perception Theory, focusing on the cognitive processes involved in forming impressions of others and deriving conclusions from these impressions (Bargh et al., 1996). Within the realm of social psychology, Person Perception Theory addresses the social processing issues that influence how individuals perceive, interpret, and extract attitudes and behaviors from others (Cunningham, 2019). This perspective is particularly valuable for understanding the personal attributes of school leaders and teachers and their role in the transformative process within education. The aim is to uncover the personal attributes relevant to the issues at hand and to examine how leaders perceive STEAM as an interdisciplinary approach.

Person perception is a subjective process influenced by various variables, including the observation of people, the context of the situation, personal traits, and experiences. It facilitates a critical analysis of leaders' thoughts and perceptions regarding the identified issues.

On the other hand, social constructivism emerges as another significant theoretical perspective for instruction and practice, grounded in social experiences. School leaders engage in diverse interactions and participate in workshops and training sessions regularly. These interactions, visits, and participations contribute significantly to shaping perceptions of STEAM as a pedagogical approach. Social constructivism emphasizes the fundamental role of social interactions in the cognitive development of learners (Vygotsky & Cole, 1978). Regular participation in workshops, interactions, and collaborations is crucial for the complete integration of STEAM in schools. This study aims to construct knowledge, understanding, and skills among school leaders regarding STEAM, ultimately facilitating the implementation of the STEAM approach in school education.

For the successful integration of various disciplines under the STEAM approach, consistent interactions with teachers from different disciplines and other stakeholders are essential. This interaction allows for the implementation of STEAM in schools by garnering ideas and perceptions from observations, interactions, and collaborations. The constructivism theory underlines the significance of authentic learning experiences reflective of students' environments, involving the acquisition of understanding through interaction and collaboration with others, such as teachers, leaders, and experts (Wilson, 1996). This dialectic perspective aids in interpreting personal perceptions on the raised or forthcoming issues through the qualitative research design.

Methodology

Research Approach

In this investigation, I employed interpretivism paradigms to elucidate leaders' perspectives on STEAM education. The focus was on uncovering leaders' perceptions regarding the implementation of STEAM as a pedagogical approach, exploring their experiences, beliefs, and how these factors influence the incorporation of STEAM in schools. To address the research question, a qualitative approach was chosen. Intensive, focused, and purposeful

interviews and interactions were conducted with four school leaders to gather qualitative data. The use of narrative in this study facilitated the extraction of personal perceptions from respondents based on their experiences and beliefs.

The qualitative approach was selected to enable an in-depth exploration of leaders' perceptions regarding STEAM and its integration into teaching activities at schools. This method facilitated a comprehensive understanding of school leaders' perspectives on using STEAM in educational settings.

From the total schools in Budhanilkantha Municipality, four school leaders were selected for in-depth inquiry, comprising two from public schools (one male and one female) and two from private schools (both males). To ensure varied information related to the issue at hand, one public and one private school where STEAM or STEAM-related activities were already underway were chosen. Additionally, one public and one private school were selected where such practices were not being implemented. Purpose sampling was adopted to capture diverse perspectives on the implementation of STEAM in schools.

Method of Data Collection

To gather comprehensive information, semi-structured open-ended interview questions were prepared. The interviews took place separately in the respective offices of the school leaders in physical mode. Open-ended questions provided participants with flexibility in responding, aligning with Creswell's (2012) recommendation. In-depth interviews and focus groups were considered ideal methods for collecting data, aiming to extract individual experiences and perceptions of STEAM in education as a pedagogical approach.

A detailed interview guideline and formulated questionnaires were utilized, with verbal consent obtained through mobile phone calls before conducting the interviews. The interviews were conducted on different days, with a single-day session for public school leaders and a subsequent day for private school leaders. Responses were recorded using a mobile device, and brief notes were taken during the interviews. Prompts were employed to encourage participants to expand on their responses. The recorded information was transcribed for further analysis. The qualitative data were gathered through in-depth interviews and conversations, focusing on participants' academic background, professions, core subject areas, and willingness to progress in understanding their perceptions of STEAM practices in schools.

In a qualitative study, ethical considerations are of particular importance due to the in-depth nature of the study process (Arifin, 2018). To uphold ethical values, measures were taken, including safeguarding the identity of schools and leaders, obtaining verbal consent via phone calls before interviews, informing respondents about the issues, and securing consent for audio recording. Interviews were conducted in the leaders' offices at their respective schools on different dates and times, with respondents participating voluntarily. To protect personal identity, school leaders were coded as respondents A, B, C, and D.

Participants

A purposeful selection of four school leaders within Budhanilkantha Municipality was undertaken to gather perceptual data for the study. The participants comprised two school leaders from different public schools and two from private schools. Among the four schools,

one public and one private institution had initiated the concept of STEAM. The demographic details of the participants are outlined as follows:

Participants	Sex	Age (in years)	Type of School	Academic Background	Work Experiences as Leader	STEAM Experiences
A	Female	52 years	Public	Science Background at first, M. Ed. in Nepali T. U.	27 years	Intermediate
B	Male	48 years	Public	B. Sc., M. Ed., EPM from KU	13 years	Heard term STEAM with little knowledge
C	Male	49 years	Private	Master in Economics	17 years	Intermediate
D	Male	47	Private	Master in English and M. Phil in English from PU	15 years	Heard term STEAM with little knowledge

Results and Discussions

This study aimed to investigate the perspectives of school leaders on the implementation of STEAM (Science, Technology, Engineering, Arts, and Mathematics) in education using a qualitative research approach. The study employed a purposive sampling method in the context of Budhanilkantha Municipality, involving respondents from both public and private schools. The findings, derived from four in-depth interviews and the researcher's observations, are presented in three overarching themes.

STEAM in Education: An Integrated Approach

This study aimed to perceive and recognize people's experiences and knowledge regarding the practice of STEAM in education. The information obtained from selected respondents explored the role of academic background, experiences, and participation in this context. Respondent A reported that, due to a science background, her academic starting enabled her to view STEAM in school as an integrated approach to learning. She emphasized the importance of long experiences and various pedagogical exposures, which supported her in employing effective teaching and learning approaches.

Respondent A further highlighted that STEAM, as an innovative and creative pedagogical approach, amalgamates Science, Technology, Engineering, and Mathematics. Involving students in STEAM enhances learning tendencies and outcomes, fostering problem-solving skills. Active, dynamic, and well-trained leaders, according to respondent A, play a significant role in understanding and implementing STEAM in school education. STEAM, as an integrated pedagogical approach, enhances students' understanding across multiple

disciplines, contributing to improved problem-solving skills, application of science concepts, and advancements in technology and engineering (Psycharis, 2018).

Arts and Mathematics in STEAM are deemed essential, with arts playing a pivotal role in fostering creativity, expression, emotions, feelings, and imagination. The aesthetic value of arts in STEAM contributes to students becoming more creative and critical thinkers (Tan et al., 2021). Respondent B, a science background professional with an M. Phil in Education Leadership, expressed that STEAM is crucial for fostering creativity, critical thinking, innovation, and problem-solving skills. He provided an example illustrating the fusion of Science, Technology, Engineering, Arts, and Mathematics in a comprehensive learning approach.

According to Respondent B, STEAM is an integrated method that necessitates a shift in teaching methods within the classroom. He emphasized the importance of teacher preparedness and willingness, which is achievable with energetic, dynamic, and change-making leaders in schools. Respondent B asserted that STEAM is the best pedagogical method for teaching and learning in schools in the 21st century, indicating a paradigm shift in educational practices (Tan et al., 2021).

Respondent C, a leader in a private school with a management background, enthusiastically participated in the interview. Despite not having a detailed understanding of STEAM, the respondent acknowledged its significance through collaboration with a social enterprise. The involvement in activities of this organization helped the respondent recognize STEAM as a robust and influential integrated pedagogical approach in teaching and learning in schools.

The curriculum is essential for teaching specific disciplines in schools, but the integration of different disciplines for lifelong learning poses challenges. The Nepalese government has introduced an integrated curriculum in primary education, aligning with the STEAM model (Yakman, 2010). Respondent C emphasized the importance of STEAM in meeting the goals of 21st-century education, focusing on creativity, critical thinking, collaboration, communication, imagination, global citizenship, problem-solving, and digital literacy.

21st-century education aims to enhance survival skills through soft skills and technological skills, demanding their integration into schools. However, this integration creates challenges in pedagogy and assessment, with curriculum, professional development, and assessment being intertwined factors (Soland et al., 2013; Erdem, 2020). Aligning STEAM in the curriculum is deemed essential for a better life in the world, fostering new entrepreneurship, sociability, and adaptability.

Respondent D, with an academic background in mathematics and literature, has served as a school leader in various institutions. As a member of the PABSON committee, Respondent D participated in discussions, training, and workshops, gaining insights into the use of STEAM in education as an integrated approach. Although not extensively aware of its implementation, Respondent D recognized STEAM as an integrated curriculum emphasizing science, technology, engineering, arts, and mathematics through multidisciplinary and interdisciplinary approaches.

STEAM education has gained popularity, emphasizing interdisciplinary and transdisciplinary learning approaches (Liliawati et al., 2018). Respondents in this study, through interviews, expressed STEAM as an integrated approach to teaching and learning, essential for 21st-

century education. STEAM incorporates innovative, creative, collaborative, and communicative skills, addressing real-world problem-solving.

Moreover, Richard & Biffle (2016) argue that STEAM is a multidisciplinary to transdisciplinary approach, focusing on problem-based inquiry, research, lifelong holistic learning, and enhancing problem-solving, critical thinking, and tactile skills (Maeda, 2014). Respondents highlighted that STEAM develops self-reflection, communication, collaboration, creativity, and innovation in students, facilitating holistic and innovative learning (Naithram, 2014). Although respondents acknowledged the importance of STEAM in school-level education, they expressed a lack of a clear concept on its implementation in existing classroom settings.

Implementation of the STEAM Approach Poses Challenges

This study aims to explore how school leaders perceive and act upon the practices of STEAM education within their schools, focusing on the integration of STEAM into classroom teaching and learning activities. Interview questions under this theme seek to identify the efforts STEAM leaders undertake to embed STEAM across various content areas in the school. Respondent A asserts that integrating STEAM into the teaching and learning process enhances liveliness, effectiveness, and creativity. The respondent emphasizes the successful initiation of the STEAM approach after training 40 teachers, leading to enthusiastic teacher adoption and effective teamwork. The gradual growth in this approach is illustrated through examples of traditional object displays, incorporating indigenous knowledge to enhance STEAM practices in the school.

The implementation of the STEAM approach at the school level is acknowledged as challenging but crucial, with the leader's role being pivotal in ensuring success. Proactive, dynamic, and committed leaders play a significant role in embedding STEAM in teaching and learning activities at the school level. Collaboration among teachers from different disciplines is deemed essential for developing STEAM-based curricula and lesson plans (Hammad & Khan, 2021). The integration of traditional and indigenous tools, techniques, arts, and artifacts further aids in aligning STEAM subjects with traditional ones.

Respondent B provides a different perspective, highlighting the difficulties faced in implementing STEAM practices in a government school setting. Resistance to change among teachers, coupled with concerns about job security, poses obstacles to the successful integration of the STEAM approach. Effective collaboration between leaders and teachers is deemed crucial for overcoming these challenges and ensuring the successful implementation of STEAM in school-level education.

Respondent C, a leader in a private school, emphasizes the inevitability of incorporating STEAM practices in teaching and learning processes. Despite challenges in perfect implementation across all grades and subjects, the leader underscores the role of leaders' perception in driving effective STEAM practices. Professional development, collaboration among teachers, and effective communication of concepts are identified as key factors supporting STEAM in the school curriculum (Hammad & Khan, 2021).

Respondent D expresses reservations about the feasibility of integrating STEAM during regular class hours, citing teachers' and parents' time constraints. However, acknowledging

the importance of incorporating new approaches in the curriculum, the respondent highlights the challenges associated with teachers' preparedness, attitudes, and interests.

The common theme among respondents is the unanimous recognition of the essential nature of STEAM in school education, despite facing challenges. Barriers include teachers' preparedness, willingness, and proactiveness, as well as national curriculum constraints, time limitations, and a marks-oriented mindset among guardians. Challenges in STEAM implementation reported by teachers include collaboration difficulties, increased workload, and a lack of understanding of STEAM integration (Harro et al., 2018).

Sustainability of the STEAM Approach in Schools Requires Regular Professional Development Programs

In Nepal, a paradigm shift in pedagogical approaches from traditional 'chalk and talk' to innovative, effective, and creative methods is imperative. STEAM, an integrated learning approach, amalgamates various disciplines to address and solve real-life problems. Given the multitude of challenges at the community, national, and international levels, as well as environmental concerns crucial for survival, integrating STEAM into teaching and learning becomes essential. This approach connects knowledge and skills with real-life situations and environments, fostering the development of better individuals for the future.

However, ensuring the sustainability of implementing STEAM in teaching and learning activities faces challenges. Respondent A emphasized the necessity of regular discussions, interactions, and participation in training and workshops for the effective and sustainable implementation of STEAM. Despite acknowledging STEAM's significance, challenges such as budget constraints, limited space, and primarily teachers' attitudes and behavior hinder the integration of STEAM in school education.

Respondent A highlighted that participation in various workshops and STEAM training sessions positively influenced her and motivated her to promote STEAM in her school. Despite the growing interest in STEAM education in Nepal, its sustainable implementation is hindered by factors such as teacher and leader awareness, training on STEAM pedagogy, teachers' attitudes, willingness, and budget constraints. Workshops and training sessions have proven to increase teachers' interest in implementing STEAM in their classrooms and enhance their enjoyment of teaching STEAM lessons (Boice et al., 2021). Continuous and robust support for teachers plays a crucial role in the sustainable implementation of STEAM.

In terms of sustainability, respondent B outlined plans to incorporate STEAM in their system, including STEAM-based training for teachers in the current academic session with the collaboration of Kathmandu University and other organizations. Kathmandu University School of Education (KUSOED) has introduced programs focusing on STEAM education, offering training and workshops for schoolteachers and leaders.

Respondent C demonstrated a proactive stance, emphasizing the importance of nurturing students' innovative attributes through engaging activities for a safer and wiser world. Commitment from school leaders and regular support to teachers is crucial for the perfect implementation of STEAM in schools. Leader awareness and proactiveness are essential for conducting training and workshops, enhancing teacher efficacy, and ensuring sustainable STEAM use.

In comparison, respondent D highlighted the importance of ongoing support through training, workshops, and interactions for effective STEAM implementation. The attributes of teachers can impact STEAM implementation negatively, necessitating leaders' roles in motivating teachers to understand and implement STEAM in teaching and learning activities. Implementing STEAM in the classroom presents challenges, requiring collaboration, increased workload, and an understanding of STEAM integration. Therefore, teachers should be continuously trained and encouraged for STEAM implementation through practical and interactive workshops.

Respondents collectively agreed that the perception of school leaders on STEAM is often insufficient, and regular support for both leaders and teachers is essential for effective STEAM implementation at the school level. Professional development programs for leaders and teachers increase confidence in planning and implementing STEAM, fostering interest, motivation, creativity, and collaborative abilities. Respondents emphasized the need for advanced professional development training and workshops that are practical, interactive, and hands-on, ensuring that educators can directly apply what they learn in the classroom.

Findings and Conclusion

In the context of Nepal, STEAM emerges as a novel integrated pedagogical approach in school-level education, garnering significant attention in educational forums and institutions. Kathmandu University School of Education (KUSoEd) has taken proactive steps by introducing Master and M. Phil courses in STEAM education. These programs aim to produce well-qualified and trained schoolteachers and leaders, enabling them to effectively implement STEAM in school-level education.

The qualitative narrative inquiry and discussions conducted for this study revealed key insights. The primary conclusion is that school leaders exhibit varying degrees of awareness about STEAM. Approximately half of the participants have initiated the implementation of STEAM in their schools to some extent, although they express uncertainty about the precise methods. The remaining respondents are aware of STEAM but have not yet initiated its implementation. All participants unanimously acknowledge the importance of STEAM in education, citing its positive impact on students' creativity, critical thinking, and engagement. However, the study underscores that the leadership's role is crucial, as school leaders directly guide teachers in integrating STEAM into their teaching practices.

Sanchez et al. (2020) highlight the unique role of school leaders in guiding and supporting the professional development of teachers. Consequently, the perception of school leaders regarding the practices of STEAM in school education plays a pivotal role. Effective implementation becomes more feasible when leaders possess a well-crafted understanding of STEAM and are committed to its application in schools. Respondents emphasize the need for sequential and continuous professional development training and workshops for teachers to successfully adopt the STEAM approach in teaching-learning activities.

The study participants, primarily from public schools, note the challenges posed by teachers' resistance to change and their hesitation to embrace a new system or approach, particularly when transitioning from traditional methods. Teachers' efficacy, interest, and attitudes emerge as consistent factors hindering the perception and implementation of STEAM in schools.

Collaboration among teachers of different subjects is identified as a key strategy for enhancing understanding and support for STEAM. The essence of STEAM education lies in applying knowledge to real-life situations and fostering problem-solving skills through innovation, creativity, critical thinking, and collaboration.

In the context of Nepal, the study finds that only a limited number of school leaders have a well-formed perception of STEAM and are committed to its practice. However, a majority of school leaders remain unaware of STEAM. Consequently, the study advocates for the widespread adoption of the STEAM approach across all schools. Achieving this goal requires comprehensive training, workshops, and continuous support for schoolteachers and leaders, enabling them to fully embrace and understand STEAM for the benefit of present and future generations.

Recommendation

Based on the results and discussions presented, several recommendations emerge for the effective implementation of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education in schools. These recommendations aim to foster a conducive environment for nurturing students' creativity and problem-solving skills:

Commitment of School Leaders: The transformation from traditional schools to STEAM-based institutions requires a steadfast commitment from school leaders. To enhance students' creativity and problem-solving skills, school leaders should actively embrace and drive the necessary changes.

Professional Development for Teachers: School leaders play a pivotal role in facilitating the integration of STEAM into the curriculum. They should prioritize engaging teachers in professional development programs that focus on the integrated approach of teaching and learning within the STEAM framework. This ensures that educators are well-equipped to deliver STEAM-based education effectively.

Self-Motivation and Collaboration: Both school leaders and teachers must exhibit self-motivation and commitment to the practice of STEAM in schools. It is imperative that they approach this educational shift with positivity, willingness, and a keen interest in fostering discussions and collaborations. This collaborative spirit is essential for the seamless and effective implementation of STEAM education.

Further Research: To deepen our understanding of the perceptions of leaders and teachers regarding STEAM education, additional studies should be conducted. These studies could delve into the specific attitudes, challenges, and opportunities that educators encounter when transitioning to STEAM-based teaching methodologies.

Leadership in STEAM Integration: School leaders are encouraged to take on the role of STEAM leaders. By assuming this leadership position, they can actively equip, encourage, and motivate teachers to embrace the pedagogical changes associated with transitioning from traditional teaching methods to the more integrated and holistic approach of STEAM education. This leadership is crucial in fostering a positive and supportive environment for both educators and students.

Appendix

Questionnaires
Perceptions of School Leaders' on the Practices of STEAM as Pedagogical Approach in School Education

Questionnaire for quantitative information
Respondent's Information
Name of respondent: …………………………………………………………………....
Age.: ……………………..Sex: Male ☐   Female ☐
Subjective Background: …………………
Qualification………………………………
Experience: ……………… years   Pedagogy used in classroom: …………….
Training and workshop taken:………………. Times   Type: ………………………….
Name of school and address:
Types of school: Private ☐   Public ☐

Questionnaires for interview

1. Would you introduce yourself and little about family background?
2. How do you describe your experiences in school as leader, including elementary school, middle school, and high school?
3. How familiar are you with teaching pedagogy practiced in school?
4. Have been you involved in training or workshop related to pedagogical approaches in school? Please share your experiences
5. Describe your Understanding of STEAM in Education as a pedagogy?
6. What do you believe that STEAM is appropriate teaching learning pedagogy in this era? Elaborate based on your experiences.
7. What would you like others to know about how schools can better educate students through STEAM approach in learning process inside the classroom?
8. How often your teachers use STEAM approach in classroom teaching – learning activities?
9. Are you satisfied whatever teachers are using STEAM in teaching learning activities? If yes or no, present your argument over the statement.
10. What reformative efforts are required for effective implementation of STEAM in school?

Note: Some probing questions were asked for the extraction of further perception of respondents on STEAM as pedagogical approach i

References

Arifin, S. R. M. (2018). Ethical considerations in qualitative study. *International Journal of Care Scholars*, *1*(2), 30-33.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology, 71,* 230-244.

Boice, K. L.; Jackson, J. R.; Alemdar, M.; Rao, A. E.; Grossman, S.; & Usselman, M. (2021). Supporting teachers on their STEAM journey: A collaborative STEAM teacher training program. *Education Sciences, 11*(105), 1 – 20. https://doi.org/10.3390/educsci11030105

Byun, S., Sim, J., & Baek, Y. S. (2016). Teachers' perceptions and practices of STEAM education in South Korea. *Eurasia Journal of Mathematics, Science and Technology Education, 12*(7), 1739 – 1753. https://doi:10.12973/eurasia.2016.1531a

Conradty, C. & Bogner, F. X. (2020). STEAM teaching professional development works: effects on students' creativity and motivation. *Smart Learning Environment, 7*(26). https://doi.org/10.1186/s40561-020-00132-9

Cook, K. L., & Bush, S. B. (2018). Design thinking in integrated STEAM learning: Surveying the landscape and exploring exemplars in elementary grades. *School Science and Mathematics*, *118*(4), 93-103.

Creswell, J. W. (2012). *Educational research*. Pearson.

Cunningham, S. (2019). *Person Perception in Psychology*. doi:10.1093/obo/9780199828340-0136. https://www.oxfordbibliographies.com/view/document/obo-9780199828340/obo-9780199828340-0136.xml

de la Garza, A. (2021). Internationalizing the curriculum for STEAM (STEM+ Arts and Humanities): From intercultural competence to cultural humility. *Journal of Studies in International Education*, *25*(2), 123-135.

Erdem, C. (2019). Introduction to 21st-century skills and education.

Hammad, S. & Khan, N. (2021). School Leader`s Perceptions about STEAM Education to develop STEAM Schools in Pakistan. *LC International Journal of STEM 1*(4), 155-165. https://doi.org/10.5281/zenodo.5149807

Harris A. & Bruin, L. R. D. (2018). Secondary school creativity, teacher practice and STEAM education: An international study. *Journal of Education Change, 19*(2), 153-179. Doi:10.1007/s10833-017-9311-2

Harro, D., Quigley C., & Cian, H. (2018). The Challenges of STEAM Instruction: Lessons from the Field. *Action in Teacher Education, 41*, 1-19. 10.1080/01626620.2018.1551159.

Herro, D., Quigley, C., & Jacques, L. A. (2018). Examining technology integration in middle school STEAM units. *Technology, Pedagogy and Education*, *27*(4), 485-498.

Jho, H., Hong, O., & Song, J. (2016). An analysis of STEM/STEAM teacher education in Korea with a case study of two schools from a community of practice perspective. *Eurasia Journal of Mathematics, Science & Technology Education,* 2016, 12(7), 1843-1862. https://doi:10.12973/eurasia.2016.1538a

Kathmandu University School of Education (KUSOED). (2019). *STEAM education. Program Brochure.* https://soe.kusoed.edu.np/steam-education/

Kathmandu University School of Education (KUSOED). (2018). *Curriculum for M.Phil. in education: Specialization in STEAM education.* http://soe.kusoed.edu.np/wp-content/uploads/2019/01/MPhil-STEAM.pdf

Kim, S. Y. (2014). Changes of preservice biology teachers' epistemological beliefs and worldviews through teaching practice focused on constructivism. *Korean Journal of Teacher Education, 30*(4), 235-254.

Lathan, J. (2017). STEAM Education: A 21st Century approach to learning. University of San Diego. https://onlinedegrees.sandiego.edu/steam-education-in-schools/

Lee, J. M., & Shin, Y. J. (2014). An analysis of elementary school teachers' difficulties in the STEAM class. *Journal of Korean Elementary Science Education, 33*(3), 588-596.

Lewis, A. (2015). Putting the "H" in STEAM: Paradigms for Modern Liberal Arts Education. In: Ge, X., Ifenthaler, D., Spector, J. (eds) Emerging Technologies for STEAM Education. Educational Communications and Technology: Issues and Innovations. Springer, Cham. https://doi.org/10.1007/978-3-319-02573-5_14

Liao, C.L. (2016). From Interdisciplinary to Transdisciplinary: An Arts-Integrated Approach to STEAM Education. *Art Education, 69*, 44 - 49.

Liliawati, W., Rusnayati, H., & Aristantia, G. (2018). Implementation of STEAM education to improve mastery of concepts. *Conference Series: Materials Science and Engineering 288* (1),

Luitel, B. C., Pant, B. P., & Pant S. K. (2020). STEAM pedagogy as an Approach for teacher professional development. *Mathematics Education Forum Chitwan, 5*(5), 28 – 33.

Maeda, J. (2013). STEM + Art = STEAM. *The STEAM Journal,1*(1). doi:10.5642/steam.201301.34

Ministry of Education, Science and Technology (2076). Education Policy. Government of Nepal, Sighadarbar

Naithram, R. (2014). How music education powers the STEAM movement. Neat Today. Retrieved from http://neatoday.org/how-music-education-powers-the-steammovement

Psycharis, S. (2018). STEAM in education: A literature review on the role of computational thinking, engineering epistemology and computational science. Computational STEAM pedagogy (CSP). *Scientific Culture*, *4*(2), 51-72.

Quigley, C.F., & Herro, D. (2016). Finding the joy in the unknown: Implementation of STEAM teaching practices in middle school science and math classrooms. *Journal of Science Education and Technology, 25,* 410–426.

Richard, L., & Biffle, T. (2016). *Introduction to STEAM (Science, Technology, Engineering, Arts, and Mathematics)*. Thomas College

Riley, K., & Solic, K. (2017). "Change Happens Beyond the Comfort Zone" Bringing Undergraduate Teacher-Candidates Into Activist Teacher Communities. *Journal of Teacher Education*, *68*(2), 179-192.

Sanchez, J. E., Paul, J. M., & Thornton, B. W. (2020). Relationships among teachers' perceptions of principal leadership and teachers' perceptions of school climate in the high school setting. *International Journal of Leadership in Education*, 1-21.

Soland, J., Hamilton, L. S., & Stecher, B. M. (2013). *Measuring 21st century competencies: Guidance for educators.* RAND Corporation.

Tan, W. L., Samsudin, M. A., Ismail, M. E., Ahmad, N. J., & Talib, C. A. (2021). Exploring the effectiveness of STEAM integrated approach via scratch on computational thinking. *EURASIA Journal of Mathematics, Science and Technology Education, 2021, 17*(12), 1-19 https://doi.org/10.29333/ejmste/11403

Taylor, P. C. (2016). *Why is a STEAM Curriculum Perspective Crucial to 21st Century?* In: 14th Annual conference of the Australian Council for Educational Research, Brisbane

Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard University Press.

Wilson, B. G. (1996). What is a constructivist learning environment? In B. G. Wilson (Ed.), Constructivist learning environments: *Case studies in instructional design*, 3-10, New Jersey, NJ: Educational Technology.

Yakman, G. (2010). *What is the point of STE@M? A brief overview.* http://www.academia.edu/8113832/

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