PROMOTING STEAM-BASED TEACHER PROFESSIONAL DEVELOPMENT FOR TRANSFORMATIVE LEARNING IN NEPAL: A PARTICIPATORY ACTION RESEARCH

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AN ABSTRACT

of the dissertation of *Durga Pandey* for the degree of *Master of Philosophy in STEAM Education*, presented on 23 September, 2026, entitled *Promoting STEAM-Based Teacher Professional Development for Transformative Learning in Nepal: A Participatory Action Research*.

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Teachers play an integral role in shaping the education system. They are the key agents responsible for implementing educational policies. The future of learners depends upon how teachers guide, support, and shape their learning. In this 21st-century educational landscape, various innovations and trends are evolving. The rapid development of innovative pedagogies, curricula, and technologies is continuously shaping and transforming the unpredictable future of learners. In this context, to address future challenges, learners need more holistic learning that focuses on integrated, creative, critical, collaborative, and problem-solving skills, rather than content- or subject-specific knowledge. Teachers are the main pillar of education, whose right guidance paves the way for a better future for learners. Therefore, teachers need continuous professional development (TPD) to update their knowledge, pedagogical practices, and skills, and to respond effectively to the evolving needs of contemporary classrooms. Meaningful transformation in education is possible only when teachers are continuously supported to reflect on and improve their practice

However, most Teacher professional development (TPD) programs in Nepal remain largely theoretical and expert-driven rather than participatory and responsive to teachers' actual needs. Further, many training programs neglect the practical application of the learning in the actual classroom. Furthermore, most teacher professional development sessions are often designed without analyzing teachers' needs, challenges, and reflections. In today's educational landscape, it is essential to focus on the holistic development of the learner; to do so, it's essential to prioritize

teacher professional development, which actively involves them in identifying challenges and solutions and in implementing practices. This requires a shift from traditional top-down, expert-driven approaches to more participatory, bottom–up approaches. A STEAM-based teacher professional development approach provides an opportunity to facilitate such a shift by focusing on a multi-, inter-, and transdisciplinary approach in which learners are allowed to collaborate and develop critical, creative thinking.

This study seeks to promote transformative learning in education through a STEAM (Science, Technology, Engineering, Arts, and Mathematics)- based Teacher Professional Development. As the main purpose of the research is related to the transformation of education, for this, teacher direct involvement in the TPD is essential. For this, Participatory action research was used as the research method, with participants as co-researchers directly involved from needs analysis to reflection. In addition, the research was conducted with 10 teachers at a private school who taught grades 3-6. Data were collected through interviews, observation, questionnaires, and focus group discussions. The research was conducted in two cycles: in the first cycle, teachers designed, implemented, and reflected on integrated projects. The second cycle focused on the opportunities and challenges of integrating art into learning to enrich creativity and meaningful learning in the classroom.

The research findings focus on the effectiveness of STEAM-based TPD in fostering reflective practice, collaborative engagement, and holistic learning environments. The research highlights the importance of teacher-led, need-based, continuous STEAM-based teacher professional development programs as a catalyst for educational transformation.

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शोधसार

STEAM Education मा दर्शनशास्त्रको स्नातकोत्तरको डिग्रीका लागि दुर्गा पाण्डेयको शोध प्रबन्धको शिर्षक “रूपान्तरणात्मक सिकाइका लागि STEAM शिक्षामा शिक्षकको व्यावसायिक विकास: एक सहभागितामूलक कार्य अनुसन्धान” ७ असोज २०८३ मा प्रस्तुत गरिएको थियो ।

.....

सह. प्रा. विनोद प्रसाद पन्त, पीएचडी

शोध निर्देशक

शिक्षा प्रणालीको संरचनात्मक, गुणात्मक तथा रूपान्तरणकारी विकासमा शिक्षकको भूमिका महत्त्वपूर्ण तथा अपरिहार्य रहन्छ। शिक्षकहरू ज्ञान हस्तान्तरणकर्ता मात्र नभई शैक्षिक नीति, पाठ्यक्रम तथा शिक्षण–सिकाइसम्बन्धी प्रावधानलाई व्यवहारमा कार्यान्वयन गर्ने प्रमुख अभिकर्ता हुन्। विद्यार्थीको बौद्धिक, सामाजिक, भावनात्मक, सिर्जनात्मक तथा नैतिक विकास शिक्षकको मार्गदर्शन, सहजीकरण र व्यावसायिक दक्षतासँग प्रत्यक्ष रूपमा अन्तर्सम्बन्धित हुन्छ। त्यसैले शिक्षकलाई शिक्षा प्रणालीका कार्यान्वयनकर्ता मात्र नभई शैक्षिक रूपान्तरणका प्रमुख परिवर्तनकारी अभिकर्ताका रूपमा चित्रण गर्न सकिन्छ।

एक्काइसौँ शताब्दीमा तीव्र रूपमा परिवर्तित शैक्षिक परिदृश्यमा डिजिटल प्रविधि, कृत्रिम बुद्धिमत्ता, नवीन शिक्षणशास्त्र तथा पाठ्यक्रममा हुने नवप्रवर्तनले शिक्षण–सिकाइका परम्परागत अवधारणालाई पुनः परिभाषित गरिरहेका छन्। यस परिवेशमा विषयगत ज्ञानको मात्र सम्प्रेषण पर्याप्त नभई विद्यार्थीमा एकीकृत चिन्तन, सिर्जनात्मकता, आलोचनात्मक चिन्तन, सहकार्य, सञ्चार तथा समस्या समाधानजस्ता उच्चस्तरीय क्षमताको विकास अपरिहार्य भएको छ। यसका लागि शिक्षकहरूलाई समकालीन ज्ञान, शिक्षणशास्त्रीय अभ्यास, प्रविधि तथा विद्यार्थीका परिवर्तनशील आवश्यकतासँग निरन्तर अनुकूलित गराउन शिक्षक व्यावसायिक विकास (Teacher Professional Development—TPD) लाई निरन्तर, अभ्यास–केन्द्रित तथा आत्मचिन्तनात्मक प्रक्रियाका रूपमा स्थापित गर्नु आवश्यक हुन्छ।

शिक्षामा दिगो रूपान्तरण नीति, पाठ्यक्रम वा प्रविधिगत हस्तक्षेपबाट मात्र सम्भव हुँदैन। यसको वास्तविक प्रयोग शिक्षकहरूको कक्षाकोठामा दैनिक अभ्यासमा हुनुपर्छ। प्रभावकारी TPD ले शिक्षकलाई बाह्य विशेषज्ञबाट ज्ञान ग्रहण गर्ने निष्क्रिय प्राप्तकर्ताका रूपमा नभई आफ्नै व्यावसायिक ज्ञान तथा अभ्यासका सक्रिय निर्माता र सहनिर्माताका रूपमा स्थापित गर्नुपर्छ। तथापि, नेपालको सन्दर्भमा विद्यमान TPD कार्यक्रमहरू धेरै हदसम्म सैद्धान्तिक, प्रशिक्षणमुखी तथा विशेषज्ञ–निर्देशित देखिन्छन् । जसमा शिक्षकका वास्तविक आवश्यकता, कक्षाकोठागत चुनौती, स्थानीय सन्दर्भ तथा आत्मचिन्तनलाई पर्याप्त स्थान नहुन सक्छ। फलतः तालिमबाट प्राप्त ज्ञानलाई वास्तविक शिक्षण–सिकाइ अभ्यासमा रूपान्तरण गर्ने पक्ष चुनौतीपूर्ण रहन्छ। यस सन्दर्भमा शीर्ष–देखि–तल (top-down) पद्धतिबाट सहभागितामूलक, आवश्यकता–आधारित तथा तल्लो–तहदेखि–माथितर्फ (bottom-up) उन्मुख TPD तर्फ रूपान्तरण आवश्यक देखिन्छ।

यसै सन्दर्भमा विज्ञान, प्रविधि, इन्जिनियरिङ, कला तथा गणित (Science, Technology, Engineering, Arts and Mathematics—STEAM) मा आधारित TPD ले शिक्षकको व्यावसायिक सिकाइलाई बहुविषयात्मक, अन्तरविषयात्मक तथा अन्तर्विषयक दृष्टिकोणमा पुनर्संरचना गर्ने सम्भावना प्रस्तुत गर्दछ। यसले विषयगत ज्ञानलाई एकीकृत गर्दै सिर्जनात्मकता, आलोचनात्मक चिन्तन, सहकार्य तथा समस्या समाधानमा आधारित सिकाइलाई प्रवर्द्धन गर्दछ। विशेषतः कला समावेशीकरणले सिकाइमा कल्पनाशीलता, अभिव्यक्ति, सिर्जनशीलता तथा वास्तविक अनुभवलाई सुदृढ गर्ने आधार प्रदान गर्दछ।

अनुसन्धानका निष्कर्षहरूले STEAM-आधारित TPD ले शिक्षकहरूको आत्मचिन्तनात्मक अभ्यास, सहकार्यात्मक संलग्नता तथा समग्र सिकाइ वातावरणको विकासमा सकारात्मक सम्भावना प्रस्तुत गर्ने देखाएका छन्। शिक्षकलाई आवश्यकता पहिचान, चुनौती विश्लेषण, समाधान सहनिर्माण, नवीन अभ्यासको प्रयोग तथा आत्मचिन्तनमा सक्रिय रूपमा सहभागी गराउँदा व्यावसायिक सिकाइ सन्दर्भ अनुकूल, अर्थपूर्ण तथा रूपान्तरणकारी बन्न सक्ने देखिन्छ। अतः शिक्षक नेतृत्वमा आधारित, आवश्यकता-केन्द्रित, निरन्तर तथा अभ्यास-आधारित STEAM TPD लाई शिक्षकको व्यावसायिक क्षमता अभिवृद्धि तथा शिक्षण–सिकाइमा दिगो रूपान्तरणका लागि महत्त्वपूर्ण उत्प्रेरकका रूपमा विकास गर्न सकिन्छ ।

..... & असोज @)*३

दुर्गा पाण्डे

उपाधि उम्मेदवार

This dissertation, entitled *Promoting STEAM-Based Teacher Professional Development for Transformative Learning in Nepal: A Participatory Action Research*, was presented by *Durga Pandey* on *23 September 2026*.

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DECLARATION

I hereby declare that this dissertation is my original work, and it has not been submitted for candidature for any other degree.

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DEDICATION

I dedicate this dissertation first and foremost to my beloved husband, Manoj Parajuli, whose guidance, vision regarding the value of higher education, and unwavering encouragement have continuously inspired me to contribute to the field of education. Further, I also like to dedicate it to my parents, Akhileshwor Pandey and Balkumari Pandey, whose continuous support, unconditional love, and belief in me paved the way for my educational achievements. I dedicate this dissertation to my two lovely princesses, Liza and Liyana, who bring immense joy to my life. My sincere appreciation goes to my sister–in–law, Mina Parajuli, and my brothers, Ganesh Pandey and Gagan Pandey, who always stood by me through the ups and downs of life, offering their support, care, and encouragement whenever needed. Finally, I dedicate this dissertation to my family members, mentors, participants, and colleagues; without their valuable contributions, I would not have been able to complete this important milestone in my MPhil journey.

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ABBREVIATIONS

AI	Artificial Intelligence
CDC	Curriculum Development Center
CEHRD	Centre for Education and Human Resource Development
MED	Master's in Education
MOEST	Ministry of Education, Science and Technology
NCF	National Curriculum Framework
NELTA	Nepal English Language Teachers Association
PAR	Participatory Action Research
PBL	Project-Based Learning
PD	Professional Development
STEAM	Science, Technology, Engineering, Arts, Mathematics
STEM	Science, Technology, Engineering and Mathematics
TPD	Teacher Professional Development

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CHAPTER I
INTRODUCTION

This chapter explores the need for STEAM-based teacher professional development in school education for transformative learning. In addition, I have explained why STEAM-based Teacher Professional Development (TPD) is needed in education, drawing on my own experiences, the situation of Nepal's education system, scholars' views, and the demands of today's educational landscape. Furthermore, this chapter presents the study's purpose, research question, significance, and limitations.

Background of the Study

In the 21st century, the educational dimension has been undergoing a significant shift towards democratic, emancipatory, and transformative STEAM education, which helps learners tackle future problems and issues in a holistic manner. The advancement of technology has created opportunities for innovation, with learners exploring and experimenting with a range of tools and learning strategies. The advancement of technology is also bringing challenges alongside opportunities, such as changes in learner behavior, more demanding classroom environments, diverse learner needs, and higher expectations among learners, and so on. In addition to technological advancement, new scientific innovations and various global issues are also emerging. To prepare learners for the future and enable them to tackle global issues, there is a need to focus on inter-, trans-, and multidisciplinary knowledge in education, which not only provides the content knowledge but also enhances their skills of collaboration, communication, logical reasoning, digital literacy, reflection, and other relevant skills. Thus, to develop such learners in this digital era, teachers need to adopt an interdisciplinary approach that encourages learners to use creativity alongside their technical knowledge to tackle problems in the curriculum, "in the general and global crisis in particular" (Dahal, 2022, p. 170). Furthermore, to develop these kinds of learners in this era, teachers also need to continuously update themselves by focusing on innovative professional development sessions, such as STEAM-based approaches that emphasize an inquiry-based, learner-centered, multidisciplinary approach.

Rather than disciplinary content knowledge, 21st-century education demands authentic and experimental learning. I have been involved in the educational sector for the last seven years. As a teacher and educator, I have encountered various dimensions of teaching and learning. While pursuing my Master's degree at Kathmandu University, I realized that the world is rapidly progressing towards new dimensions of education. Without continuously updating my knowledge and practices, it will be difficult to understand the contemporary educational landscape of the 21st century. Before joining Kathmandu University, my teaching practices and perceptions of students and teaching were the same as I had been taught as a student more than two decades earlier. As a teacher, I used to believe that learners needed to memorize mathematical procedures by heart. However, when I enrolled at Kathmandu University, I had the opportunity to encounter various education-related theories and pedagogies. Additionally, I attended some teacher professional development programs organized by the British Council and other organizations. Everything I learned from these training sessions and courses from Kathmandu University, I have tried to apply in my classroom. The results I achieved in my students' progress compelled me to rethink my approaches. I then realized that to make learning meaningful, it is essential to engage and motivate learners in the classroom through a variety of techniques and strategies. In Habermas' words, we need to adopt the qualities of practical and emancipatory teachers rather than technical ones in the classroom. Therefore, I believe that teachers need to participate in various professional development programs to enhance their capabilities, stay up to date with different dimensions of learning, and ultimately improve the overall quality of education.

I believe teachers play a pivotal role in shaping the education system and helping to envision the nation's educational goals. Schools are considered temples of knowledge and shape the future of learners. To keep this temple alive and prepare learners for the future, teachers need to continuously update themselves through different teacher professional programs. As claimed by Ankomah et al. (2005), "Schools without trained teachers cannot effectively fulfill their roles, and teachers play a pivotal role in educational provision and significantly affect education quality" (as cited in Abebe & Woldehanna, 2013, p. 1). A teacher's role in education is not confined to pedagogical and subject-matter knowledge or skills. Teachers are required to have a broad knowledge base, helpful, caring attitudes, professionalism, and the ability to organize and manage diverse groups of pupils. Teachers navigate the

education policy of the government, and teacher professional development “enables teachers to realize change and act as a change agent.” (Pokhrel & Behera, 2016, p. 191). I believe a teacher professional development program not only helps teachers sharpen their abilities but also adds another strong brick to their careers. In the rapid growth of the AI era, teachers need to integrate new technology into their teaching rather than rejecting it (Gentile et al., 2023). Nowadays, classrooms are filled with various types of learners, including abused, neglected, and ill-prepared students. To address these learners, teachers also need to update themselves with different practices and techniques (Larrivee, 2000). In this context, teacher professional training is essential to practice inclusive learning in the classroom.

Furthermore, in the 21st century, innovative educational practices and pedagogies have been emerging. However, our teaching methods have often remained conventional. Focusing solely on textbook knowledge is no longer sufficient. The world is progressing towards innovation, and education must follow suit. As Dewey suggests, we need to focus on learning by doing, art integration, and a range of strategies to make learning more meaningful (Roberts, 2003). Similarly, in addition to subject-specific knowledge and skills, soft skills such as critical thinking, logical reasoning, problem-solving, creativity, digital and technological literacy, leadership, collaboration, and global awareness need to be integrated into learning. To help learners develop these skills, teachers need to develop them in themselves first. Addressing these skills in learners requires teachers to understand the integrated concept of learning, which is only possible through STEAM-based teacher professional training. Further, in today’s world, STEM provides technical knowledge; integrating the arts into STEM helps learners develop critical and creative knowledge, which is essential for solving the 21st century's obstacles and challenges.

Teacher professional development relates to teachers' learning and the application of that knowledge in the classroom to meet learning standards. As stated by Creemers et al. (2012), “educator training and professional development are essential mechanisms for enhancing teachers’ content knowledge and developing their teaching practices to high standards” (p. 3). In this scenario, I believe there is a need for a well-planned teacher professional program to make learning transformative and sustainable. Additionally, as suggested by Yakman's (2010) model of STEAM, since our disciplines are interrelated, we need to focus on the integration model (STEAM-based) of teacher professional development, which helps transform learning.

While reviewing the Nepali context, we found that certain organizations have been providing various training to teachers in public schools, including the Center for Education and Human Resource Development (CHERD), the Nepal English Language Teachers Association (NELTA), universities, and some private organizations. However, the training they provide is insufficient; they seem more export- and supply-driven than need-driven (Dhungana & Gnawali, 2023). In one of the documents of the British Council and CHERD, it is illustrated that teacher professional development structures and responsibilities in Nepal are distributed across the federal, provincial, district, and local levels, as shown in the following image (Borg & Poudel, 2024). Based on this, we can say that in recent years, teacher professional development programs have been designed and responsibilities have been allocated among different federal, central, and local entities.

Figure 1

Different-Level Teacher Professional Development Entities of Nepal

Level	Units	Responsibility
Federal	MOEST – CEHRD	Formulate policies and central level plans; develop TPD framework and set TPD standards; provide central funding for TPD training; set quotas for TPD/ customised training; design TPD curriculum and training manual; conduct MTOT/ TOTs; verification of training.
Provincial	PETC	Deliver TPD training, plus customised training (needs-based) on cross-cutting issues and topics not covered in general TPD training and refresher training.
District	EDCU	Co-ordinate between PETC and Local Education Units in the selection of teachers for TPD training, sharing of trainers for TPD and customised trainings, curriculum orientations workshops.
Local (municipal)	Local Education Units	Support the selection of teachers for TPD training in coordination with schools; deliver customised training using programmes designed by CEHRD; implement TPS by observing teachers in schools and providing feedback; design and organise tailor-made training courses for teachers within the municipality.

Despite this type of structure, Mahara (2024) claimed that most of the training provided by such organizations is insufficiently informed by research on teachers' needs, views, challenges, and difficulties. Furthermore, the National Education Policy (2019) envisions a prominent role for teachers in education; however, the training required to enhance their skills remains inadequate. Further, several news reports claimed that the curriculum is usually revised by the National Curriculum Framework (NCF) committee based on its interests and needs. Similarly, books are prepared based on so-called experts' interests, whereas teachers, who are the real implementers of the curriculum, do not receive adequate professional training. For instance, the Ministry of Education, Science and Technology (MoEST) recently announced an

exam-free system through grade 5 (CDC, 2026), without consultation with teachers and educational leaders and with insufficient consideration of preparedness.

Similarly, private schools have their own policies and systems for organizing in-service and during-service teacher training programs. However, in the private sector as well, most training has been conducted based on the headteachers' demands without considering teachers' preferences and needs. Although the private sector is financially sound and has greater autonomy over its financial structure than community schools, there is still a lag in the teacher professional development section. For effective teacher professional development, many factors matter, including leadership, school priorities, organizational culture, policies, individual freedom, and teacher preparedness (Darling-Hammond et al., 2017; Shrestha, 2022). Further Teacher Professional Development (TPD) sessions ought to be centered on teachers' classroom needs and interests rather than on organizational or head teacher interests (Tamang et al., 2024). Most of the sessions, which are conducted in private schools, are trend- or stakeholder-driven and highly ambitious, rather than grounded in the actual needs of the classroom and in analysis of teachers' interests and needs (Shrestha & Acharya, 2023). Teacher professional development is a rigorous learning and development process that addresses the diverse needs of learners, rather than just training. Further, a review of the literature makes it clear that although most TPD training programs are beneficial for enhancing teachers' individual skills, much of the training lacks practical applicability in classroom settings. Some of the techniques discussed in the session did not align with the classroom's actual needs (Poudel, 2024). In this context, we can claim that the TPD in Nepal, both provided by the government and the private sector, are export-driven rather than school-based or need-based.

Basically, TPD is an approach that allows teachers to internalize the changes, act as change agents, and develop competencies within themselves. Though Nepal's curriculum has been updated gradually, teachers have not been provided with adequate in-service training (mostly in private schools), which would enable them to address the challenges they have faced during implementation (Kshetree & Pokhrel, 2024; Mahara, 2024). While working with teachers as an Academic Coordinator, I realized that teachers' needs differ from what we see on the surface. Basically, teachers have been seeking training that can be used in their classroom and make their teaching more effective. In most of the TPD programs I have attended in my career, I

have found that they focus on theoretical and philosophical perspectives rather than practical strategies we can implement directly in the classroom. My experience and participants' sharing during the needs analysis process reflect the border patterns of the Nepalese private school TPD culture. Though private schools have autonomy in decision-making and the financial sector, research indicates that teachers often have limited access to collaborative, sustainable professional development sessions. Thus, to enhance the teaching and learning environment, it's indispensable to focus on the STEAM-based teacher professional development program, which not only analyzes teachers' needs but also helps them keep pace with current teaching and learning practices and align them with learners' needs.

In today's educational landscape, it's essential to focus on training that is applicable in the classroom to enhance teaching and learning. Along with advances in technology and other artificial intelligence, it's essential to reform the pattern and nature of TPD. During interactions with the teachers (participants) after the completion of the 1st and 2nd cycles of the STEAM-based TPD sessions, they mentioned that the sessions were supportive, time-relevant, and classroom-applicable. Furthermore, they mentioned that, unlike other sessions, STEAM-based TPD provides learning opportunities in which teachers are directly involved and more focused on their needs and interests. Furthermore, these STEAM-based TPDs allow them to learn from each other by directly involving them in the session, from planning to reflection.

Statement of the Problem

Despite the Curriculum Development Center (CDC) of the Nepal government providing for the incorporation of innovative, modern pedagogical approaches, such as integrated learning, art-based learning, and project-based learning, these approaches have not been fully implemented in the classroom. In addition, CDC advocates for competency- based, integrated, and learner-centered learning; these policy aspirations have not been reflected in classroom practices. This implementation gap is influenced by fragmented, expert-driven TPD, examination- oriented school culture, teachers' limited preparedness to adopt innovative pedagogical practices, and inadequate opportunities for collaborative professional learning (Adhikari & Budhathoki, 2025; Dhungana et al., 2021). To achieve the curriculum's targeted goal, teachers need to understand and internalize these policies, trends, and pedagogies in their teaching and learning. Further, due to insufficient school-based TPD and CPD programs, teachers have been following the textbook as the curriculum and focusing

on traditional rote-memorization techniques in the classroom. In this context, to update teachers and enhance the quality of education, continuous professional training for teachers is necessary. The prolonged belief in the education system has been changing due to the emergence of different pedagogies and the use of technology (Pant et al., 2020). Most teachers in private schools are not familiar with new approaches to education and focus on conventional methods. In this context, the role of teacher professional development is to develop the knowledge and skills of "teachers for improved classroom teaching" and to transform education (Khanal & Adhikari, 2020, p. 11). Hence, to improve teachers' skills and make them familiar with current trends and changes in the education system, continuous professional development for teachers is needed.

In Nepal, although teacher professional development has been recognized as an important component and included in policy since 1971, the training is not collaborative and fails to address the difficulties teachers face. Furthermore, the nature of the TPD conducted is prescribed by donors, rigid, and inadequate (Dhungana et al., 2021). Moreover, such programmers are based on policymakers' interests, lack participatory needs analysis, and follow a top-down, one-size-fits-all model that may not address teachers' individual needs and contexts (Nugroho et al., 2024). In addition, as a school coordinator, I realized while talking with teachers that they are seeking a classroom approach that motivates their learners and fosters a positive mindset. Although they have participated in various TPD sessions organized by different institutions, they claim that most are theoretical and do not address the real problems teachers face in the classroom. In this context, most training is driven by institutional interests rather than the teacher's. In today's classroom, learners' nature is different; the strategies we have been following in recent years might not be useful. As a primary mathematics teacher, I had also been facing various challenges in managing students and helping them understand. For this, I employ various pedagogies in the classroom, including storytelling, role-playing, presentations, and integrated projects. In doing so, learners not only become motivated to learn but also understand the content from different perspectives. To bring about change in the education system and achieve 21st-century skills, there should be a focus on training grounded in teachers' needs that helps them change their practices to transform education. As presented in the British Council paper, training needs to be more action-oriented so that teachers can implement it in the classroom to bring about

changes in learners and education (Borg et al., 2020). Thus, to address the learners' needs of today's classroom and transform the education system from conventional to modern, action-oriented teacher professional programs are essential.

Although the Teacher Competency Framework, 2072 (2015/16) includes continuous learning and professional development among its goals, most schools and teachers still lack these opportunities. Furthermore, the courses and training offered by various universities and by local and federal governments still do not adequately support the development of the pedagogical component (Ministry of Education, Science and Technology [MoEST], 2022). Several studies have claimed that, in Nepal, teacher professional development programs cannot incorporate the local curriculum or implement it in the classroom with interdisciplinary integration (Borg et al., 2020; Dhungana et al., 2021). Moreover, shaping the future of the learner's equitable education is mandatory. But in our country, it's very hard to find well-trained, qualified teachers. For instance, the Nepalese government has been updating the curriculum, but only a few teachers are aware of this. Some articles (Dhungana et al., 2021; Panthee, 2021) claimed there is "a gap between policy and the practice of teacher professional development in Nepal. Various educational reform policies and movements worldwide are raising learning and teaching standards; however, in Nepal, we are still guided by conventional strategies and have not prepared teachers to adopt global trends in education. In this regard, to maintain the standards of the 21st-century educational movement, teachers' need-based continuous professional development is required.

Similarly, as school coordinators, we welcome novice teachers to our profession, but they are often unaware of the new trends in teaching and learning. Similarly, in our classroom, we observe a variety of learning styles. One strategy is not useful for everyone. In my experience, I believe in teacher development programs that foster collaboration and learning among teachers. As we know, quality education can determine children's futures; thus, it is essential to offer a range of professional development programs for teachers.

While STEM and STEAM share a common goal of developing competent learners, they differ in their educational emphasis. STEM education aligns with the subject-specific technical, rational, logical knowledge, whereas the integration of the 'A' in 'STEM' education advocates for creativity alongside rationalization (Boy, 2013). As Dahal (2022) claims, STEM focuses on the technical knowledge of a

particular subject; along with this, the fusion of STEM with ‘A’ provides learners with aesthetic value through interdisciplinary knowledge. In school education, it’s essential to understand learners’ mental well-being, emotions, and feelings. Technical knowledge provides concepts to learners, but bringing empathy and beautification to the learning component of Art is essential. Baraily and Belbase (2025) argued that teaching is not merely about delivering content but also about mentoring, facilitating, motivating, and inspiring learners. In addition, Rafiq-uz-Zaman (2026) asserted that, unlike STEM, the integration of the arts into learning makes the learning “environment more inclusive, enabling students to bridge the gap between their technical and humanistic knowledge” (p. 3). Thus, in today’s educational landscape, curriculum, pedagogy, and TPD sessions need to focus on aesthetic values rather than rigid disciplinary content knowledge, which may lead to disengagement and detachment in the learning and teaching process (Manandhar et al., 2022). Although various teacher professional development training sessions have been conducted, as suggested by Morris et al. (2021), we are still focusing on the disciplinary approach in the classroom, which is no longer useful in today’s classrooms. Our various problems and their solutions in daily life involve integrating different subjects. Thus, in learning, we also need to focus on integrating the disciplines through STEAM education. Further, the existing prescribed CPD programs that utilize off-site training approaches have not been effective in improving teachers' performance in schools. (Dhungana et al., 2021). To address all these problems, there is a need for participatory teacher professional development in STEAM education.

Purpose of the Study

The purpose of my participatory study is to enhance transformative learning among teachers through a STEAM-based teacher professional development program in a school.

Research Questions

Based on the purpose of the research, I generated the following research question:

How does STEAM-based teacher professional development promote transformative learning among teachers in the school?

Significance of the Study

Since my study is based on STEAM-based teacher professional development, it focuses on how we can shift attention to integrating learning in the classroom

through this approach. In this era, learning is moving towards a new dimension that not only provides learners with integrated content knowledge but also develops their soft skills. My study would be useful for teachers who want to focus on integrating learning.

Further, although the Nepali government has implemented an integrated curriculum in grades 1–3 and envisions a teacher professional development framework in the policy, teachers remain unaware of how to integrate the curriculum in the classroom. As my teacher's professional development is based on STEAM education, it will be helpful for those institutions that want to implement an integrated curriculum in their learning. Finally, the study will shed light on the teachers who want to update themselves and improve their practices through self-reflection.

Delimitation of the Study

My research particularly focuses on the STEAM-based participatory teacher professional development in Nepal, where teachers involved, updated their knowledge, and implemented it in the classroom for transformative learning. During the STEAM-based TPD session, teachers reflected on their practices and were updated through reflection, interaction, training, and practice reform. In addition, the TPD was based on the integration notion of the STEAM approach in the Nepali context.

My study focused on the STEAM-based TPD session, in which teachers explored various approaches to teaching and learning, including inquiry-based, integrated, and art-based approaches. Basically, STEAM-based TPD is an approach that enables teachers to use hands-on, inquiry-based, and creative learning experiences through an integrated approach to teaching. Thus, this research is limited to the STEAM-based teacher professional development programs.

Organization of Dissertations

This overall research is organized into VI chapters. The first chapter presents the background, purpose, research question, and statement of the research problem. The second chapter of the research is related to the various literature review sections, where the literature has been viewed in four sections: thematic, theoretical, policy, and empirical. The third chapter of this dissertation covers the methodology section, where it explains which paradigms this research aligns with and what the axiology, ontology, and epistemology perspectives are. Further, this chapter explains the research design, study location, how data were generated, what the quality standards

are, and how ethical standards have been maintained. Chapter four focuses on finalizing the participants and conducting a needs analysis based on their previous experiences and requirements. This chapter vividly describes how the co-researchers decided to go with an integrated project, what types of projects they planned and implemented in various grades, along with the challenges they faced in the process of implementation. Chapter V presents how the reflection of the co-researchers on the integrated projects paved the way for another cycle of the PAR related to art integration in learning. This chapter presents how participants planned and implemented their lessons by incorporating different forms of art and reflecting their understanding in artistic form. This chapter shows the challenges and benefits of using art in learning. Finally, Chapter VI presents the overall reflection, the lead researchers' learning, and responses to the research question, findings, and implications of the research. It highlights the key learning and findings generated through both PAR cycles in STEAM-based teacher professional development. The chapter concludes by connecting the findings and reflections back to the research questions that guided the study.

Chapter Summary

This chapter begins with the background of the study, which mainly focuses on how I developed an interest in teacher professional development in STEAM-based education through my past and present experiences. While presenting the background, I briefly mentioned the current provisions for teacher professional development in Nepal and their characteristics. Furthermore, the chapter highlights the nature of existing teacher professional development and the need to shift it from conventional, supply-driven training toward STEAM-based teacher professional development. In addition, the chapter clearly stated the purpose of the study and the research questions around which the study revolved. Finally. It discusses the study's significance and highlights its scope in the delimitation section.

CHAPTER II
LITERATURE REVIEW

In this chapter, I have reviewed the literature on teacher professional development, STEAM education, and relevant theories for my research topic. While doing this, I have sought to identify the gap within the existing education system and current teacher professional development. While doing this, I have clearly stated my positionality as a researcher. Further, I have tried to present and interpret literature from four perspectives: thematic, theoretical, empirical, and policy review. These perspectives offer a broad understanding of the research context and demonstrate how the study is relevant within existing literature and educational policies.

Thematic Review

In this section, I discuss some of the concepts and themes that are related to my research study. While doing this, I reviewed a range of literature, including scholarly articles, research reports, and books. From this review, it was evident that they advocate the themes of teacher professional development, STEAM education, and transformative learning.

STEAM Education

As my research focuses on STEAM-based teacher professional development, it aligns with the STEAM approach. I believe STEAM is an inter-, multi-, and transdisciplinary approach that helps to provide knowledge of different disciplines. Mehta et al. (2019, as cited in Belbase, 2019) claimed that "STEAM, as an acronym, stands for science, technology, engineering, art, and mathematics; however, it is not just an instructional strategy, but it is a transformative curricular and pedagogical approach" (p. 1). To solve our real-world problems, interdisciplinary knowledge and collaboration are needed, and the Nepal government has been implementing an integrated curriculum in grades 1, 2, and 3. Furthermore, in today's world, various challenges have arisen due to the development of technology and industry, population growth, and other factors. Only theoretical knowledge of a particular discipline makes learning incomplete. In this line, I believe that interdisciplinary connections are also needed in higher grades (Belbase et al., 2022). Thus, to solve such challenges, learners need to develop a range of skills that help them build holistic learning. In this regard, Wahyuningsih et al. (2020) stated that "STEAM learning is considered as

learning that can integrate skills (hard and soft) that are needed by children". As stated by Manandhar (2022) in his paper, I also believe that the compartmentalization of disciplines forced students to narrow their critical reasoning and creativity, as they didn't find any connections between the disciplines. In the 21st century, what we learned and taught in the past is no longer applicable; we need to reform our educational system and adopt an integrated approach to teaching. As stated by Manandhar (2022), "The interconnectedness of learning and context appears to be essential for developing rich experiential learning" (p. 66). I also feel that in the classroom, when content is presented with examples and relevant context from their lives and cultures, learners understand those concepts more quickly.

In addition, in today's world, just providing a technical or "banking model of education "causes learning dissatisfaction and increases the rate of dropouts (Luitel et al., 2022). To make learning more authentic, meaningful, and inclusive, I believe the STEAM approach is one of the best approaches in this century. Moreover, I believe that as teachers, we need to provide equal opportunities to the learners. All learners have different talents, and STEAM plays a vital role in enhancing their multiple intelligences. STEAM embraces the concept of transdisciplinary learning, in which students integrate multiple academic disciplines. This approach emphasizes that learning occurs through a seamless blending of subjects, and students actively solve problems situated in authentic real-world contexts (Belbase, 2019). In my view, the 'Art' component in 'STEAM' helps address all learners in the classroom. To build a building, we need to create a strong foundation. In the same way, to prepare learners to face different future challenges, we need to build a strong foundation of learning from their early grades. The component of 'Art' in learning helps to foster the creativity and imagination of the learners, and it makes learning interesting and meaningful. As a teacher, I feel it's essential to attract learners' attention in the early grades, and as facilitators, we need to create a plan or adopt a pedagogy that fosters curiosity and engagement in learning without feeling burdened. To that end, we can incorporate art into learning through the STEAM approach. As stated by Dahal (2022), STEAM is a teaching approach that encourages students to become lifelong learners who continually seek new and creative solutions to real-world problems. STEAM approaches focus on innovative teaching methods such as art-based pedagogy, integrated learning, flipped learning, and the Technological Pedagogical Content Knowledge (TPACK) model. Among them, in my research, I

have used art-based pedagogy, integrated learning, and an inquiry-based approach as the main approaches of teacher professional development sessions.

As discussed, the STEAM approach includes the integral component of Art, which is also a key dimension of STEAM education. Basically, an art-based approach uses different forms of art, such as visual, literary, and performing arts, as tools to make learning more understandable and engaging and to connect with learners' emotional and cognitive skills. As Salim (2025) claims, the art-based approach integrates artistic processes and practices into educational settings to foster deeper understanding and retention of subject matter. In various articles, it is claimed that an art-based approach of teaching fosters creativity and creative problem-solving skills in the learners (Dahal, 2022; Griniuk, 2021). Overall, the art-based approach enhances learners' engagement, creativity, and deeper understanding.

Further, as the name suggests, the STEAM approach is a multi-, inter-, and transdisciplinary approach that integrates knowledge across disciplines (Yakman, 2010). As mentioned by Silva-Hormazábal and Alsina (2023), STEAM is a meta-discipline, an integrated approach that eliminates traditional barriers between STEM subjects, focuses on innovation and critical thinking, and integrates knowledge from various disciplines with interdisciplinary skills. In today's landscape, various issues are arising, and to solve them, learners need knowledge across various subjects. Thus, in today's world, it's essential to adopt an integrated approach in which learners acquire knowledge and skills across various subjects.

Aligned with the theory of constructivism, STEAM education focuses on an inquiry-based approach in which learners construct knowledge independently, with facilitation from educators. An inquiry-based, student-centered learning approach allows learners to pose questions, investigate topics or issues, and construct new understanding. Inquiry-based approaches allow learners to take ownership of their learning (Khasawneh et al., 2023). Apart from the traditional approach, it provides space for learners to collaborate, investigate, and expand their knowledge, rather than being confined to what teachers transmit. Most research shows that the STEAM approach makes learning more meaningful and relevant to real life, and motivates students to engage more actively and retain knowledge longer.

STEAM- Based Teacher Professional Development

As the name suggests, STEAM is an inter- and transdisciplinary approach that integrates Science, Technology, Engineering, Arts, and Mathematics to foster 21st-

century skills such as critical and creative thinking, problem solving, and collaboration (Bertrand & Namukasa, 2023). In the contemporary education system, STEAM is significant, as it incorporates a holistic learning approach that emphasizes interdisciplinary knowledge.

Further, Teacher professional development is a pivotal element of teaching and learning, enhancing the quality of education and driving educational transformation. In today's educational landscape, a range of innovative, technology-enabled educational phenomena are emerging. With the rapid advancement of artificial intelligence in learning, many students have become increasingly dependent on AI-generated answers and devices. As a result, learners' creative thinking and logical reasoning seem to be diminishing.

In this context, to address these challenges and prepare learners for the future occupations that have not yet emerged, teachers need to adapt their pedagogical and professional knowledge. Teachers are the pillars of education and are responsible for guiding learners toward holistic, creative, and critical learning. I believe that by adopting STEAM–based approaches, teachers can nurture students' creativity, adaptability, and innovation. Thus, it's essential for teachers to enhance their teaching and learning practices by aligning them with learners' needs, curriculum requirements, and ongoing technological and innovative advancements. As Mercado (2026) claims, conventional education is more focused on disciplinary content knowledge, whereas STEAM emphasizes the real-world application of knowledge through an inter- and transdisciplinary approach. Similarly, our conventional teacher professional development has been largely content-driven, 'as a banking model', in which trainers deliver the knowledge based on their own interest rather than addressing participants' interests. In contrast, STEAM-based TPD embodies the core principles of STEAM by focusing on real-world applications, collaboration, participation, and innovative pedagogies. Pant et al. (2020) argue that STEAM-based TPD allows teachers to focus on interdisciplinary, real-world application of knowledge, which traditional TPD practices often fail to address.

Transformative Learning

In the education dimension, we can find different types of learning, such as behaviorist learning, constructivism, and transformative learning. The behaviorist learning approach focuses primarily on student behavior, reflecting a teacher-centric notion of learning. Bacanli (2016) explains that the behaviorist approach claims that

“learning can develop by establishing a connection between stimulus and behavior and that any behavior can be changed through reinforcement” (p. 20). It is mostly focused on the teacher-centric notion, which takes learners as passive receivers. It believes that past experiences and the environment shape learners' behavior and knowledge. As stated by Bacanli (2016), “The pioneers of the behaviorist approach are Pavlov, Watson, Thorndike, Guthrie and Skinner” (p.19). It believes that the human mind is like a blank sheet of paper and that what is created is shaped by the environment and experiences. Similarly, it believes that learning occurs only under conditions such as punishment and reward. It ignores the student's perspective and takes learners as passive receivers.

Further, the second approach is related to constructivism, which focuses on learning through scaffolding, hands-on activities, and the equal and active participation of learners. Woolfolk (1993) states that "the key idea is that students actively construct their knowledge: the mind of the student mediates input from the outside world to determine what the student will learn" (p. 485). Emanuel Kant, Jean Piaget, Vygotsky, and Brioun are considered pioneers of constructivism. Constructivist theory holds that knowledge is constructed through social and individual interactions and experiences. It has a very positive impact on both teachers and students.

Another approach is transformative learning, which helps an individual to think and question their beliefs, thoughts, feelings, and actions. Transformation starts with ourselves when we start to question our “frame of reference”, which is guided or shaped by our experiences, background, and so on (Mezirow, 1997, p. 1). Further, transformative learning begins in the classroom when teachers develop their questioning, reflect on their practices, and focus on the emancipatory rather than the technical interest in learning. In my research, through different STEAM-based teacher professional development programs, teachers will begin to question their beliefs and experiences and bring awareness to transform their teaching practices. Further, due to the TPD teacher’s action, thoughts will shift from traditional practice to an innovative or disciplinary approach to STEAM. For transformative learning, three fundamental elements are needed: critical reflection, rational disclosure, and the centrality of experiences. In transformative learning, learners need to critically reflect on their experiences. As Mezirow suggests, to become a transformative learner, one needs to accept others' views and assumptions, and integrate different dimensions of

experience into holistic development (Dirkx, 1998). Similarly, in my research, through the STEAM-based teacher's professional development, different teachers accept others' points and collaboratively create a new experience for the holistic development of the child. "Transformative learning is an approach to teaching, where the facilitator encourages learners to critically question and assess the integrity of their deeply held assumptions about how they relate to the world around them" (Eschenbacher, 2020, p. 762, as cited in Mezirow & Taylor, 2009, p. xi). In this research, I subscribed to the notion of transformative learning, as I believe teachers should critically reflect on their practices, question their own structure, and bring change in their teaching and learning processes through a STEAM-based approach.

Through teacher professional development, teachers recognize their strengths and empower themselves and their students through innovative pedagogies (e.g., art integration, inquiry-based approaches, and ICT-based approaches).

Teacher Professional Development

Professional development refers to the continuous process of enhancing one's professional roles through different training, workshops, academic knowledge, and so on. In other words, it refers to the different types of activities in which people are involved or participate, such as short- and long-term workshops/ training sessions, mentoring, classroom observation, book and study, and so on. Teacher professional development provides opportunities to teachers to participate in different activities, training, workshop to strengthen their knowledge and skills for improved classroom teaching and indeed to support the learning of the students, As claimed by Pokhrel and Behera (2016), Teacher Professional Development refers to the ongoing process of enhancing a teacher's academic qualifications and cultivating greater proficiency and effectiveness in fulfilling their professional responsibilities within and beyond the classroom. The teacher professional development program is designed to help educators develop their skills, attitudes, and practices to enhance learners' learning (Guskey, 2000, as cited in Khanal & Adhikari, 2020). Teacher professional development is not only about enhancing your own skills but also about improving educational practices. The effectiveness of the TPD depends on the teacher's motivation to develop innovative ideas to change their pedagogical practices (Khanal & Adhikari, 2020).

As various scholars (Dhungana et al., 2021; van Veen et al., 2012) have claimed, different types of training are occurring worldwide, but they ignore teachers'

needs and focus on lecture methods that are not useful in the workplace. Teacher professional development focuses on enhancing learners' learning and achievement by improving teachers' teaching quality. In my opinion, in the 21st century, various types of learners and learning strategies have been developed to better support them and help learners become logical, critical, and creative. Along with the policies, teachers also need to upgrade their knowledge through different professional development programs. The process of continuous development helps teachers to develop their expertise and encounter new opportunities in the field of education (Sancar, 2021). Teacher professional development includes different types of training models such as "initial training, induction courses, in-service training, and so on" (Pokhrel & Behera, 2016, p. 190).

Furthermore, across the literature, most teacher professional development programs focus on developing teachers' pedagogical and content-specific knowledge to enhance learners' learning. In today's world, as suggested by Taylor (2016), "the rapid emergence of digital technologies, artificial intelligence, DNA mapping, robotics, nanotechnology, 3D printing, biotechnology and the 'internet of things', business and industry have been bringing enormous challenges, and we need to prepare the students to solve those issues in the future" (p. 90). In this line, today's teacher professional development program also needs to be updated and focus on the integrated notion of education.

Project-Based Learning

Project-based learning is an inquiry-based approach that allows learners to collaborate and solve problems through creative, critical, and scaffolded activities and to produce tangible artifacts (Guo et al., 2020). In the 21st century, education requires a holistic approach to learning. Focusing on the subject leads to learner disengagement (Manandhar, 2022). As stated by Putri and Dwikoranto (2022), the integrated project-based learning model enables students to apply concepts across disciplines through projects that foster real-world problem-solving and enhance their 21st-century skills. Trisdiono et al. (2019) stated that integrated project-based learning enhances critical thinking skills and student collaboration in learners. Furthermore, it incorporates social constructivism and focuses on the learner's acquisition of knowledge through collaboration and interaction with the facilitator and fellow learners.

An integrated project is a learning approach in which various subjects are interlinked and interconnected. Integrated Project-based learning provides opportunities for collaborative learning, in which learners are directly involved in learning and solve problems by discussing and analyzing issues (Trisdiono et al., 2019). In today's educational context, to develop holistic knowledge in learners, integrated project-based learning is needed, where learners collaborate, understand, and internalize the paramount importance of the various subjects they learn in a compartmentalized form. Zayyinah et al. (2022) explained that, "STEAM-PBL gives a start for students to integrate various disciplines in an application of concepts in the form of project assignments so that in the end, they can improve multiple 21st-century skills" (p. 627). In the 21st century, along with subject knowledge, learners also need to develop soft skills. Whatever knowledge we give to the learners, learners are the implementers and evaluators of their learning for real-life applications. Trisdiono et al. (2019) argued that "integrated learning is done by integrating the dimensions of attitudes, knowledge, and skills into one whole unit in each subject" (p. 19). Hence, integrating STEAM-based projects not only promotes interdisciplinary understanding but also equips learners with 21st-century skills

Furthermore, in the Nepalese context, the CDC has implemented an integrated curriculum system through grade 3, a Continuous Assessment System (CAS) at the primary level, and a formative and summative evaluation system through grade 10. To align with these educational provisions and provide learners with meaningful, comprehensive learning opportunities, integrated project-based learning is essential. Integrated project-based learning allows subject teachers to collaborate with other teachers, make resources more effective and efficient, and save teachers' time (Pandey et al., 2025). Thus, integrated project-based learning enables learners to develop both subject-specific and soft skills holistically. In today's educational landscape, alongside subject matter, learners' habits and interests have been changing. Focusing on the traditional method and subject-specific knowledge might provide learners with insufficient knowledge and decrease their interest. Thus, I believe in today's educational era, learners need to be familiar with various dimensions of knowledge and subjects with real-life implications, and this can only be achieved through integrated project-based learning.

Art-Based Pedagogy

I believe that in teaching and learning, the choice of an appropriate pedagogical approach plays a significant role in knowledge construction and deepening understanding. The proper plan, appropriate tools, and various pedagogical methods embrace the learner's engagement in learning. Furthermore, as suggested by progressive educationists, learners' self-engagement makes learning meaningful and effective. It helps to develop creativity, critical thinking, problem-solving, and innovation skills among the learners. In this regard, art plays a pivotal role in learning.

Art-based pedagogy is an innovative approach that uses components of art, such as performing, visual, literary, and many other forms, in teaching and learning to make learning more meaningful, understandable, and interesting by connecting students' emotional and cognitive skills (Salim, 2025). Rather than viewing art as a separate subject, art-based pedagogy recognizes artistic experiences as a way of constructing knowledge and promoting imagination and creativity in learning. Dewey (1961) claimed that art is an experience that combines emotion and intellect, helping learners construct meaningful experiences through active engagement. Similarly, Marshall (2016) argued that art-based pedagogy is an approach to teaching in which learners construct and demonstrate understanding through an artistic form. Further, the role of ARTs in STEAM is to enhance creativity and empathy. Art-based pedagogy allows learners to think, imagine, and express their ideas from various perspectives and methods. Participatory performing arts enhance children's affective engagement and creativity through a co-creative learning environment (Griniuk, 2021). Overall, the literature suggests that art-based pedagogy supports holistic learning by connecting cognitive, emotional, and creative dimensions. Furthermore, Larrivee (2000) emphasized that in today's classrooms, various types of learners are neglected, abused, and distracted. To address all learners in the classroom, we need to adopt a variety of pedagogical approaches that motivate them to construct meaningful knowledge on their own. As we get bored eating the same thing in everyday meals, students are also uninterested in the classroom if the teacher uses the same teaching pattern every day. Overall, the literature indicates that art-based pedagogy provides the philosophical foundation for learner-centered, creative, and transformative education by incorporating the aesthetic dimension of art.

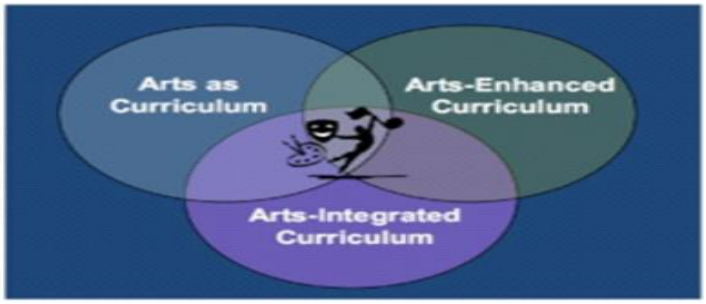
Art-Integrated Learning

Art- based pedagogy provides the philosophical foundation through artistic experiences in learning. Whereas art-integrated learning focuses on the practical integration of the artistic process. As stated by Pathak (2023), Art-integrated learning is an educational approach that incorporates the arts (visual, performing, and literary) across various disciplines to enhance learning experiences by using artistic processes, techniques, and creative expressions to deepen understanding and engage students in a multi-dimensional way. As Dahal and Pant (2022) claim, the arts component makes STEM learning more engaging by encouraging interdisciplinary thinking. Srivastava further argued that art-integrated learning promotes an interdisciplinary and holistic concept of learning (Srivastava, 2023). In visual art, there are drawing, sculpture, and painting; in performing art, there is dancing, singing, role-play, and so on

Art-integrated learning is the embedding of an artistic component in teaching and learning to make learning more enjoyable and interesting. A combination of arts in education creates inclusive and engaging learning experiences despite having different learners' abilities (Priya, 2024). Art-infused learning to foster collaborative engagement with a learning activity. Student Participation is a key aspect of arts integration pedagogy. It provides opportunities for active learning, self-exploration, and creativity. The fundamental reason behind the integration of arts is to create "aesthetically-rich learning environments as those that enable children to wonder, to notice, to imagine alternatives, to appreciate contingencies and to experience pleasure and pride" (Sinclair, 2001, p. 26). With the help of art, embedding in other subjects paves the way for deeper learning.

Figure 2

Art-Based Pedagogy



In the Nepalese context, art integration is often limited to drawings or diagrammatic representations rather than to means that promote motivation and

creativity in learning. Pant et al. (2020) claimed that in Nepal, most teachers still do not use art pedagogy in subjects such as Mathematics and Science; as a result, most students are disengaged from learning. Integrating artistic processes into subject teaching can enhance authentic and interdisciplinary learning. As stated by Pant et al. (2023), “Art infusion allows students to do more than just schools that offer a way to arts-enhancement curriculum; memorizing the content and process of solving particular problems” (p. 2). It allows learners to find the connection between art and other subjects. The use of art in learning promotes learners' participation and makes learning an active process. As suggested by Srivastava (2023), we can integrate art into learning in three ways: art as a curriculum, art enhancement curriculum, and art-integrated curriculum. Art as a curriculum particularly focuses on enhancing various art skills, such as visual, performing, literacy, dance, and so on. In the art as a curriculum, the primary objective is art itself (Srivastava, 2023; Silverstein & Layne, 2010). In the art enhancement curriculum; art is used as a means or tool to teach other subject areas. For instance, if we are using song to teach trigonometry in mathematics, it is aligned with the notion of an art enhancement curriculum. In the art enhancement curriculum, various forms of art, like visual, literary, theater, and other forms, are used to teach other subject areas to make learning meaningful and gain more profound understanding. Further art- integrated curriculum is a rigorous interdisciplinary approach where various forms of art are used in the learning to achieve and enhance artistic skills as well as the content of core subjects. In this type of curriculum, students construct and demonstrate understanding of a core subject through an art form and meet dual learning objectives (Srivastava, 2023). For instance, while teaching tessellation, the one-way learner learns the core concept of what tessellation is. On the other hand, while making patterns in the shapes, they are enhancing various patter skills. Overall, various authors and literature suggest that integrated learning operationalizes the principles of art-based pedagogy by embedding artistic experiences into practical classroom activities.

Theoretical Review

While analyzing and viewing something, we are directly or indirectly guided by some theoretical lenses. While conducting the research, my views as a researcher, the teacher’s views as a participant and co-researcher, and the students’ views as the target group were guided by social constructivism. This research helps move towards a constructivist journey, where learners and teachers question and reflect on their

subject-centric practices during integration. Similarly, it helps teachers think beyond the box, moving from traditional to progressive teaching strategies. Further, learners play a vital role in learning. Learner interaction, active participation, and collaboration help to make learning more meaningful and authentic. Thus, social constructivism is a theory in which my research revolves.

Social Constructivism

Social constructivism underscores the collaborative aspects of learning, facilitated by an instructor or through joint efforts with peers. In my research, I am using the concepts of scaffolding, interactive processes, and more knowledgeable others (MKOs) as essential elements in knowledge construction.

Scaffolding

Scaffolding is an instructional method in which a facilitator provides guidance to a learner to reduce the complexity of any task. While conducting the teacher professional development session on STEAM education, teachers (participants and co-researchers) learn from others and strengthen their learning. In this line, I used the ideas of “scaffolding” and “apprenticeship”, which suggest that advanced peers play a role in organizing or configuring a task in a way that enables a novice to successfully engage with it (Nooijen et al., 2024). As suggested by McLeod (2022), scaffolding involves support or facilitation offered by more knowledgeable others that gradually enhances others’ knowledge and skills. The main purpose of this TPD was to enhance teachers' skills and knowledge. Professional development sessions involve the collaborative engagement of teachers within the same department, subject, or grade. These sessions provide opportunities for active learning and are designed to align with and complement teachers' existing experiences. (Birman et al., 2000).

The teacher professional development sessions follow certain scaffolding steps, such as sessions based on participants' interests, engaging them in different activities, providing suggestions and support as needed, and demonstrating activities they can use in their classrooms (McLeod, 2022). In my study, I used this idea while designing the session. In the beginning, I interacted with the teachers on their needs. Based on their needs, we designed the session on integrated projects in the initial phase. During this process, I helped teachers design and understand integrated project-based learning. To facilitate their plan, I had shared articles and references.

Interaction

Learning is possible through social interaction with the tutor or with one another (Vygotsky, 1978, as cited in McLeod, 2022). The theory of social constructivism also suggests that learning is a social activity and that interactions with peers are integral to learning. Learning is a dynamic process in which individuals actively construct new ideas by drawing on their existing knowledge and experiences (Bruner, 1960). Similarly, STEAM-driven participatory teacher professional development sessions provide space for teachers to actively interact with one another, helping them acquire new concepts and construct fresh, innovative understandings. Teachers draw on their prior knowledge and construct new knowledge through interaction, with a focus on hands-on activities, scaffolding, and interdisciplinary projects. As argued by Nugroho et al. (2024), teachers are viewed as social learners who engage in "dialogue with peers, exchanging ideas, and collectively constructing knowledge through meaningful interaction (p. 1419). It emphasizes a learner-centered approach and focuses on constructing meaningful learning through collaborative work among learners. In my opinion, the STEAM approach is designed to foster self-learning, interactive discussions, critical thinking, and cooperation skills to build learners' knowledge, which aligns with the notion of social constructivism.

Furthermore, Social constructivism emphasizes learners' active participation in constructing knowledge. As Taylor (2015) claims, social constructivism encourages educators to situate learning activities within students' lives outside of school, fostering more meaningful and relevant learning experiences. I believe that the Teacher's Professional Development in STEAM education creates an environment for learners that connects to real-life problems, allowing them to use their creativity, critical reasoning, and multidisciplinary knowledge to learn. The teacher professional development concept holds that teachers need to update, upgrade, and adapt to their unique environments and develop teaching strategies through collaborative work.

More Knowledgeable Others

Upon deeper analysis, my research aligns with Vygotsky's concept of more knowledgeable others. In Vygotskian theory, an MKO is an individual who possesses greater comprehension or proficiency than the learner in a specific task, process, or concept. As McLeod (2023) claims, more knowledgeable others include not only teachers and peers but also ICT and other resources, through which learners can construct knowledge through various activities. While implementing TPD in STEAM

Education, different teachers share their knowledge, practices, and work in the group, become familiar with other teachers' practices, and strengthen their knowledge. As Nugroho (2024) claims, these TPD sessions assist teachers in identifying and designing TPD sessions that fit their needs and in engaging in regular discussions to reflect, adjust, and plan for their future personal and professional development.

The concept of more knowledgeable others aligns with the concept of the Zone of proximal development, the area between what learners can do independently and what they can do with the help of a more knowledgeable other, who might be an adult or a peer. or anything. Teacher professional development refers to the continuous process through which teachers enhance their professional skills, approaches, and attitudes and improve their teaching and learning. Viewing the STEAM-based teacher professional development through the lens of Vygotsky's concept of MKQ reveals a process of learning through social interaction with peers, experts, trainers, learners, and researchers who provide guidance and support.

Transformative Theory

Jack Mezirow (1991) posits a disorienting dilemma as the first step of transformation, in which people face challenges to their existing beliefs, perspectives, and thoughts, creating confusion and dilemma. The second steps of the transformative theory involve self-examination of fear and guilt. In this stage, people begin to reflect on their own perspective, beliefs, or thoughts. The third stage of this is the critical assessment of assumptions, in which people begin to question why and how these assumptions are held. Likewise, in transformative theory, people begin to explore new actions, plan for them, seek support or training, implement them, and reflect on them again. In this Teacher development profession on STEAM education, teachers reflect on their experience and challenge their beliefs in the subject-centric notion of education. As Mezirow et al. (2009) claim, transformative learning enhances consciousness by questioning self-assumptions, beliefs, and one's own feelings. I believe this happens in teacher professional development. In my research, I focused on multi-, inter-, and transdisciplinary concepts, student-centric notions, and innovative pedagogies in which participants (teachers) challenge their assumptions and prior beliefs. Further, as Jack Mezirow suggests, I use new insights into action, which teachers use in their learning through teacher professional development in the classroom.

As Morris et al. (2021) claim, teacher professional development is essential to pedagogical and curricular reforms by enabling reflection on one's own practices and their improvement. In teacher professional development, teachers not only reflect on their prior understanding and practices but also reform them. "Learning is a process of utilizing prior interpretations to construct new or revised interpretations of the meanings of one's experiences and using this as a guide to action" (Mezirow & Associates, 1990, p. 5).

During the teacher's professional development session in STEAM education, the teacher critically reviewed, assessed, and reflected on their previous practices in teaching and learning, as well as their perspective on disciplinary, subject-based learning. While planning and implementing an integrated, art-based project, they noted that, whatever assumptions they made about the approach, their teaching and practice needed to be refined, or they needed to think differently from the learners' and other disciplines' perspectives. According to the transformative theory, when adults realize that past beliefs have been wrong, they undergo a shift in perspective and plan a course of action. Similarly, in this research, co-researchers also changed their weekly plans, assignment formats, and teaching pedagogies after the STEAM-based TPD sessions.

In conclusion, these STEAM-based TPD sessions closely align with the principles of Social Constructivism and Transformative Learning Theory. From a social constructivist perspective, this STEAM-based TPD provided a collaborative environment in which the teachers (co-researchers) could learn from one another. Further, as this research aligned with the participatory notion, co-researchers actively participated in the sessions and co-constructed knowledge through dialogue, peer interaction, shared experiences, and collaborative inquiry. In addition, co-researchers actively engaged in collaborative lesson planning and the implementation of integrated projects and art-based pedagogies across various grades. While doing this, co-researchers had the opportunity to design various projects and become familiar with the content, curriculum, and teaching strategies of another teacher/subject. Furthermore, this STEAM–based TPD session, unlike other non-participatory TPD sessions, enabled co-researchers to collaborate and share knowledge and skills with one another. This collaboration process reflects Vygotsky's concepts of the Zone of Proximal Development, more knowledgeable others, and scaffolding, in which teachers expanded their knowledge and skills. Social constructivism holds that

knowledge is constructed through dialogue and social interaction. In this STEAM-based TPD session, co-researchers interacted with each other, discussed their plan, and collaboratively designed an integrated project and an art-based lesson plan that are aligned with the principles of social constructivism. Further, collaborative discussion, classroom implementation, and critical reflection allow teachers to revisit their previous assumptions and beliefs on teaching practices. While reflecting on their previous practices, they questioned themselves and experimented with various new pedagogies in the classroom even after the sessions. This shows the transformative notion among teachers, who critically reflect on their previous practices and question their frames of reference. As Mezirow (1991) suggests, transformation begins with a disorienting dilemma, in which individuals critically question their existing assumptions, beliefs, and frames of reference. In this STEAM-based TPD session, teachers also questioned their traditional practices and made changes in themselves and in their teaching through various innovative STEAM approaches.

Policy Review

Teacher Professional Development plays an essential role in navigating the education vision of any nation or state. In the context of Nepal different policies has been formed and include teacher training as a major component to reform the teaching/ learning from 2004 B.S as claimed in the paper of UNICEF/ Nepal- FoE (1998) to train basic schools' teachers After the formation of education department in university in 1956, it runs the program of MED or BED with the motif of produce the teachers (Bhandari, 2013). A teacher competence framework of Nepal (2016) has envisioned continuous learning and teacher development as one of the basic competencies along with seven other competencies of teachers, including “content knowledge, pedagogical knowledge, knowledge about children/learners, learning environment and classroom environment, communication and collaboration, legal bases and professional conduct, and information and communication technology” (CEHRD, 2015).

Similarly, MoEST (2022) has envisioned to “coordinate with universities for the development and implementation of a teacher preparation- service training program. Similarly, it declared that it would develop and implement the TPD, teacher support mechanisms, and related measures to enhance teachers' skills. Further, the school education sector plan (2022/23- 2031/32) has also envisioned empowering teachers with subject-matter knowledge, pedagogical skills, and modern information

and communication skills (MoEST, 2022). Since the implementation of the Constitution of Nepal in 2015, the functions and responsibilities of education have been divided among the local, provincial, and federal governments. The National Education Policy 2019 has provided for the local level to take the lead in conducting various TPD programs, including customized training, seminars, observation visits, teacher networks, collaborative research, coaching, and more (MoEST, 2022). It also provides local authorities with the authority to conduct the training in a suitable mode, such as face-to-face, blended, or online. Local-level governments need to establish a dynamic teacher professional support system to provide teachers with on-site support and guidance for transformative learning (MoEST, 2022). The seven education training centers (ETCs), one in each province, provide in-service training for the continuous development of teachers.

Though the Nepal government has policies for various teacher professional development programs, some training is provided by the federal and local governments, and some programs can be taken by teachers themselves. But these policies are for the public-school teachers. Further, it claimed that university courses cannot develop teachers' practical pedagogical perspectives, and that there is a lack of collaboration between the local and federal governments in conducting training.

Empirical Review

In this section, I review empirical studies on my issue that strengthen STEAM-based teachers' professional development in Nepal. To date, various studies have been conducted nationally and internationally on teacher professional development, STEAM education and participatory-based teacher professional development. To make my empirical review more organized, I have divided it into two sections; STEAM education and Teacher professional development.

STEAM Education

An article entitled "Needs of STEAM Education in Elementary Classes (Grades 6–8) in Pakistan: A Systematic Review (2023-2025)" by Rafiq-uz-Zaman (2026), articulates the need for STEAM education in today's 21st-century educational landscape. At the beginning of the article, he provides a clear argument for the shift from STEM to STEAM. He claimed that, unlike STEM, where subjects may be taught in isolation, STEAM requires authentic arts integration, in which the arts are "disciplinary equals" rather than just a supportive add-on to science or math. Further, the main agenda of this paper is to explore the necessity and challenges of integrating

STEAM (Science, Technology, Engineering, Arts, and Mathematics) into the Pakistani middle school curriculum. While discussing the challenges, the paper identifies the main issues as the policy-practice gap, inadequate teacher training, a culture of rote learning, and a lack of resources. Further, this article argues that, at the elementary level, the STEAM approach is essential to modernize the education system, which requires a comprehensive, multilevel, and coordinated strategy to overcome deep-seated systemic barriers.

Another article from Nepal, entitled "STEAM Education in Nepal: Status, Opportunities, Challenges and Future Perspectives for Nurturing 21st Century Learners," by Pant et al. (2024), discussed the status of STEAM education in Nepal from an educator's perspective. In the beginning, this paper discussed how the interdisciplinary concept of STEAM has been emerging worldwide and how universities in Nepal and other organizations are also embedding it in their practices. Furthermore, this paper argues that STEAM aims to promote critical thinking, creativity, collaboration, communication, and technological literacy among learners (Pant et al., 2024). It further argues that STEAM education often engages learners of all levels in various hands-on, project-based learning experiences, where they use their knowledge and skills to solve real-life problems in their daily lives. Along with the opportunities of STEAM education, the paper also highlights challenges such as limited research, the conventional status quo among teachers and stakeholders, difficulties at the policy level, and disciplinary ecocentrism.

The article "At the Dawn of Science, Technology, Engineering, Arts, and Mathematics (STEAM) Education: prospects, priorities, processes, and Problems" by Belbase et al. (2022) presented various examples and reports on the implications of STEAM education in different countries. In this article, the writers focus on the literature review and center it on the "STEAM movement, the purpose of STEAM education, and the benefits of STEAM education". This paper's discussion was confined to higher-grade students.

The conference paper by Manandhar et al. (2022) focuses on the nature of STEAM and its implications in Nepal. This paper has been written from the perspective of critical reflexivity and transformative education. In this paper, the writer discusses how STEAM pedagogy is essential in today's world for addressing multidisciplinary and transdisciplinary concepts. Furthermore, the paper advocates the

holistic integration of multiple disciplines in real-world contexts. This paper only describes the theoretical perspective of STEAM education.

Teacher Professional Development

In this section, I reviewed articles on teacher professional development, where authors articulate its current status and challenges and offer ways to make it effective. In the article entitled "Teacher Professional Development" by Morris et al. (2021), the authors focus on the interdisciplinary approaches of learning to "enhance students' problem-solving, critical, and analytical thinking skills, which helps to make learners constructive and innovative citizens" (p. 81). Further, the author argues that teacher professional development plays a vital role in 'reforming the pedagogical and curriculum part of education'. This paper emphasizes the need for interdisciplinary knowledge among teachers to enhance learners' skills through STEM education (p. 82). To support the claim, the paper provides a summary of the 11 papers, in which "eight papers are related to in-service teacher/ leader professional development" in STEM education, and the other three are related to "pre-service teacher training in STEM education" (p. 82-83). Although this paper systematically reviews various papers, it does not discuss the methodological aspects of how and when the studies were conducted.

Furthermore, another article by Conradty and Bogner (2020) focuses on the implications of teacher professional development in STEAM education for enhancing learners' creativity and motivation. It emphasizes that, unlike other forms of professional development, STEAM-based teacher professional development focuses on teaching differently to enhance learners' motivation and creativity. Based on quantitative research, this article articulates the importance of integrating the arts in STEAM to reduce the rigidity of STEM and enhance creativity in learning. Conradty and Bogner (2020) further claimed that STEAM bridges "boring knowledge with creative brainwork may help to overcome the existing creative gap in STEM" (as cited in Runco et al., 2017, p. 20). In addition, it focuses on the linear relation between PD, teachers, classrooms, and students.

Another article on teacher professional development and STEAM education from a South Asian country is "STEAM for the future: Educational strategies in Pakistan and India by Rafiq-uz-Zaman and Malik (2025). In this paper, the authors provide a robust analytical framework for evaluating how India and Pakistan are implementing STEAM education and Teacher Professional Development. The study

is presented as a comparative examination of five core thematic areas: Strategic policy and curricular framework; pedagogical strategies and teacher training; technology integration and digital equity; equity and socio-economic disparities; and Student outcomes and Employability. This research further shows the significant gap between policy and teacher readiness to implement STEAM pedagogy in the classroom due to 'untrained in STEAM methodology' (Rafiq-uz-Zaman &Malik, 2025). Furthermore, the paper demonstrates the emerging changes in the educational policies of India and Pakistan to incorporate 21st-century educational trends. The paper also highlights the need for STEAM education in today's context. It argues that, based on the World Economic Forum's (2020) report, by 2025, 85 million jobs worldwide will be replaced and 97 million new positions will be created, requiring analytical thinking, creativity, and problem-solving skills. For this, our traditional education models do not help develop such skills in learners; therefore, an interdisciplinary education model is needed that focuses not on content memorization but on application and creativity.

Another article by Dhungana et al. (2021) " Context-responsive Approaches of /for Teachers' Professional Development: A Participatory Framework", highlights the current TPD system of Nepal and advocates for the participatory and collaborative professional development. This paper argued that the collaborative nature of teacher professional development provided the opportunities for teachers to develop greater autonomy and professional agency, particularly in curriculum development, pedagogical decision-making, and the implementation of context-responsive practices (Dhungana et al., 2021). Further, this research emphasized on four types of collaboration; cross-sectoral collaboration, teacher-student collaboration, interdisciplinary collaboration, and cross-professional collaboration. However, while the study demonstrates the potential of PAR for strengthening teachers' professional agency and contextualizing professional development in Nepal, it does not specifically examine STEAM-based professional development may contribute to transformative changes in teachers' pedagogical perspectives.

Article which highlights the gap between policy and implementation, especially in science teacher professional development is "Science teachers' professional development at Tribhuvan University: Bridging the policy-implementation gap" by Acharya (2024). This research was conducted between 41 science teachers at Tribhuvan University by using a mixed method design. Unlike Dhungana et al. (2021), this article highlights certain challenges that prevent TPD

policies from being effectively implemented such as limitations of resources, geographical disparities this article argued for the accessible, systematically implemented and responsive to teacher's professional needs (Acharya, 2024).

Although several national and international studies have been conducted on teacher professional development, STEAM and STEM education, PAR, and other innovative pedagogies. However, very few studies have incorporated these concepts through Participatory Action Research in the Nepali context. Existing research has primarily focused on curriculum implementation, challenges in higher education, opportunities for using the STEAM approach, and general teacher training, each addressed individually.

Research Gap

While exploring the literature (national and international), it is claimed that there is a gap between policy and practice regarding STEAM application, TPD sessions, and the notion of education (Dhungana et al., 2021; Rafiq-uz-Zaman & Malik, 2025). In Nepal, despite policy suggestions from the Ministry of Education in Nepal, the Ministry emphasized creating a collaborative, collegial, and purposeful learning culture in schools. However, still many school have been following traditional/ conventional teaching approaches in the classroom due to a lack of participatory TPD, short-term training sessions, lack of resource availability, teacher unpreparedness to adopt new pedagogies and so on (Belbase et al., 2022; Pant et al., 2024). Furthermore, Morris et al. (2021) argued that, today's world needs to focus on interdisciplinary knowledge for teachers to enhance the different skills of the learners through STEAM education.

Although some schools in Nepal have begun integrating disciplines, most remain focused on conventional teaching methods and continue to view them separately. On the other hand, the Nepalese government implemented an integrated curriculum in Grade 1 from 2077 and extended it to Grades 2 and 3 from 2078, yet teachers are still unsure how to integrate disciplines and implement an integrated approach in the early grades. My research helps narrow these gaps and supports transformative learning through STEAM-based professional development for teachers.

There is a body of literature on teacher professional development, the STEAM approach, and Teacher professional development in the STEM-based approach, both nationally and internationally. However, empirical reviews reveal limited research on

STEAM-based Teacher Professional development aligned with Participatory Action Research. Moreover, few studies have explored how participatory TPD sessions and the STEAM-based approach help enhance teaching and learning and support teachers in improving their pedagogical practices. This research study addressed the theoretical, empirical, and contextual gap by exploring how a STEAM-based Teacher professional development supported transformative learning and pedagogical change among teachers in the Nepalese context.

Chapter Summary

This research chapter is based on a literature review, in which I reviewed relevant literature aligned with my study to build a strong foundation for my research. While reviewing the literature by various scholars, I divided it into three sections: thematic, theoretical, and policy. In the thematic review, I attempted to incorporate likely themes related to my research, such as STEAM education, teacher professional development, art-based approaches, and project-based learning.

In addition, in the theoretical review, I closely examined the theories of social constructivism and transformative learning and discussed how these theories align with my research. Furthermore, in the policy review section, I examined Nepal's government provisions on teacher professional development. In the empirical review section, I presented the key findings from selected research articles on teacher professional development in STEAM education and identified the challenges faced by teachers and researchers during implementation. Overall, this chapter reviews existing studies, identifies challenges, and determines the research gap.

CHAPTER III
RESEARCH METHODOLOGY

The methodology section of any research is a roadmap for my participatory study. In this chapter, I have described the research paradigms, philosophical assumptions, and research design concerning my study. Further, I have described my research location, participants, and tools for data generation, as well as how I interpreted the data. Further, I have elaborated on different ways to maintain quality standards in my research, along with ethical considerations.

Multiparadigm: Interpretive Paradigm and Critical Paradigm

Deciding on an appropriate research paradigm is a challenging task. Based on the nature of the research problem and the study's objectives, this study aligns with the multi-paradigm approach, mostly connected with interpretation and criticism. During my studies as a STEAM scholar, I reflected on my learning and teaching habits and decided to improve in my field. The main endeavor of the interpretive paradigm is to understand the subjective world of human experience (Guba & Lincoln, 1989). This paradigm holds that knowledge is constructed socially, based on the researcher's personal experience. Similarly, in this research, teachers are involved in developing STEAM lesson plans and projects. I assess the plan's implications through the teacher's feedback and the learners' experiences. It involves my subjectivity too. As this paradigm is related to social constructivism, it promotes an engaging *intersubjective approach to understanding* social phenomena through actors' lived experiences (Pant, 2019). In my research, I also created several activities and projects where learners can engage and share their learning and experiences with me. As Taylor and Medina (2011) claim, this paradigm helps researchers generate local understandings of the lifeworld experiences of teachers and students, and of the cultures of classrooms, schools, and the communities they serve.

Similarly, as I critically reflect on my practices, where we have been focused on the disciplinary approach to learning and are moving towards the betterment of education through applying the STEAM approach, which is an inter-, multi-, and transdisciplinary approach to learning, in this line, my paradigm is also related to the *critical paradigm.* As stated by Taylor and Medina (2011), in this paradigm, "The researcher raises his/her critical consciousness and constructs a moral vision of a

better society" (p. 6). In this research, too, as a researcher, I am challenging the traditional approach to teaching and helping to develop the participants' (teachers') awareness of the impact of teaching through the STEAM approach.

The main purpose of using both paradigms in this research is to understand the real issues in existing TPD sessions and, based on that, bring meaningful changes in the education sector through participatory STEAM-based TPD sessions. The interpretivist paradigm helps in understanding teachers' needs, beliefs, and perspectives in research, whereas the critical paradigm provides the foundation for emancipation and transformation. In this research, I first discussed the study with the co-researchers and gradually developed rapport with them. After taking consent, we collaboratively identified the TPD session based on their interests, needs, and classroom challenges to enhance their personal and professional growth. Similarly, we collaboratively designed various integrated projects, art-integrated lesson plans, and reflected on our understanding, challenges, experiences, and practices. While doing this, we analyzed teachers' needs, understood their lived experiences, and explored their perspectives, all of which align with the principles of interpretivism. As suggested by Pervin and Mokhtar (2022), within the Interpretivism paradigm, researchers articulate or incorporate participants' subjective notions and beliefs into the research. However, the main purpose here is not only to understand teachers' experiences. The interaction between participants, collaborative planning, observation, and reflection allows participants to question their own past practices. In this way, the interpretivism paradigm creates a foundation for the critical paradigm. While reflecting on previous practices, co-researchers began to question their conventional pedagogies, the nature of previous TPD sessions, and established classroom cultures, which led them on a journey of transformation. The main purpose of the Critical paradigm is not only to understand social reality but also to question it in pursuit of transformation or empowerment.

Therefore, rather than treating the Interpretive and Critical paradigms as separate philosophical positions, this study viewed them as complementary. The Interpretive Paradigm provided an in-depth understanding of teachers' needs, experiences, and professional realities, while the Critical Paradigm built upon that understanding to promote collaborative action, critical reflection, teacher empowerment, and transformative changes in teaching and learning through Participatory Action Research.

Epistemological Consideration

Epistemology concerns how knowledge is generated from various sources. According to Blaikie (1993, as cited in Khatri, 2020, p. 1437), epistemology is "the theory or science of the method or grounds of knowledge, expanding this into a set of claims or assumptions about the ways in which it is possible to gain knowledge of reality". In this line of my research, knowledge was generated or co-created through collaborative discussion, interaction, reflection, implementation, sharing experiences and observations, and prolonged engagement with the participants for the co-construction of knowledge. As stated by Khatri (2020), "Epistemology focuses on the nature of human knowledge and comprehension that you, as the researcher or knower, can possibly acquire so as to be able to extend, broaden, and deepen understanding in your field of research" (p. 1437). In this context, it helps to figure out the researcher's positionality. This research was based on Participatory Action Research (PAR), in which knowledge emerged through the collaborative engagement of co-researchers and the researcher. In the research, the researcher and co-researchers collaboratively planned, implemented, observed, and reflected on the STEAM- based TPD sessions. Throughout the session, co-researchers shared their experiences, perspectives, reflections, and classroom practices, jointly co-creating a new understanding. While creating knowledge, rather than positioning myself as the sole producer, I worked alongside the co-researchers as a collaborative learner and facilitator. In this regard, the epistemology of this study is Subjective and co-constructed.

Ontological: The Perspective of Realities

Ontology is related to the study of the concept of existence, reality, being, or becoming. According to Khatri (2020), "Ontology deals with the philosophical assumptions about the nature of reality or existence" (p. 1436). Ontology creates the framework for how we, as individuals, connected in societies, make sense of the reality in which we live. This research does not view reality as a single truth; rather, it recognizes that realities are multiple and framed by personal experiences, social constructs, and so on. In this research, we (the coresearcher and I) explore the realities from our own experiences and beliefs. In addition, as ontology holds that multiple realities exist, my perceptions and experiences differ from those of my participant; thus, this study's ontology is relativism. As further claimed by Khatri (2020), "ontology is the philosophical standpoint about the nature of existence or reality, of being or becoming, as well as the basic categories of things that exist and their

relation" (p. 1436). In my research, the reflection I gained from the integrated project differs from that of the co-researcher. For instance, my experience of implementing the integrated project differed from that of the co-researchers because they were not previously familiar with the concept. So, on this basis, what was new for them was, as usual, new for me. In this line, the experiences and perspectives on looking at something varied among my participants. In the planning phase, participants' knowledge of STEAM varied. Some of them explained it as an acronym for Science, Mathematics, Technology, Engineering, and Arts, while others viewed it as a pedagogy. Furthermore, as the research progressed through the phases of planning, acting, observing, and reflecting, multiple realities were shared, and multiple forms of knowledge were collaboratively constructed. Rather than recognizing a single reality, it valued every co-researcher's experience, perspectives, and reflections. Consequently, multiple realities were formed.

Axiological Assumption

Axiology concerns the ethical issues in research that need to be considered throughout the process by both the researcher and participants. As stated by Khatri (2020), "It involves defining, evaluating, and understanding concepts of right and wrong behavior relating to the research" (p. 1438). Axiology, also known as the theory of value, concerns the role of value in research. This study was based on participatory action research, in which participants' values and beliefs also influenced the study's direction. The axiology of this research study is value-laden. On the other hand, while conducting the research, my values and interests might have influenced its direction. Further, as this researcher was based on participatory action research, which aligns with the concept of collaboration, collaboration was one of the values in this research. As claimed by Mahara (2024), "PAR believes in the generation of knowledge in collaboration with local experts, the incorporation of the perspectives of those possessing firsthand knowledge" (p. 2). As the co-researchers' ideas and beliefs were essential and affected the value of the research, a collaborative notion was one of the values of this research.

Study Location and Participants

My study was conducted in one of the private schools in the Kathmandu district, where I have been involved for 6 years. My co-researchers were the 9 to 10 teachers, who have been involved in the teaching field for the last 4 to 10 years. During the research period, we (my participants and I) shared different understandings

of STEAM approaches and pedagogical aspects which implemented in the classroom for transformative learning. Through this study, I believe I helped my colleagues develop various pedagogical skills in STEAM education, such as art integration and integrated projects.

Table 1

Participants Information

Participants	Teaching Grade	Experiences
Dilu	4 and 5	6 to 7 years
Kamala	6 and 7	More than 15 years
Shanti	6 and 8	More than 8 years
Prabesh	4 and 5	More than 5 years
Amit	6 and 7	More than 5 years
Riya	3 and 6	More than 7 years
Minu	Grade 3	More than 10 years
Rinu	Grade 3	More than 10 years
Reshmi	Grade 4 and 5	More than 10 years
Rewati	Grade 3 and 5	More than 8 years

Participatory Action Research as a Research Method

Any research design is intended to provide a clear framework for any study. As this study focuses on improving our educational practices through teacher professional development grounded in critical reflection, my research design is participatory action research.

As this study is focused on improving our practices at school and moving towards a collaborative, transformative learning journey, my research design is based on participatory action research. As its name suggests, in participatory action research, participants play a crucial role from planning to reflection. As James et al. (2007) claim, PAR is a type of research design "where diverse practitioners work together to achieve reliable results" (p. 8). As stated by Cornish et al. (2023), "Participatory action research (PAR) is a scholar-activist research approach that brings together community members, activists, and scholars to co-create knowledge and social change in tandem" (p. 2). Further, apart from other research, PAR focuses

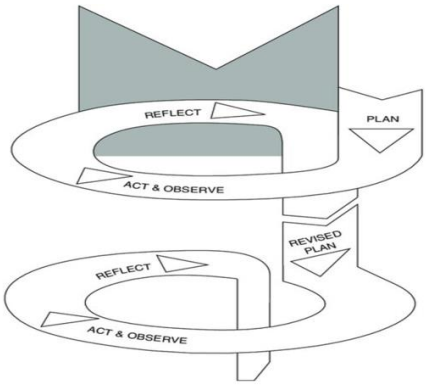
on research whose purpose is to enable action through the reflective cycle, with the direct involvement of participants. Further in my understanding, it is the process of reforming a particular sector through the direct involvement of the people who take action to reform their field through critical reflection. In this context, in my research, I sought to reform my own workplace culture of learning and teaching through teacher professional development on STEAM approaches, involving teachers as co-researchers. During the research phase, teachers reflected on their issues and problems related to learning and teaching and sought to address them through direct intervention and involvement.

In this view, in my research, we (my participants and I) collaborated to plan, implement, and reflect on the teacher professional development sessions. In addition, through STEAM-based teacher professional development programs, teachers (co-researchers) reflected on their practices and beliefs, empowered themselves, and tried to reform the education system. In my research, I also involved teachers in various professional development programs, where they investigated and implemented different teaching and learning methods in their practice. Furthermore, PAR focuses on the transformation achieved through fostering dialogical engagement with co-researchers (Kemmis & McTaggart, 2006). Unlike other forms of action research, participatory action research employs participatory modes of inquiry that reveal individuals' lived experiences.

In PAR, rather than a linear process, the research follows an Iterative cycle. There are different cycles of participatory action research, but in my research I followed the steps of defining the problem, taking action, observing, and reflecting as a PAR cycle (Cornish et al., 2023, p. 3). In PAR, when one cycle finishes, another cycle is formed, based on the reflection of the previous cycle. Figure

Figure 3

PAR Cycle Framework



(Kemmis & McTaggart, 2005)

Planning

In participatory action research, the first step is planning, where researchers establish relationships with participants, identify the issues (action), and collaborate to decide on them. Further in this cycle, participants decide their roles and responsibilities and share the plan and outcomes (MacDonald, 2012). While planning, researchers use various methods, including focus groups, participant observation, and interviews (Macdonald, 2012). In this line, I discussed my research with participants (approximately 10 people), who were co-researchers, built a rapport, and attempted to understand their issues. Based on the issues regarding their professional development, we collaboratively planned and designed the necessary training sessions as part of an integrated project and an art-integrated approach. We worked collaboratively to determine the outcomes. Further, as PAR suggests, in my research, also "participants were active in making informed decisions throughout all aspects of the research process for the primary purpose of imparting social change through active participation as the ultimate goal" (MacDonald, 2012, p. 34). In this research, various TPD sessions, weekly plans, integrated projects, and art-based plans were planned in the first stages of planning.

Acting

In participatory action research, the second stage involves implementing the plan and moving forward. MacDonald (2012) claimed that the acting phase of participatory action research focuses on fostering social change through collaborative efforts between researchers and community members toward shared goals. On the other hand, this phase involves implementing the plans developed (Walker, 1993). During this phase of my research, we implemented the plan together. While

implementing, as social constructivism suggests, we (the researcher and co-researcher) actively participated in the session and sought to enhance our skills. Based on the teacher's professional development training, we implemented our learning in the classroom to make learning transformative. As part of an integrated classroom project, an art-based approach was implemented as an action during the STEAM-based TPD session.

Observation

As a researcher in participatory action research, observation is a continuous process in which the researcher observes every action, planning, and reflection of participants and themselves. Observation in action research is documenting the effects of critically informed action. Kemmis et al. (2014) argued that observation involves systematically examining the plan's effects and outcomes through careful analysis. In this stage, the researcher observes what happened, why it happened, what is going well, and what needs improvement for the following steps. Based on the observation, a new cycle of participatory action plans will be conducted. As Walter (2009) claims, the actions and outcomes need to be observed by the researcher and co-researcher in the PAR. In my research, my co-researcher and I observed our planning and actions through field notes, observation sheets, classroom observation, student performance of the art-integrated approach, integrated projects, and so on throughout the research. Further observation was conducted on the implementation of STEAM- based TPD in the classroom by the teachers.

Reflection

In participatory action research, the reflection is considered an essential component. As stated by Larrivee (2000), "reflection is a systematic way of thinking about our actions and practices so we can improve our practice and action." (p.299) In the reflection part, the researcher and co-researcher had reflected on their practices and actions through self and collective reflection methods. In the process of reflection, the researcher and co-researcher explored and unpacked the hidden factors, beliefs, and assumptions that guided their practices, and, based on this reflection, they redesigned the second cycle of PAR. In this line, we can say the reflection part indicates how we need to plan the second cycle (Walker, 1993). In my research, my co-researchers and I reflected on our practices and observations and sought to understand the reasons behind the plan's success or failure. Based on that, we will also reflect on what to add to or remove from our plan so that our plan and actions are

more fruitful for transformative learning. Based on the reflections of the researcher and participants, the next cycle will be planned collaboratively.

Data Generation Procedure

As my research is qualitative, my data were generated from an external social constructionist perspective. Furthermore, while collecting data, I used various tools, including open and unstructured interviews, focus group discussions, reflection notes, photo voice, and so on. As a social constructivist suggests, I used Focus group discussions to understand the teachers' different opinions on themes such as art integration in learning, teacher professional development, and integrated project-based learning. Further, as my research was based on participatory action research, we (my participants and I) were equally involved in the reflective writing and shared our thoughts at each step of PAR. Further, I kept a memo for each meeting and session, analyzed and transcribed them to generate data, and presented them in writing.

Table 2

PAR Cycle

Cycle	**Intervention**	**Objective**	**Date & duration**
Preliminary interaction with participants (Pre-research interviews)	Developing rapport and obtaining informed consent	Finalizing the participants for the research and developing the rapport with the co-researchers	April 23 to April 30, 2025
Need analysis	Collaborative needs assessment	Figuring out the teacher need and their understanding of STEAM education and Teacher professional development	April 30 to May 3, 2025
1st cycle intervention design	Participatory STEAM-based Teacher Professional Development (Orientation, collaborative planning of integrated projects and lesson	Planning for the new TPD based on the reflection of the previous TPD session. Planning for the integrated project	May 6th to May 12th , 2025

	planning)		
Implementation of the 1st cycle and interaction with the co-researcher	Implementation of integrated projects in classrooms, classroom observation and collaborative support	Implementing STEAM-based integrated projects and observing classroom practices	May 13 to June 8th, 2025
Focus Group discussion (Reflection integrated projects)	Collaborative reflection on the intervention	Exploring co-researchers' experience and challenges of implementation of integrated projects	June 10th, 2025
Cycle II: Intervention	Art-integrated Teacher Professional Development (art-based lesson planning, implementation, observation and reflection)	Reflection and paving the way towards the second cycle of PAR based on art integration	June 15th to August 22, 2025
Reflection	Evaluation of the intervention	Listening to teachers' experience of a Steam-based TPD session	September 5, 2025

Summary of the Table in Details

The table above presents an overview of Participatory Action Research (PAR) and the interventions conducted throughout the study. The research began with preliminary interactions to develop rapport with the co-researchers. In the initial sitting, we discussed the purpose of the study, taking consent, and our roles and responsibilities. This was followed by the identification of needs, during which the session focused on understanding one another's needs, perceptions, expectations, and views on Teacher Professional Development and STEAM Education. Based on the need identification, the first cycle of PAR was designed based on an integrated project. Co-researchers collaboratively planned and implemented them in their respective classrooms. After implementation, observation and reflection were conducted. In the reflection, we discussed the challenges, strengths, and lessons learned from the integrated project. Further, based on the first-cycle reflection, we collaboratively decided to design a second cycle of PAR grounded in art-based pedagogy. As in the first cycle of PAR, in this cycle teachers also collaboratively

planned, designed various lessons, implemented and observed them, and reflected on them. This iterative PAR process enabled continuous improvement in teaching practices and supported teachers' professional development through the research process.

Data Analysis and Interpretation

Data analysis is an essential part of any research. As stated by Clarke and Braun (2013), "Data analysis is a systematic way of identifying, organizing, and offering insight into patterns of meaning across a data set" (p. 1). As claimed by Clark et al. (2020), "The goal of data analysis is to identify themes and patterns to provide robust evidence for any claims you are able to make from your findings" (p. 92). Based on these scholarly statements, the data analysis involves transcribing and interpreting the collected data into themes and presenting them in understandable language, supported by evidence. Different research designs have their own approaches to interpreting data, as stated by Dahal (2025): "In PAR, data analysis is a collaborative, cyclical process of collective reflection on data with coresearchers to produce knowledge that directly informs and empowers further action for social change"(p.1). Hence, data analysis and interpretation are systematic processes in which raw data collected from various tools such as interviews, observations, focus group discussions, memos, and so on are organized, coded, and interpreted into themes and presented meaningfully in the dissertation or article with supporting evidence.

When interpreting data, scholars offer different steps and formats depending on the nature of the data and the research design. In qualitative research, generally the researcher follows these steps: "familiar with data, generating certain codes, searching for the theme, reviewing and defining the theme, Naming and defining the theme, and producing the final report" (Braun & Clarke, 2012). In my research, I also followed these steps after collecting the data, using tools such as observation notes, field notes, focus group discussions, memos, and reflections. After each TPD session, classroom implementation, classroom observations, and reflective discussion, I organized and transcribed the interviews, reflective conversations, field notes, and journals. After that, I read the data for two or three times and then coded phrases and words based on the research questions and purpose. After preliminary coding, I shared it with the participants during the collaborative reflective meeting. Together, we reviewed the coded words and phrases, then discussed whether the codes accurately represent co-

researchers' experiences and points of view. After the discussion, the codes were revised based on the participants' suggestions; similar codes were then grouped and refined into themes, and the resulting themes were finally presented in a write-up employing both deductive and inductive methods (Dahal, 2025). Similarly, while interpreting the data, I reviewed relevant literature and incorporated it into the discussion to support my ideas and findings. This collaborative coding process ensured that the interpretation of the data reflected not only my perspective as the researcher but also the voices and lived experiences of the co-researchers.

Quality Standards

The researcher must conduct the research in a realistic, natural setting and get valid and authentic information. According to McNiff and Whitehead (2010), an action researcher works as a practitioner, and their job is to set the standards of practice and judgment. The first step in establishing validity is collecting information and providing evidence, but to make our validity authentic, others also need to agree on the validity we claim. Unlike traditional qualitative research, this study is based on the rigor of PAR through the five validity criteria suggested by Anderson and Harr (1999). There are five levels of the validation. First, outcome validity was achieved as the research successfully collaborated with the teachers and came up with various integrated projects and art-integrated classroom practices to enhance teacher professional development. Second process validity was maintained by incorporating iterative cycle of PAR, plan, act, observe and reflect. Third, from the beginning to the end of the research process there was direct collaboration and equal participation of the co-researchers, thus ,this research also has democratic validation. At the level of catalytic validity, the research not only helped to enhance professional development of the teachers with various STEAM based approaches but also provided opportunities for the co-researcher to reflect on their practices and came up with the various ideas to enhance their teaching practices. Finally, dialogic validity was fulfilled through collaborative plan of various art integrated and integrated project, peer observations, critical reflection and constructive feedback to peer plan for refined their plans and ideas.

At the personal validity level, I presented my reflective journal, meme, and photos, from which I collected data on my observations and physical meetings, as mentioned under the personal validation (McNiff & Whitehead, 2010). Similarly, in the social validation section, I described the interaction with the participants

(teachers). However, the researcher needs to express gratitude to all the participants and give credit for their contribution to the research.

Further, in my research, we were involved in various discussions and interactions from which we derived meaning; thus, my quality standard is also secure in terms of trustworthiness. Further, while conducting research, we raised questions about our practices, reflected on our past practices, and analyzed and implemented new approaches in our classroom. Based on the reflection, we construct meaning; thus, in this context, my research meets the standards of reflexivity (McNiff & Whitehead, 2010). In addition, while interpreting the data, I offered a balanced perspective and upheld authenticity standards.

Further, as this research is based on reforming our own pedagogical approaches to enhance teaching and learning through teacher professional development, it maintains the standard of pedagogical thoughtfulness. As stated by Luitel (2009), pedagogical thoughtfulness involves making teachers aware of their own rooted beliefs and practices. In my research, while reflecting on my own practices, I found that teachers were aware and questioned their own pedagogical practices and assumptions. Similarly, while conducting research, I was not doing it for the sake of a complement to my thesis, but to bring some transformation in teaching and learning through regular critical self-reflection; in this scenario, my research upholds the quality standards of praxis.

Ethical Consideration

Ethical considerations include sampling procedures, respect for participants, maintaining each participant's privacy, language use, and obtaining their consent. During the research process, I tried to address all ethical issues associated with this study by protecting participants' privacy and respecting their views and ideas. To this end, I initially emailed participants and gave them the freedom to join or leave the research at any time. After that, I ensured that the participants clearly understood their collaborative role from problem identification through reflection and helped them assess what their participatory experience might be like (Cook, 2010). As a researcher in participatory action research, I maintained participants' confidentiality and respected the thoughts and analyses they presented during the TPD sessions (Cook, 2010). In any research, when sharing findings and views on certain topics with an organization or a particular group, there is a chance of encountering problems or

being hurt. In this regard, I took care of the participants to prevent them from any harm.

Further, PAR focuses on active participation and involvement in the research. PAR has an inclusive research paradigm in which everyone's voices are counted (Lenette, 2022) and upholds the ethics of inclusion. In my research, I have tried to listen to and incorporate the voices of all co-researchers without bias. Thus, this research is aligned with the ethics of Inclusion. Participatory action research is based on the collaboration between researchers and co-researchers; it shares the ethical consideration of the power relations. As a lead researcher, I have balanced my research by providing equal opportunities to all participants and maintaining a balance that does not dominate my voice over the co-researchers'. Participatory Action Research advocates for collaboratively generated knowledge in the collaboration of the researcher and co-researchers (Lake & Wendland, 2018). In this research, we have also collaboratively developed, implemented, and reflected on a plan. During this process, we have collaboratively generated knowledge with the active participation of researchers and co-researchers.

Researcher Positionality

Researcher positionality creates a significant impact on the research. In contrast to positivist perspectives, which focus on objectivity, qualitative research believes that the researcher's subjectivity, background, beliefs, and thoughts may impact the overall research. Thus, it is essential to identify and clarify the researcher's positionality in the research. In PAR, the researcher's positionality strongly influences the research, as the researcher is directly and equally involved, working with participants as a co-knowledge creator. Kitagawa (2023) argued that the reflexive awareness of insider and outsider relationships is essential for managing the power imbalances and ensuring ethical balance in the PAR. As Pant et al. (2023) claim, in PAR our professional background may sometimes influence the co-researcher and the entire research process, so, as researchers, we need to clarify our positionality with co-researchers. As Ozkul (2020) notes, the baggage of ideas and perspectives makes it difficult for researchers to adopt a participatory mindset. In my research, my dual role (as a coordinator and a researcher) may have affected the participants' views, perceptions, and interactions. Likewise, the research might be thought of as having a power bias, and the participants' views and perspectives were affected by the title of "coordinator." To minimize these issues, efforts were made to create a collaborative,

respectful, and non-hierarchical environment throughout the research process, as I was also working as a co-teacher with some of the teachers. For instance, along with the coordinator, I was the mathematics subject teacher of Grade 6. In my role not only as a coordinator but also as a teacher, we usually sit with the teachers, discuss learners' perspectives, and collaboratively design classroom activities. Further, in various sessions, I participated as a teacher. Thus, there was good communication and a relationship with the teachers. Rather than a coordinator, they took me as their friend, so they could share their experiences and perspectives with me freely. This shows that my positionality was not dominated throughout the research journey. Further, rather than a coordinator, they took me as a collaborative partner from the beginning to the end of the research. In the research, teachers were encouraged to share their genuine experiences, reflections, and challenges without fear of judgment.

Further, while working at a particular school, we are guided by the school calendar's timeline. Along with planning and implementing various projects and lessons, co-researchers had other tasks such as copy-checking, completing the curriculum, addressing parent concerns, and so on. However, from the beginning of the session, we planned our timeframe so that our planning and execution aligned with our curriculum. For instance, the Grade 6 project was targeted for the environmental day, where teachers taught various topics on environmental preservation and conservation across subjects. For this, we designed a field trip that was an essential school activity. During the same field trip, we incorporated our project, based on which we developed a worksheet, and finally conducted the exhibition. By aligning the research activities with existing curricular responsibilities, the co-researchers did not perceive the research as an additional burden. Instead, they actively participated in planning and decision-making, which helped minimize the coordinator–teacher hierarchy and strengthened our relationship as collaborative partners throughout the research process.

Chapter Summary

This Chapter covered the overall research methodology, from my philosophical orientation to my positionality as a researcher. I see PAR as a research design to collaboratively empower my co-researcher. Further, I explained which tools I used and how I interpreted data in my research, with a particular focus on the PAR. Finally, I discussed the quality standards, ethical issues, and the positivist approach I employed in this research. In the follow-up chapter, I discussed how I chose this

research topic, how I collaborated with the co-researchers, and how I paved the way for 1st cycle of Participatory Action Research.

CHAPTER IV
TAKING A STEP TOWARDS A TRANSFORMATIVE JOURNEY THROUGH THE INTEGRATED PROJECT: A STEAM APPROACH

This chapter outlines my journey of teacher professional development in STEAM education for Transformative learning. It begins by describing the process of discussing and finalizing the co-researchers. Further, it provides a general outline of the co-researchers' needs, their experiences with previous TPD, and their understanding of STEAM education. Based on their past experiences, reflections, and understanding, the chapter illustrates how we selected our first TPD session as an integrated project. Moving forward, this chapter presents an overview of the iterative cycle of PAR, based on the design, implementation, and reflection on integrated projects. To describe the research journey of the researcher and co-researcher, narratives and reflections were used to represent ideas and insights.

Further, while discussing teachers' experiences, this chapter sheds light on TPD status in Nepal and ways to bring change in the traditional form of TPD through the positive impact of STEAM-based Teacher Professional Development. Through the experience and reflection of the co-researchers, this chapter of research tries to address the research question: "How does the participatory approach promote STEAM-based teacher professional development for transformative learning?" Furthermore, this chapter highlights the significance of the STEAM approach in contemporary classrooms for fostering transformative learning, innovation, and creation in teachers and students through teacher professional development. Moreover, as we analyze our needs, reflect on our practice, and move towards an integrated approach to learning, this chapter demonstrates how the concept of PAR relates to social constructivism and Mezirow's ideas of transformation. It provides the minute details of different TPD sessions and teachers' learning.

Building a Collaborative Team: Finalizing Co-Researchers in Teacher Professional Development

On April 23rd, I was sitting with three teachers in the staff room. The purpose of the discussion was to finalize the co-researcher for my research. Although I had previously informed them about my research topic and objectives, I asked them to finalize their participation.

I inquired, "I *am about to initiate my research, which focuses on Teacher Professional Development (TPD) in STEAM education*. In this research, we shall collaborate, discuss, analyze, and plan for the session. Thus, *I would like to know if you are willing to participate?"* Further, I emphasized that the nature of this research requires us to collaborate, work collectively, and make decisions together.

In response, Reshmi enthusiastically replied, "T*his sounds like a wonderful opportunity for me. We will learn many new things together. Yes, please include me in your research*."

Another teacher, Rewati, said, "Can *you also tell me what we need to do in this? It sounds quite interesting to me. I always want to learn new things*."

I replied that this is all about our professional development. As teachers, we have faced certain problems and wanted to overcome them. Similarly, as teachers in today's world, we need to grow in ways that meet our learners' needs and the demands of today's educational landscape. We will design workshops necessary to share our understanding through reflection.

After listening to this, she replied,

> *Of course, I also want to be a part of this research. As a teacher, I attended several TPD sessions, but most focused on hypothetical scenarios rather than the implementation phase. Please let me know what I can do?*

While listening to this, another teacher, Dilu, also said, *"I have already learned many thin*gs from *you before as well. This is a great opportunity for me, so I am also in"*.

After talking with teachers, we decided to formalize my research. To provide equal opportunities to everyone, I emailed the teachers of grades 1 to 6, asking them to participate voluntarily in my study. In the email, I provided information related to research and its purpose. Within two hours of sending the email, I received responses from 7 to 8 teachers in grades 3 to 6. So, I decided to include them as my research participants.

On April 25, when I was in the staff room, one of the grade 3 teachers, Rinu, came to me and asked me. "Ma'am, *I heard that you are going to do some research. I missed your email. Can you tell me more about your research?"* I replied to her that this research is related to teacher professional development, where we collaboratively enhance our skills and learn new techniques. While saying this, she replied to me

"*I know you already said you are going to limit it to five to six participants in your research. I also want to learn and grow. Can you please include me in your research*?" While hearing this from her, I was excited because I had previously heard that it was difficult for us to find participants in participatory action research. In contrast, in my research, participants were willing to be a part of it.

On April 26th, I sent another email to teachers and asked them to gather in the staff room to discuss and receive further orientation. At 4:10 p.m., we all gathered in the staff room with evening tea, and I started talking first. Firstly, I thanked everyone for being a part of my research. While I was speaking, one of the teachers, Shanti, said, "*Thanks to you as well, ma'am, because of you, we are all here to explore something together, right teachers*?" (Everybody laughed).

I added, this is our informal talk, so let's be together in learning and growing. The main purpose of gathering here is to make you familiar with my research agendas and the process of this. In this research, I would like to collaborate with you to enhance our teaching strategies, both personally and professionally. For that, I will also send a consent form to all of you. If you really want to be part of this, kindly join. There is no mandatory requirement to be a part. These are your choices. To discuss further, let's sit on April 30 to formally start our session on teacher professional development. Rinu said, "*Sure, let's sit on that day, and move forward."* Minu asked, *"Ma'am, do we need to do something before tha*t?"

I answered her question and mentioned that in the next meeting we will discuss how we are teaching, the challenges we are facing, and so on. But then it was already 4: 45 pm, so we dispersed.

Teacher's Enthusiasm towards Collaborative Professional Development

The initial discussion with the teachers revealed that they were highly enthusiastic about participating in the research process. Rather than seeing it as extra work or a burden, they saw it as an opportunity to learn new things and foster their personal and professional growth. For instance, Rewati responded to the researcher, describing it as a "wonderful *opportunity to learn various new things*"; Rewati desired to explore more about the nature of research, and Rinu's willingness to participate in the research after missing the email timeline are a few examples that demonstrate this. The teachers were intrinsically motivated to participate and viewed the research as a shared learning opportunity rather than as an imposed task.

In education, it’s important to understand teachers' interest and willingness to be part of the change makers. The major engine of educational success or transformation lies in the teacher’s competencies (Rahman, 2021). I believe that, to achieve the desired goal in any manner, it's essential to have the willing participation of the groups. As a researcher, I believe that when participants engage enthusiastically, it helps to generate authentic data in any research. In addition, as stated by Bennett (2004), active and full participation of co-researchers in Participatory Action Research (PAR) can create great awareness among the participants. Moreover, as constructivism suggests, learning will be meaningful and authentic when learners construct their own knowledge. Similarly, when a teacher willingly participates in teacher professional development, it helps develop inclusive learning in the classroom.

Building Trust through Voluntary Participation

The interaction above between the researcher and the teacher underscored the importance of building trust. Rather than selecting participants directly, I invited teachers by mail and clearly stated the purpose of the research, the study's collaborative nature, and their right to participate or withdraw voluntarily. I believe the usefulness of Teacher Professional Development (TPD) lies in teachers' direct involvement throughout the process, from planning to implementation. By working collaboratively with teachers, we can identify their actual needs and tailor the development programs accordingly. As Dhungana et al. (2021) assert, "The participatory professional development approach is conceived as professional co-learning in which the boundary between trainer and trainee blurs, enhancing the professional autonomy of the participants" (Introduction section, para. 2).

Furthermore, to foster creative and innovative learning, the direct involvement of teachers is essential. Lim et al. (2020) argue that teacher involvement in professional development makes training more innovative and co-creative. Teamwork strengthens efforts by bringing diverse perspectives to the table. While viewing a situation through a single lens offers only one perspective, collaboration enables a deeper and more nuanced analysis. By keeping the purpose of becoming co-creative in the learning process, I chose Participatory action research as a methodology that emphasizes generating knowledge through collaboration with local experts and the inclusion of those with firsthand experience (Mahara, 2024). This approach ensures

that professional development is grounded in real-world contexts and addresses practical needs effectively.

The next section of my research shows how we collaborate and envision different teacher professional development sessions.

Exploring Teachers' Needs through Participatory Action Research

My research is based on participatory action research (PAR), in which the first step was to identify and explore teachers' needs. On April 30, I sat with a group of teachers to discuss the problems and challenges they had been facing in their classrooms. To begin the session and understand the teachers' perspective, I started our discussion with the question, *"*What types of problems and difficulties are they facing in the classroom*?"* To make our discussion more interactive, the researcher told teachers to share their ideas and issues based on their classroom experiences. After listening to my perspective, Amit, one of the teachers of grade 6, shared, "*I have been in this teaching field for the last 5 years. But day by day, it has become challenging to manage the students in the classroom. They usually don't listen and do not submit assignments on time."*

Reshmi also added her point by saying, "*In my class, there is one boy who always disturbs the class by roaming around during lesson time. I've tried consoling him several times, but he never listens to me. I believe other colleagues also have been facing the same problem."*

After hearing their responses, to make the discussion more point-centric, I followed up with another question: as a teacher, there are various issues in the classroom; some might be facing behavior issues, some might be facing issues with students not completing assignments, and so on. Apart from these, what specific difficulties are you facing in developing yourself professionally*?*

After my follow-up question, Dilu, the teacher for grades 4 and 5, mentioned that she struggled to complete her course on time due to numerous school events. She explained further,

> *When students reach grade 4, they transition from an integrated curriculum to subject-specific teaching. From grades 1 to 3, we have grade teaching, but from grade 4 onward, it becomes subject-specific. Because of this, students find the grade 4 curriculum overwhelming and face difficulties in both the evaluation system and writing.*

Classroom Challenges and Changing Learners' Behavior

From the participants' responses, the first issue to emerge in the discussion was the changing nature of the classroom. Several participants expressed concern about increasing behavioral challenges among the learners. The discussion among the participants suggested that teachers were struggling to respond to learners' changing behavioral needs, possibly due to various factors. Our learners' behavior and classroom challenges have been changing nowadays**.** As the discussion continued, I realized that today's classroom challenges are quite different from those of the past. In earlier times, teachers often used physical punishment to maintain silence in class, ignoring students' actual concerns. Today, the issues are far more nuanced, shaped by technological advancements, diverse classroom dynamics, and evolving teaching practices. Previously, students listened to the teacher, possibly due to the teacher's authoritarian role. Furthermore, in today's educational landscape, parents' expectations of teachers and schools have been changing. Previously, parents focused on grades, but the trend is changing nowadays. Especially at the primary level, apart from a few parents, most parents were concerned about learners' happiness and holistic development rather than rote memorization.

Reflecting on the session, I felt that while some of the teachers' concerns were valid, the core issues I was trying to uncover for my research had not yet emerged. To design meaningful interventions and move forward effectively, I need a deeper understanding of their actual needs. Looking at today's classrooms and the trend in TPD sessions, most focus only on the trainer's side. In my research, as I employ the interpretivist paradigm, the initial step was identifying the teachers' need for transformation. As suggested by participatory action research, the primary aim of PAR is to enhance our practices and profession through collaboration, reflection, and transformation (Rajbanshi & Luitel, 2020). Keeping this in mind, I decided to run another session differently, which was discussed under the following heading.

Sharing Participants' Own Understanding of Professional Development

I believe that before starting any session or any class, it is essential to understand the learners' existing (prior) knowledge and experiences. As my research focuses on Teacher Professional Development (TPD), understanding participants' views on TPD and its nature is the fundamental starting point. This also allows us to identify where we currently stand and whether we are aligned with the research's

intended purpose. Thus, I planned to begin our session with an exchange of our views on Teacher professional development.

In the following meeting on May 3rd, I commenced the session by discussing the teacher competencies outlined in the Competencies Framework (2023) by the Government of Nepal. After reviewing those competencies, we began reflecting on how we were working to achieve them and what difficulties we were facing in doing so. In addition, we had discussed what teacher professional development was for us. Amit said, "*F*or *me, professional development is adopting new techniques in teaching*."

I replied, "*Ok*," and asked other teachers if they wanted to share what teacher professional development is for them. Minu said, *"I want to add some points. For me, tea*cher *professional development is learning different techniques in teaching for the holistic development of the learners."* After her, another teacher from grade 6, Shanti, mentioned that for her*, "Professional development means being able to adopt 21st century skills in teaching and learning, and exploring different techniques for the learners*." While some of the participants were sharing, I noticed that all the co-researchers were eager to share their understanding of teacher professional development. While asking this question, another teacher, Prabesh, shared that, "*It is the process of updating and sharing our knowledge through different techniques of teaching*." In the statement of Prabesh, Kamala added, "*TPD is the session where we enhance our profession*. "

While the teachers were sharing their views, I felt relaxed because our perceptions were the same. To explore TPD further and understand their actual gap, I added a question. I asked them, why do we need different types of professional development training? And how did these trainings satisfy their need and challenges? In response to my queries, Shanti stated that

> *How we learn and how we were taught are different. In today's classroom, we need to run classes based on students' interests, so, in my view, TPD is about learning new teaching techniques that address all learners' opinions*.

In addition to the same question, Riya said, "*Our knowledge and learning are different from what our curriculum expects. To achieve the curriculum goal, we need to update our knowledge so we can bridge the students and the curriculum goal."*

Furthermore, while asking how we could develop our professional growth, the English teacher mentioned that,

> *By adopting new techniques in the classroom. In today's world, we need to update ourselves based on learners' perspectives, as what we learned and taught differs from what our learners demand and need.*

Rinu shared that in her classroom, she encounters different learners who think beyond what we imagine. In this line, she believes that as teachers, we need to be familiar with different teaching and learning strategies that make learning meaningful in today's world.

In addition, while discussing how we develop our professional growth, most of the teachers stated that we can do so by attending different skill-enhancement training sessions, reflecting in practice, and learning different teaching techniques. Moreover, we discussed whether we can meet all the teacher competency skills prescribed in the revised version of the Teacher Competencies Framework (2023). Teachers said that they were facing certain challenges in the classroom in achieving those goals. The teachers shared points such as student disengagement in the classroom, the time constraints in completing the curriculum, and challenges with the assessment system.

Teacher Professional Development as Continuous Professional Learning

The above discussion on Teacher professional development revealed that, although participants define TPD in different words, their thoughts are common. Most of the participants viewed TPD as a continuous process of learning new strategies, updating pedagogical knowledge, and improving classroom behavior by addressing learners' needs. Further, they perceived professional development as the adoption of 21st-century skills, the development of a culture of sharing, and the focus on the holistic development of learners. As Sancar and Deryakulu (2021) claim, in today's world, teachers need to be familiar with emerging trends in education due to society's growing emphasis on new ways of thinking and educational innovation. Teachers are the keystone of education; without them, education cannot be better. I believe that in today's world, teacher training is essential for enhancing teachers' content and pedagogical knowledge. As defined by Rout and Behera (2014), "Teacher Professional development provides teachers with opportunities to explore new roles, develop new instructional techniques, refine their practice and broaden themselves, both as educators and as individuals" (p. 9). In the discussion with the teachers, most were also willing to learn new knowledge, a trend in today's educational progress.

Furthermore, to explore the nature of training that they have been taking and implementing in the classroom. I asked them, what type of training is useful in the classroom? How often do you attend the training? And are they useful?

After my question, the Grade 4 English teacher mentioned that she had been attending different teaching training workshops, but most of them were ideal and difficult to implement in the classroom.

Further, Amit mentioned,

> Absolutely, *I also attended various training sessions, but most of them focused on other areas rather than our needs. For example, as a math teacher in today's world, I want to explore ICT-based teaching in my classroom, but we are still relying on paper and pen for knowledge*.

In support of this, another teacher, Riya, mentioned that, "*Recently, we attended one training based on creating activities, but our main problem is related to making the learner understand the content. Nowadays, the training that was provided by the trainer, we easily access it on the internet."*

Dissatisfaction with Existing Teacher Professional Development

The discussion further revealed that although teachers regularly participated in various TPD sessions, they were not satisfied with their nature and content. Most participants argued that most of the training was theoretical, supply-driven, and failed to address their actual needs. For instance, Amit was seeking ICT-based sessions, but most of the training he attended focused on conventional paper-and-pen approaches. From this, we found that most TPD training fails to address teachers' real needs. As stated by Dhungana and Gnawali (2023), most of the teacher professional development in Nepal has been supply-driven rather than need-driven (p. 100). In Nepal, the CDC, the Education Ministry, and related policies have envisioned making teachers skilled and capable of addressing 21st-century skills in the classroom and view training as an essential tool to enhance teaching and learning (Pant et al., 2020). Teachers are unable to transfer the training they gain from TPD due to the rigid, fixed, and non-participatory nature of the program (Dhungana et al., 2021). I believe learners' involvement is essential to learning. As social constructivism suggests, which focuses on the collaborative nature of learning, sharing our knowledge with one another enhances our learning and helps us identify areas for improvement. When learning collaboratively, as suggested by constructivism, we connect our prior

knowledge with new knowledge to achieve meaningful learning (Chand, 2023). In this research, as a STEAM scholar, I worked with the teacher and for the teacher.

Exploring Participants' Needs for the Integrated Project

After we had shared our understanding of what we could improve and how we could advance our professional growth, we met on May 6th to identify our needs. We started our meeting with casual talk, and I started the meeting by asking a question to teachers, as a teacher, what do we think, what are the difficulties we have been facing in our teaching and learning? To simplify my queries, I asked them to consider what we could work on together to enhance our teaching and learning, so that, as teachers, we could also grow and give our best in the classroom. To this, one of the teachers from grade 3 responded by saying,

> Ma'am, *we have observed that you have been implementing various integrated projects in higher grades. Though we are following an integrated curriculum, we are still facing problems implementing the integrated projects, so for me, it might be helpful if we focused on them.*

Adding to the point of the Grade 3 teacher, another teacher from Grade 6, Amit, stated, "*That's a good idea; even in higher grades, we need to give 32 marks for the project. If we combined the project in such a way, it might be helpful for the grading as well."*

They were struggling to design integrated projects and worksheets and incorporate subject integration based on festivals and themes. They were confused about how they could integrate all these things into the curriculum so it would be easy for them to assess them as well. While doing this, they also asked how they could evaluate learners using an integrated approach.

A grade 4 teacher added that they were also interested in learning about integrated projects and subject integration. They stated, "*Now, in the assessment system, they need to evaluate learners internally as well, and based on the project."*

They also mentioned that they have issues designing projects across all subjects and topics. They only have 40 minutes to deliver the content, and because they are doing a project in each subject, their course will not be completed on time. In the same question, Rewati shared, "*Nowadays, the education paradigm is also changing, so if we are able to design the project from the integration line, it will be easy for teachers, and we will also learn new things."* Another teacher, Shanti, from grade 6, also agreed and asserted that" *Yes ma'am, we also have the same dilemma of*

internal assessment. I believe it might be easy if we go through the concept of an integrated project."

After listening to teachers' voices, I felt I was on the right track. As a STEAM scholar, I also focused on teacher professional development training aligned with the STEAM approach. STEAM is an inter-, multi-, and transdisciplinary approach that focuses on integrating learning. As our real-life problems and their solutions are interrelated, different subjects in learning are correlated and connected (Yakman, 2010). In addition, as suggested by Nhill (2021), "STEAM aims to promote the importance of project-based learning through the experimental and practical learning method" (p. 82). Furthermore, the STEAM approach opposes discipline-based learning, which has led to disengagement in the learning process; instead, it focuses on inter-, multi-, and transdisciplinary concepts that aim to foster critical and creative thinking among learners (Manandhar et al., 2022). In addition, in today's landscape, learners need to be familiar with both hard and soft skills for their holistic development. For this, it's essential to focus on the real-life application of learning through an integrated approach, which is possible with STEAM-based learning.

Planning Project Collaboratively

After deciding to move forward with designing an integrated project, we convened a meeting on May 8th. The meeting began with formal introductions and a recap of previous meetings. Following the previous meeting, we agreed to plan the integrated project collaboratively around a single theme. One of the teachers, Minu, suggested, "*Now we are teaching the theme 'me and my family'; if I am not wrong, directly or indirectly, we are teaching them a higher grade as well. Shall we work on this?*" After listening to her, all the teachers agreed to work on the central theme.

As an educator, to understand the prior knowledge of integration and project work, I allow the co-researcher to plan their project collaboratively. I believe that to start any session, it's essential to have prior knowledge of the learners. As suggested by constructivism, prior knowledge is the foundation for constructing new knowledge, skills, values, and attitudes (Geofrey, 2021). Prior knowledge is an essential factor for teachers/ researchers in designing and modifying appropriate plans.

Another teacher, Dilu, added, *"I think let's go with the sub-theme of food"*. After listening to this, everyone started working together. First, they segregated their task. Minu from grade 3 said, "*I will create a background of the project and provide our input in our respective subjects*". She started giving background information on

the project, which was presented as an essay. While Minu was sharing the background of the project, Prabesh proposed, "*As we know, the environmental day is approaching, shall we also add that in the project?"* After listening to him, Asmi stated, "*That's a wonderful idea; from there we can also make students aware of the waste which we produce from food at home or school*." In her statement, Shanti mentioned the concept of digital literacy in the project. Another teacher introduced the concept of slogans to promote environmental improvement. Ashmi added the concept of ascending and descending numbers. While writing and sharing these points of the project, Amit suggested that,

> *Rather than trying to fit all the subjects' projects within this small passage, what if we expand the passage into a small story, which would tackle different subjects in different sections? For example, rather than listing all the characters' ages on a single line, we could add new characters and their ages gradually. We could create a story about the characters going into a shop to buy groceries, incorporating ideas from health science and mathematics, such as addition and subtraction.*

Rewati and other teachers agreed with his point and began developing the story accordingly.

> *We also added the concept of the Digestive System: Teaching how our bodies turn food into energy and get rid of waste. Ages and Growth: Talking about how people and plants grow over time and eventually die. Diagrams of plants or animals showing their different stages of the life cycle.*

Another participant, Rinu, suggested, "*We can also list out the greeting words and leave-taking words that you use at home as well as at school."* Further, Riya stated that

> *Maybe we can also write a journal entry for the day his maternal uncle visited him, and include the conversation that day with his maternal uncle and other family members.*

Further Reshmi stated that she integrated the concept of healthy and unhealthy food through poem.

मामा आउनुभयो

मामाघरबाट हाम्रा मामा आउनुभयो (My maternal Uncle came from his home)

झोला खोली हेर्न मन छ के ल्याउनुभयो ?(I was curious to see what he brought in his bag?)

नमस्कार गरे मैले पानी पिउन दिएँ (I greeted him and offered water to him)

छेउमै गई बसेर हालखबर सोधेँ (I sat near him and asked about his well- being)

कुखुरे र म:म अनि फलफूल दिनुभयो (He gave me Kurkure, momo and fruits)

काखमा राखी मलाई धेरै माया गर्नुभयो (Kept me in his lap and showered his love)

सधैँभरी अल्पपोषक खानुहुन्न अरे (should not eat junk food all the time)

म:म खान्छु अहिले म फलफुल खान्छु भरे (thus, I will have momo now and fruits at night)

फलफुलका बोक्रा सबै कुहिनेमा राखेँ. (I kept the peel of fruits in the degradable bin)

कुरकुरेका खोस्टा थिए झोलाभित्र हालेँ (I kept the snacks wrapper in the bag)

वातावरण सफा राख्नु हाम्रो मुख्य काम (our essential work is to make environment clean)

हिँड साथी सबै मिली फोहोर फाल्न जाम (come friends let's all go to dispose the waste in proper place)

While listening to the co-researcher's input and collaborative work, I felt grateful. All the teachers were involved in the project-making process. Apart from this, my analysis of the teachers' understanding of integration showed that they understood the concept well. In contrast, I found some areas lacking in the concept of project making. On that day, the meeting concluded by finalizing another day of meetings on May 12.

After the meeting with the teachers, I realized I needed to share some papers related to project-based learning, particularly on what makes a good project. So, in the evening, I sent two articles via mail: "*What makes a good project" by* Stager (2008) and the article "T*he effectiveness of the project- based learning (PBL) approach as a way to engage students in learning* by Almulla (2020) and informed co researchers to go through the articles and we are going to discuss on following articles and their ideas in the coming week, and self-evaluate our projects.

Collaborative Planning Promoted Shared Knowledge Construction

This process of planning integrated projects demonstrated how teachers developed the habit of working collaboratively rather than individually. Because of this collaborative work, participants came together to share their ideas from their

respective subject areas, which was rare in subject-based teaching. In addition, while designing an integrated project, they realized that much of the subject matter of a particular subject was related to other subjects. Furthermore, as teachers shared their ideas with one another, they were constructing knowledge in a dialogic setting, a core principle of social constructivism. Social constructivism believes that knowledge is co-constructed through dialogue and shared experiences.

Reflecting, Realizing, and Moving Forward with the Integrated Project

At 4. 10 pm on May 12, we gathered in one of the school's grade rooms and started our talk with a sip of tea. As we had planned to discuss project-based learning, we began by sharing our understanding of the paper. Amit shared,

> *After going through the paper "What Makes a Good Project," I found there should be 8 components to make a project good: Purpose or relevance, time, complexity, intensity, connection, access, shareability, and novelty*.

After listening to him, I asked everyone to scan the paper once and determine whether our project aligned with these components.

In response to my question, Riya said, "*While going through this paper, I found we have lots of things lacking in our project; we need to add many components*." Reshmi also stated, "*I also agree; in another paper, project-based learning has been focusing on collaboration*." Then I asked, "*Shall we go through the paper again and discuss among ourselves and find the things which we need to improve in the project*?"

All agreed on my point, and Shanti stated, "*I am also thinking about the same thing, let's do that so we can also know more about the project-based learning and its components in detail*"

> After reviewing the shared articles, teachers began to critique the project independently. One of the teachers from grade 3 claimed that, "*From the research paper, I figured out, in the project, there should be novelty in learning, but we are repeating the same thing in the learning.*" Another teacher from grade six shared, "T*here should be a limited time frame in the project so we can accomplish it within the time limit"*.

Another teacher from grade 4 stated that *"We have added different information in the same place. We need to make it specific based on the objectives and grade*."

Reflection-Initiated Transforming Learning

As teachers shared their views, I realized they were on the way to transformation. They were questioning their previous beliefs and practices and wanted to improve their practice. Instead of waiting for feedback from the researcher or others, they independently evaluated their own project based on the literature they reviewed. They themselves identified missing components, questioned their earlier assumptions, and figured out improvements on their own. This self-critique indicated that teachers had begun critically examining their own practices. As Mezirow (1997) states, when we question our frame of reference, we move towards transformation. We can become critically reflective of the assumptions we or others make when we learn to solve problems instrumentally or engage in communicative learning. Rajbanshi & Luitel (2020) stated that "transformative learning is elaboration of existing points of view, establishment of new points of view, transforming the point of view, and becoming aware and critically reflecting biases that one has." (as cited in Mezirow, 1997). Earlier narratives show that co-researchers were questioning their own project and frame of reference by themselves. As argued by Liu (2015), "critical reflection simply means looking at the things that go well and the things that do not go well." (p. 1). I believe that, while doing some work or action in our practices, if we analyze each step and experience and try to reform those practices, then we are following reflective practices and moving towards the journey of transformative learning. Transformative learning helps an individual think and question their beliefs, thoughts, feelings, and actions. Transformation starts with ourselves when we begin to question our "frame of reference," which is shaped by our experiences, background, and so on (Mezirow, 1997, p. 1). For transformation, it's essential to critically view our practices, actions, and beliefs. I believe our reflective practices help us move towards the journey of transformation.

Collaborative Pathways: Designing Integrated Learning Experiences

On the same day (May 12), after reviewing various approaches to project-based learning and the concept of integration, teachers decided to design integrated projects for their respective grades. For this, the teachers separated themselves by teaching grade and designed different projects for each grade, with plans to implement them starting May 29. So, this section focuses on the sharing session for the integrated project and the implementation plan.

After certain discussion in the group, I asked co-researchers, "*Shall we start our sharing? We are excited to listen to each one's projects, right*?" When I asked my question, everyone smiled and nodded. So, one of the co-researchers in grade 6 asked, "*Shall I start*?" We gave her a thumbs-up, and she started to share.

Riya stated that,

> *We have designed the project to align with the Environment Day. As a social teacher, I aligned it with the chapter on society and our responsibility. Similarly, in mathematics, we have decided to use the concept of sets; in English, learners will create a story based on the environment. Further in the language subject, students write their experiences through reflective writing*.

Amit added, "To *evaluate our learners' understanding, we also developed the rubrics for the assessment and evaluation.* "

We gave a round of applause for their work, and I appreciated it. Then one of the grade 5 teachers said, "Shall *we share now? We are excited to share. "We also request that all the team add their feedback and suggestions,"* I replied. *"Of course!" Move ahead*." Shanti stated,

> *In grade 5, we designed the project to align with the theme 'know your city,' where we integrated different subjects into this theme, like Mathematics, Science, English, and Social. Through this project, we have also connected the concept of Environmental Day*.

Further, another teacher from the same grade shared that,

> *In Mathematics, we have used the concept of four fundamental operations; in English, we are going to teach students essay writing; in science, we are connecting the concept of plants; and in Health, we have used the concept of environment sensitization*.

Riya further stated that,

> *We used this concept in our project, as we know that after two weeks, on June 5, which is World Environment Day. We have even decided to integrate it with the makerspace, where learners will prepare a paper bag from waste paper*.

"*Great work, really great project, I didn't find any feedback for now*," Kamala replied to them. *"Yes, the plan is good",* replied the Grade 3 teacher, Rinu. *"As I believe no suggestions have come from the other team, shall we begin our Grade 3 project? "* In response to Rina's question, '*Yes, you can move ahead*,' said Grade 5 teacher Rashmi. Rina started her sharing,

> *Now we want to share our plan for the project. We have refined our earlier project and found many flaws. As suggested earlier, we now need to problematize the issue and have students solve it themselves. Unlike the previous project, we allowed students to construct knowledge on their own. Furthermore, we also added assessment criteria as suggested in the last session*.

After listening to all the projects from different grades, I said, "*It's really great work." It seems we learn many things by reflecting on our work by ourselves*". While I was saying this, Kamala, one of the teachers from grade 6, mentioned,

> *Shall I share one thing? While doing this work or designing a project, I felt it broadened my thinking and perspective. Before designing any project, I looked at it from the perspective of Social Studies, but now I am also considering it from the perspectives of other subjects. Furthermore, it helps me learn different subjects and their topics, which helps us make curriculum mapping*.

Moving towards Interdisciplinary Thinking from Subject-based Thinking

After listening to their sharing and voices, I realized I was on the right track to fulfill my purpose of using a participatory approach to promote teacher professional development in STEAM education for transformative learning. Here, teachers were not only trying to integrate subjects into the project but also to blur the boundaries between subjects in their minds. I believe that when teaching certain subjects, we forget about other subjects and the connections between them. I believe that, as our real-life problems and their solution are related, we need to focus on STEAM education, which is an interdisciplinary approach to education that encourages learners to use creativity in their technical knowledge to tackle the problems in the curriculum "in the general and global crisis in particular" (Dahal, 2022, p. 170). It is believed that STEAM encourages students to become lifelong learners who can solve a range of future social issues in innovative ways.

Co-researcher's dedication and participation in the planning phase made me over the moon. The purpose of the research was to promote STEAM-based teacher professional development for transformative learning. An analysis of co-researcher attributes towards the project showed that they were following the essence of STEAM education, in which, rather than focusing on bookish knowledge, teachers designed projects with real-life implications that would be useful for learners in the future. Generally, in various TPD sessions, we find that the trainer imposes their ideas on the

participants and does not involve them in learning. If we see it from the perspective of the curriculum, we can claim it is a part of the curriculum. In contrast, in this research session, participants were involved in creating integrated projects for their learners by reflecting on their past experiences. This shows, one way or another, they were moving towards the journey of transformation.

From Plan to Practice: Implementing Integrated Projects in the Classroom

After the project's implementation, on June 10, 2024, we gathered again for a sharing at 4.05 pm, along with a cup of tea. The main agenda of the meeting was based on how we implemented our project and what we learned. I started the meeting with an informal talk: *How were the classes going? Were there any interesting things happening in the classroom*? and so on. After giving some time to the informal talk, I started the formal talk,

I said,

> *Ok, now let's move on to our agenda for today's meeting. I know I have also been observing the project's implementation, but we need to share it with our colleagues so we can learn from each other. Shall we start with how we implement our project? Were we able to implement as planned, and what have we learned*?

After this, all the participants smiled and nodded in agreement. As one of the participants from grade 6 needs to go early, she asked for permission to start first. Other co-researchers also agreed with her point, so we started sharing in Grade 6.

Project of Grade 6

The Grade 6 project was about integrating mathematics, health, social studies, and English around the theme of the environment. So, from the grade 6 team, Riya started sharing by stating that,

> *We started the project by taking students to the Bishnu Mati River to observe the river. During the trip, students noted what they saw along the river, such as waste, temples, people, and other sights. At the riverside, students drew the river's current condition and listed the trash they found around it.*

In the grade 6 team, there were four teachers, so they chose to share collaboratively. For sharing other things about the project, Riya handed over to Rashmi. Then Rashmi started to share that, "*After they came back, we talked to the students about what they*

saw, how they wanted to improve the condition of the river. Then we handed over the integrated worksheet where students needed to discuss and give an answer".

Another teacher, Amit, shared that,

> *We had also developed an integrated worksheet in which learners needed to answer questions across different disciplines. For example, how can they clean the river? Did you notice any signs of pollution or human activity affecting the riverbank? (Health*). *What are the solutions or ways for cleaning the surroundings of Bishnu Mati? Prepare a short dialogue between you and your friend, based on today's observation. (English and Science*). *विष्णुमती नदीको किनारमा रहेका ऐतिहासिक सम्पदाहरूलाई कसरी संरक्षण गर्न सकिन्छ ? आफ्ना सुझावहरू दिनुहोस् । (Social Studies). Based on your collected items or observation, create two sets and present them in the diagram, descriptive, set builder, and listing method on A4- sized paper (Mathematics).*
>
> Then Kabita stated,
>
> *I would also like to add on to how we concluded. After that, we organized a small exhibition where students showcased the best of their waste-to-value projects in collaboration with the art teacher and the Makerspace*.
>
> After grade six sharing, we all clapped. Then I said,
>
> *Ok, that's great. We'll come back later to what we learned, the challenges we faced during implementation, and whether we found anything interesting along the way. Or what do you think? How can we take this session ahead? First implementation, as well as sharing of reflection, or just sharing the ideas related to the implementation phase.*

While responding to my queries, grade 4 Teacher Prabesh proposed sharing the implementation first, then discussing the challenges and other issues they faced during the implementation phases. On his point, other co-researchers also agreed.

While listening to the grade 6 team, I found that they were clearly focused on an interdisciplinary approach, in which the same topic was taught in different ways across various subjects. While reviewing their ideas, I realized that our co-researchers moved away from the conventional subject-centric view toward the progressive STEAM notion of interconnection and relationships among subjects.

Figure 4

Exhibition on the Best Out of Waste of Grade 6



Project of Grade 5

From grade 5, Shanti shared her project. She stated that,

> *The grade 5 project was all about knowing your city, where our students explored different aspects of the environment, waste materials, and the concept of food. To start our project on the first day, we took them to the Kalimati, vegetable market, where students bought different vegetables. I forgot to mention that they brought Rs 200 from home to buy vegetables. The main purpose of our project was to make students familiar with real-life situations where they can buy different vegetables, interact with shopkeepers, and learn about the types of vegetables found in our vegetable market. I think I need to give other colleagues a chance to share as well, right?*

While she said this, all the teachers laughed. Furthermore, another teacher, Dilu, shared that,

> *During the field visit, students asked the shopkeeper questions about their profession and various vegetable names, and engaged in bargaining while buying vegetables. After they returned from the vegetable market, I had them discuss the prices of the food they bought in my class, and they shared their experiences with their friends. The next day, in mathematics class, I told them again to discuss with their friends and figure out the total expenditure and savings. While doing that, I also assigned some questions related to mathematics, such as: if the cost of 1 kg of tomatoes is Rs. 75, what is the price of 5 kg?*

While one co-researcher was sharing, the other co-researchers were taking notes. After Dilu shared, other participants raised their hands from the left corner and said,

> *I also want to add something about how I connected it to my subject (science). We just finished the chapter on the SI units. I asked students a question about SI units based on the things they bought. They developed the questions and found the solution. On the other hand, in science class, they learned about different types of food and the SI unit of measurement. Based on the food items they bought at the vegetable market, they learned about the SI unit and converted grams to kilograms. While doing this, they were also tasked with interacting with the parents about different measurement tools they had used in the past and currently use. On the second day, they also shared that in Kathmandu, there is 200 gm in one pau, and outside the valley, there is 250 gm. Further, I also connected ideas of different types of food which we can have from plants and animals".*

After listening to Prabesh, Shanti asked us, "*I think now it's my turn to share, right*?" Prabesh, Rashmi, and Dilu said, "*Yes ma'am, you can move ahead from here and share how you interrelate it with your subject."* She further said,

> *In health class, I connect the concept of food sensitization to the need to consume vegetables and to what happens if we eat food without washing or cooking it. Similarly, in the makerspace class, learners learned about reusing non-degradable waste, and they were assigned a task to produce something best from waste. On June 6th, there was an exhibition of things that they made from waste*.

Figure 5

Field Visit of Grade 5



"*Wow, great, I hope we learned many things during this process and faced challenges as well. We will discuss further, let's listen to grade 3 teachers, how they implemented their projects*". I said.

Project of Grade 3

Minu Shared that,

Our *project for grade 3 focuses on the theme of food and the environment. To make our project real and connect learners with real-life problems, on June 1st, we created the project background by explaining the students' stomachache problem, which has been increasing day by day at school. We told them to figure out the real causes behind the problem. Our health department has decided to create a record of the food we consume at school and at home. Further, we instructed the students to list the food items they had consumed over the past three days, along with the prices. On June 5th, the students were asked to share with their peers the food items they consumed at home and at school. After this sharing session, we asked them to classify these items into healthy and unhealthy categories in groups. While the students categorized the food, the teacher engaged them in a discussion about the effects of consuming healthy versus unhealthy food.*

Asmi stated that,

During the mathematics class, we asked learners to compare the prices of the food items that they had recorded and present them in the tally chart. Through this activity, they learned the concepts of "greater than," "less than," "equal to", and statistics. The following day, during the "Hamro Seropharo" class, the students were divided into five groups. The first group categorized the food as healthy or unhealthy, while the second group classified it as body-building, energy-giving, or body-protecting. Group C developed a healthy menu for a restaurant, Group D classified food as vegetarian and non-vegetarian, and Group E differentiated food sourced from animals and plants. Finally, the students created a poem centered on healthy food. It took seven days to complete all these tasks.

Figure 6

Group Work of Grade 3 on the Topic of Food



Figure 7

Group Presentation of Work in Chart Paper



All of these, shared by the co-researchers, reflect that this STEAM-based approach to TPD allows co-researchers to come together, share their ideas, and plan their projects. Further, while presenting, I found dedication and enthusiasm among the participants, which proves that when we allow teachers to participate in sessions that interest them and meet their needs, it automatically promotes participation and ownership in teaching and learning. Furthermore, learning will be meaningful when we are directly involved in the learning and understand the qualities and challenges by ourselves. In this Implementation phase as well, we saw that co-researchers planned their projects and identified the challenges and changes that could be made in the coming days to make them more effective.

Managing Challenges during the Implementation of the Project

In the school, various challenges arise during project implementation, such as time management, coordination with parents, logistics, and classroom management. Firstly, in our project, we faced a time management challenge due to participants' engagement across various grade levels. Since participants were engaged in various tasks, our sessions were usually conducted after school hours. Thus, if anything needed to be communicated to participants, it had to wait until school was over. Further, another challenge we faced was time management. Our projects for all grades took 3 more days than planned due to various ECA/ CCA events at the school.

Furthermore, parental support and timely communication are essential for building a strong relationship between teachers and the school. In our school, there was a practice of sending information regarding field trips to parents one week in advance, along with detailed pre-trip, during-trip, and post-trip activities. This school practice helped parents understand the educational purpose of the activities, and they were always there to support such things. For instance, in the grade 5 project, students were supposed to bring Rs. 200 to the school to buy vegetables from the vegetable market. As the learning objectives and communication were communicated in advance, parents understood that the money was used for educational purposes. So, in that case, there were not that many challenges that arose.

Apart from that, the projects required various materials. For instance, Grade 3 participants needed chart paper and regular stationery materials, whereas Grades 5 and 6 required vehicles for field trips, trip sheets, exhibition setup, and other materials. Regarding these resources, there were no restrictions from the school

administration. Therefore, teachers did not feel any pressure related to resource availability.

Sometimes, while taking students on outdoor activities, some learners became more focused on enjoying the trip than on its educational objectives. As all the teachers were aware of this challenge, they oriented the students before the trip by explaining its objectives and assigning pre-trip activities. During the trip, students were provided with observation sheets to complete. After the trip, they were also required to complete follow-up educational tasks. These activities helped students make the field visit a meaningful learning opportunity rather than merely a recreational experience.

Breaking Barriers: STEAM Integration for Transformative Classrooms

While listening to the different narratives of the teachers, I realized that collaborative or participatory-based teacher professional training helps break down the barriers of the traditional teaching approach and the compartmentalization of disciplines from the teacher's mindset and classroom. "*While designing integrated projects, we not only got the chance to know about different disciplines, but it also broadened our perspective*", shared Shanti in the indirect interview. Her statement proves that the participatory nature of teacher professional development programs in STEAM education not only helps to blur the lines between subjects but also between the teachers and their thinking. As suggested by Pant et al. (2020), the STEAM approach to teacher professional development focuses on human-centric rather than content-centric teaching through an inquiry-based approach. As the STEAM approach is defined as a transdisciplinary approach that aims to solve real-world problems (Boice et al., 2021), the participatory nature of the teacher's professional development also helps blur the line between viewing the teacher as a content deliverer and as a change agent. As stated by Wells and Chang (1986), "most effective learning occurs when the learner is treated as a constructor of his or her own knowledge and given the opportunity to share responsibility for the selection, prosecution, and evaluation of the tasks through which knowledge and competence are acquired" (as cited in Shaeffer, 1993, p. 193). In the traditional teacher training program, training was designed through a top-down approach, in which teachers were required to attend PD sessions prescribed by certain institutions. As a result, teachers took the training as a means of attending rather than gaining knowledge. As suggested by the STEAM approach, which focuses on developing 21st-century skills in learners,

TPD on STEAM education also incorporates components of 21st-century skills, in which teachers collaboratively design their plans, share knowledge with one another, use various technologies, freely express their ideas, and so on. In this integrated project session, participants also shared their understanding with each other, collaboratively planned the integrated project, reflected, and tried to become creative in the classroom, showing that the participatory nature of TPD focuses on the creative, critical ideas rather than ready-made tips, tricks, and techniques for solving various problems (Pant, 2017).

While asking the question, what *differences did you find while designing subject-specific projects and integrated projects with colleagues?*
Dillu shared that,

> *When designing a project on a specific subject alone, we may not know our own weaknesses. While working on and designing certain projects in the group, I felt we had a chance to learn a great deal from other teachers as well. After listening to other ideas, we also drew inspiration from them and questioned our own beliefs about why we were unable to think in a similar way.*

"I also agree with the Dilu ma'am, and I am also eager to share my major reflection," a teacher from Grade 6 shared,

> *Before this integrated project, I thought of English, especially Grammar, as a rigid and structured subject. I never thought of connecting Grammar with other subjects, but while integrating Grammar with Mathematics, I figured out that it's very easy to make learners understand, and they learn things more easily. Further, I also felt that directly and indirectly all the subjects are interlinked with each other; it's in the teacher's hands how they are presented in the classroom". Kamala shared.*

Prabesh shared that*, "As a Science teacher, I thought there is no matter of language in science, but this integrated project in the classroom made me realize that language also equally matters in science. Through Science, I can enhance the language skills of the learners."*

This type of concern and belief among teachers shows that the participatory nature of the STEAM approach prompts teachers to question their self-belief in the subject-centric notion. On the other hand, the nature of questioning self-belief and one's own frame of reference shows teachers are on the way to a transformative

journey. As Liu (2015) argues, critical reflection in teaching supports reform and transforms education. Teaching critical reflection, or reflective practice, helps teachers identify their strengths and weaknesses in their practice and provides a way to reexamine and reform them for the betterment of learners. As Brookfield (2015) claimed, reflective practice means seeking out new information and new understanding of existing practices, or questioning one's own practices. While seeking new information in any practice awakens us to our past practices, it also empowers us and fosters synergy by bringing something new to the existing situation. Furthermore, from a theoretical perspective, teachers can shift their understanding from the traditional to the progressive approach. While designing various integrated projects, teachers interact with one another, share their ideas, and learn new things. As suggested by social constructivism, the participatory nature of the teacher's professional development training helps teachers scaffold their ideas with each other. Social constructionists believe that learning is most effective when it focuses on interaction, collaboration, and group work (Akpan, 2020). Ashmi shared that,

> *Through this training, I figured out that the more you share, the more you learn from each other. If you limit your knowledge to yourself, it will freeze. After the session, I ask the teachers for their views and the learners' as well, so I can be more creative in my teaching*.

This statement also proves that this integrated project helps to blur the concept of taking the learner as a receiver and the teacher as a transmitter. I believe that this interdisciplinary and transdisciplinary notion of projects and ideas forces teachers to become more creative in the classroom. In this line, we can say that the collaborative notion of teacher professional training helps teachers move towards the emancipatory concept from the technical-interest concept, as suggested by Habermas (2005). One of the participants shared that,

> *While doing this type of project, I found that when designing a project in our specific subject, we might delve deeply into knowledge, but we forget the basic interlinkages among them. Through this integrated project session, I realized that if I had known these things earlier, it would have been easy for me to teach certain content to the learners. Through integrated projects, students already find the link between different subjects and can question us, "How and why is this happening*?

As argued by Spyropoulou and Kameas (2024), “STEAM education brings together different subjects in a single curriculum, linking them to real-life situations. This integrated approach not only encourages creativity and new ideas but also gives students a broader understanding, helping them get ready for the varied challenges of today’s world” (p.1). In another line, it provides practical and emancipatory knowledge as suggested by Habermas. As suggested by Spyropoulou and Kameas (2024) “unlike traditional education, STEAM integrates different subjects into a cohesive curriculum based on real-world applications (p.2). Most of the literature suggests that the STEAM approach encourages creativity, innovation, and motivation in learners, and prepares them to address the challenges of the 21st century. (Dahal, 2022; Manandhar, 2022). In the same way, the STEAM-based TPD allows teachers to think beyond the box and helps them become innovative, as demanded by today’s classroom.

From Reflection to Innovation: The Impact of STEAM-Based TPD on Educators and Learners

While conducting interviews, sharing reflections, and participating in focus group discussions on the various aspects of integrated project training sessions, I realized that participatory STEAM-based teacher professional development sessions help teachers and learners become innovators through reflection. As argued in the paper of Shrestha et al. (2022), traditional approaches to training fail to improve the cognitive skills of learners and educators. Further, in training, trainers also focus on content that avoids the logical, critical reasoning of learners (teachers). In addition, as Larrivee (2000) suggests, there are different types of learners in the classroom: neglected, distributive, and abused. To address those learners in the classroom and make learning meaningful, we need to change our pragmatic assumptions, which is possible only after changing our practices and adopting new trends in teaching and learning. To bring change in our practices from rote memorization to creative and critical thinking, we need to reexamine our practices through the eyes of the learners, colleagues, and different articles. The patterns and teaching strategies that our teachers used do not work in today’s classroom or for learners. For instance, the way I used to teach two years ago is different from how I teach in the classroom today. With the rapid growth of AI and related technologies, learners' mindsets are also changing. Thus, I believe that in today's educational landscape, to bring change, we need to be

creative and innovative. For that, we need to be familiar with and up to date on the new trends and perspectives in education.

Rinu shared,

> *With a background in traditional teaching methods, I found that joining this school offered me an invaluable opportunity to explore the STEAM approach, which emphasizes integration and interdisciplinary learning. During the Teacher Professional Development (TPD) phase, I collaborated with fellow educators to design and implement a range of innovative projects. These experiences inspired me to adopt new practices, including creating integrated projects, developing interdisciplinary assignments, and embracing activity-based learning to enhance student engagement and understanding. Furthermore, this session forced me to reexamine my practices, in which I used to treat grammar as a rigid, structural subject.*

This statement by the teacher shows that, while working together in designing, implementing, and reflecting, the integrated project workshop forces the teacher to reflect on her own practice, question her self-belief, and move forward with innovation in her practices. Rahmawati and Taylor (2015) stated that reflective practice not only critically reflects on past experiences and practices but also reveals and reconceptualizes our vision of our practices and empowers our agency. In this line, after the realization, we can challenge our hegemony, which is guided by our practices. To move towards the journey of transformation, it's essential to question our guided hegemony. In teaching, if we need to bring transformation, we need to challenge and question our practices: teacher-centric, compartmentalized, hegemonic notions that focus on rote memorization, and the banking model of education. In the statement above, the co-researcher claims that the TPD session on integrating a project, which is part of STEAM, forced her to think differently from what she had been practicing. As suggested by Dahal (2022), "STEAM education is an interdisciplinary approach to learning that encourages learners to incorporate creativity into their technical knowledge for solving curriculum issues in general and global crises in particular" (p. 170). Furthermore, the integrated projects mainly focus on real-life situations, allowing learners to gain authentic experiences that challenge them to think differently and find multiple solutions.

Further, this STEAM-based TPD also allows teachers to create or practice something different in their teaching than their regular conventional practices. When

teachers collaborate with each other, Creativity and innovation arise as teachers and trainers allow learners to see the world as they see it, without limitation.

> A*s a Nepali teacher, I often did not plan activities for the students, especially group activities. However, while working on an integrated project, I divided the students into different groups to explore ways to preserve our heritage. During this process, I observed that students shared their understanding with each other. While discussing solutions to preserve national heritage from environmental pollution, learners came up with the idea of creating a device that could distinguish between degradable and non-degradable waste—an idea I had never considered before. Although I had approached the topic from a language perspective, the students integrated knowledge from multiple disciplines to express their understanding. This experience demonstrated that using such strategies in the classroom makes learners more creative and innovative. Similarly, during group work, students often ask questions we, as teachers, might not have anticipated. To keep up with their curiosity and address their ideas, I now strive to make my classroom more active and innovative.* A language teacher shared this.
>
> Another teacher from grade 3 shared that,
>
> *While working on the integrated food project in my classroom, my students learned many things, one at a time, through repetition. While integrating the same thing across different subjects, I figured out that learners can connect its use to real life. For example, while teaching the concept of food, one of the students himself shared that we do not need to waste food, as there are many people in the world who cannot eat a single meal. What if we provided them with our food and so on? Furthermore, other groups were also able to understand the true price and importance of that food in our everyday lives*.
>
> A teacher from grade 6 shared,
>
> *In the project on smart city, we integrated with English, Mathematics and Social, during this project one of my students shared; that while doing a single project of math, he only thinks about the idea of perimeter, area and volume but while looking same smart city from the perspective of Social he is able to analyze the different lifestyles of urban and Rural societies and ask different creative questions in the class.*

Analysis of co-researchers' perspectives suggests that the integrated project is an effective approach to developing 21st-century capabilities in learners and teachers by fostering skills such as problem-solving, critical thinking, teamwork, innovation, and creativity. In Nepal, most scholars have been raising concerns about disengagement and a lack of cognitive development in the discipline-based approach and advocating for an integrated approach that focuses on inter-, intra-, and transdisciplinary concepts of education. It's believed that in today's world, it's essential to focus on the holistic development of learners, which requires adopting the integrated notion of education.

Chapter Summary

At the beginning of this chapter, I presented the collaborative journey with the co-researchers. Following this, the chapter reflects on the co-researchers' views on existing teacher professional development (TPD) practices and shares their understanding of STEAM education. The chapter then moves towards finalizing the STEAM-based TPD sessions, with a particular focus on integrated projects. This chapter demonstrates how the co-researchers' perspectives and my own views on TPD were aligned, and how we progressed together as a team through the participatory action research (PAR) process. Furthermore, it illustrates our collective journey in STEAM-based TPD, including our reflections, plans, and implementation processes that constitute the first cycle of PAR.

The first cycle of PAR continued for two and a half months, during which the co-researchers reflected on the integrated projects, their implementation, and the challenges they had faced throughout the period. Similarly, the following chapter addresses the entire journey of the second cycle of PAR, which primarily focuses on art-based TPD sessions.

CHAPTER V
ART INTEGRATED APPROACH FOR CREATIVE AND CRITICAL UNDERSTANDING

This chapter outlines the second cycle of teacher professional development in STEAM education, focusing on integrating art into learning. After implementing an integrated project across different disciplines, we (co-researchers) decided to explore how art could be meaningfully included in our teaching practices and how it would be helpful in teaching and learning. This chapter of research examines why art is essential in education and sheds light on both the challenges and opportunities of integrating art into teaching and learning. As in earlier sections, I have also used narratives and reflections to share my thoughts and experiences, as well as those of my co-researchers. It highlights the process of realizing the potential of art-based pedagogy, planning art-integrated lesson plans, implementing those plans in classrooms, and reflecting on their impact from the perspectives of both teachers and students. As this chapter focuses more on art-integrated learning, the summary is also presented in an artistic form.

This chapter is all about researching something new
Based on reflecting on the first cycle of the PAR
It paved a new way in STEAM
which makes learning interesting and enjoyable

Together we reflect on the work we have done,
And agree to move forward one by one.
With the integration of art in our way,
Learning becomes brighter day by day.

During reflection, many ideas trigger in my mind,
Different forms of art begin to apply.
Visual, performing, literary, and more,
which made our learners active though

Alignment of art with STEM fosters innovation and creativity.

Bringing excitement and deeper motivation.
Poems, role play, drawing, and more,
Make learning active like never before.

Not only do learners become creators
Teachers also join and become innovators.
This pedagogy inspires everyone's heart,
Making teachers creators through the power of art

Reexamining and Moving Forward for a New Cycle of TPD

After completing the implementation of the integrated project, we decided to meet on July 10th. The main purpose of the meeting was to reflect on our practices and identify or explore other methods that enhance our professional development. On July 10th, we gathered in grade 8 with a cup of tea. After we all assembled, I began the discussion by saying:

> *We have now completed the first cycle of PAR, and it's time to think about the next steps. Let's reflect on what we have done so far and decide what changes we need to make in our teaching* practices *to make learning more meaningful.*

After I spoke, Rashmi said,

> *I am very excited to move forward. While working on the integrated project, I had the chance to learn many new things and to practice integration techniques in the subjects I teach, such as Health, Moral Science, and Grammar. I want to explore more methods that make learning engaging and motivating.*

Kamala shared,

> *Definitely! I also want to explore new approaches to help learners enjoy my class while* improving *their academic skills. As a language teacher, I think there are only a limited number of things we can do in the classroom. While implementing integrated projects, I learned a great deal. Though it was time-consuming, the result of the learning was wonderful.*

I replied,

> *That sounds interesting, but as an educator, while viewing all the things, what are the* challenges *of the integrated project from your point of view?"*

After that, Amit shared,

> *In my view, when doing integrated projects, we need to consider certain things, suc*h *as cooperation and collaboration among teachers, and, in the planning phase, we need to think twice. Further, sometimes integrated project outcomes will go in another direction than expected. So, in my view, it's essential to discuss planning further*.

After that, Shanti shared,

> *I felt that sometimes, if we cannot decide on our subject-based objective, then it will be time-consuming as well. In contrast, if we can do it, the benefits will be greater than expected, as we realized in our last projects*.
>
> "*There is one point as well, while doing integrated projects, we need to make clear evaluation rubrics so all* the *subjects can keep the evaluation marks of the learners one at a time, and it will help save our time to design the different projects*". Shared by Minu.

After listening to them, I said, obviously, that there are challenges and opportunities in anything. So, our task is to review the challenges and try to minimize them in the coming days to make work effective and fruitful. Apart from that, let's focus on another point of the day, exploring certain pedagogies or training that will make classrooms more engaging and motivating. In your opinion, "*what are the other challenges that you have gone through in your classroom as an educator?"*

After my input, Rinu said, "*Sometimes it is difficult to capture students' attention, especially in subjects like Hamro Serophero and mathematics. Many students struggle with division* and *subtraction. It would be helpful if we could learn techniques that make classrooms more engaging and interactive.*"

Amit added, "*Yes, I feel the same. We currently have only a few techniques to teach mathematics. I use ICT* tools *like GeoGebra, Math Note, and YouTube videos. I also want to learn something new to make learning interesting, and students give interest in the mathematics learning."*

Prabesh, sitting next to Amit, stated,"

> I*n my subject, science, most of the content is straightforward. I use diagrams to teach concepts, but as I teach grades 4 and 5, I think learning learner-engaging* pedagogies *and tools would make lessons more meaningful and enjoyable. Further, while discussing the challenges of integrated projects, can we explore something we can plan for specific subjects as well?*

Listening to them, I said, "*There are many techniques and pedagogies, like outdoor learning, ICT-based learning, and art integration, that can make classrooms more engaging, and we can* plan *for disciplinary subjects as well. What do you think would be the right pedagogy for us to explore next?*"

Kamala responded, "*All of those sound interesting, but I want to explore more in art-based pedagogy, as I have not tried it yet, and I believe I can use it in English effectively."* After hearing her, Minu said, *"I've heard a lot about art-based pedagogy but never had the* chance *to explore it deeply. I think we should plan this phase like the previous one*."

"Yes, we will do that," I said, "but before planning, we need to learn more about art-based pedagogy. Is that okay with everyone?"

Shanti replied, "*That's fine. I think we are going to learn something interesting again this time,* right*?*"

Everyone agreed, and we concluded the meeting by deciding to reconvene on July 25th**.**

This co-researcher's sharing session shows how the participatory approach to teaching and learning fosters collaboration and a sense of ownership among teachers. The participatory approach is widely recognized for fostering collaboration, active engagement, and a culture of reflection (Mahara, 2024). I believe that a participatory approach is imperative to transform the teaching and learning process. In this research, rather than imposing ideas and relying on a single individual voice, we prefer to draw on the collective voices of the participants, which not only addresses their diverse needs but also makes them equally responsible for this transformative journey. STEAM-based TPD demands active participation from participants to achieve a profound goal and believes they are free from social and educational conventions (Sokhanvar & Salehi, 2018). Sharing and finalizing the subject or topic of the upcoming TPD session, based on the previous reflection, shows how participants actively engaged and understood their own needs. Aligned with this, the upcoming sections of this chapter show how participants collaborate to accomplish the 2nd cycle of the STEAM-based TPD focused on art integration.

Analyzing and Planning for the Upcoming Session

After the meeting, I reflected on the day's session and felt that my purpose of bringing transformation in education through the TPD was on the right track. While listening to the teachers' views, I felt that at the beginning of the session, they were

unable to question their own practices. However, after the sessions of the integrated project, or upon completion of the 1st cycle, it seemed they were now able to question their own practices and seek ways to improve. As suggested by Mezirow (2000), transformative learning develops the skills of critical thinking, in which people reflect on and re-examine their practices and transform into new ways of understanding.

Furthermore, listening to the participants and their decision to explore art-based pedagogy further gave me confidence that my purpose and the co-researchers' interests are aligned. As a STEAM scholar, I saw this as an opportunity to delve deeper into art-integrated learning and further my professional development. I believe that integrating art into learning is an indispensable characteristic of STEAM education. The main essence of STEAM education is promoting an interdisciplinary approach to learning, and 'ART' also fosters interdisciplinary learning in the classroom through subject integration (Jana & Adhikary, 2020). As stated by Lee (2015), "Arts-based pedagogy, or arts integration, is a pedagogical approach that uses one or more art forms (e.g., visual arts, music, drama, or dance) to deepen understanding and support non-arts and arts curricular learning objectives in the classroom" (p.1). The fundamental reason behind the integration of arts is to create "aesthetically-rich learning environments as those that enable children to wonder, to notice, to imagine alternatives, to appreciate contingencies and to experience pleasure and pride" (Sinclair, 2001, p. 26). As Eisner (2008), a leading arts educator, explains: the Arts are concerned with expressiveness, evoking emotion, generating empathic understanding, stimulating imagination that disrupts habits of mind and creates open-mindedness, and eliciting emotional awareness.

The next section demonstrates how we all sit together, share ideas on art integration, clear up our doubts, and further explore art-based learning.

Dive into the Different Opinions of ART-based Pedagogy

On July 25, as usual, we gathered for the meeting. I played a short meditation track to capture the co-researchers' attention and asked them how they felt after listening to it. Most of the co-researchers reported feeling relaxed after the music. After the music, to explore their understanding of art integration or art-based pedagogy, I asked the teachers, "I*n our own understanding, what is art? How do we define art? Does it really focus on learning*?"

After my question about art, Reshmi shared that, "*For me, art is the means of expression. In the* classroom, *while talking and expressing something, students use*

different expressions; for me, that is also art. Further, if we used drawing and painting in the teaching process, I believe that is also art-integrated teaching."

Shanti stated, "*For me, art-based pedagogy is using different drawings, songs, poems, stories in the learning to make learning enjoyable.*"

After listening to the participants, to engage them in a deeper discussion, I added, "Ok, let's add one more question: How are you using *art in teaching and learning? Let's give some examples as well*."

While I am saying this, Shanti stated that, "*I believe Art is using different poems, sculptures, and videos in teaching and learning. In my classroom, I recently used a variety of games to help students fully engage. In my Social period, I have done one activity related to a quiz also."*

Amit shared that "*In my understanding, art integration in learning means using different forms of art like singing, drawing, storytelling, and role playing in teaching and learning."*

"Great going! Let's listen to others as well." I said.

Rewati also shared, "*For me, art is like my previous friend told me. I also used art in teaching. Recently, while starting tenses in Nepali, I created some games, and students enjoyed them a lot.*

Minu shared, "*I also want to share, I think I also use art in teaching. I planned some bingo, and a quiz while teaching our past in the social. For me, art integration means using such games in teaching".*

After listening to participants' views, it seems some were clear about what art integration is, while others were unsure. Some of them were taking the game approach as an art-integrated approach. So, I have decided to provide them with some articles to help them explore the art-based approach further. Keeping this in mind, I told them, "*After listening to everyone, I found some of you were on the right track, and some of you are quite in a dilemma, so to further enhance your skills, I kindly request everyone to visit Google Scholar, where you can find articles based on the art of integrated learning. Furthermore, there are videos that explain what art-integrated learning really is. By saying this, we are going to meet next week and discuss further art-integrated learning. Is that ok?"*

"That's absolutely fine, we will also explore some knowledge, so we will also be able to share our doubts," Kamala stated, and everyone agreed with her idea.

After the session, I emailed two articles to them, which were " Art integrated learning: An innovative and inclusive approach of Education by Srivastava (2023), Engaging Students Using an Arts-Based Pedagogy: Teaching and Learning Sociological Theory through Film, Art, and Music by Hunter and Frawley (2023), and provided the link to Google Scholar from where they can learn various articles. To further enhance their knowledge, I also wanted to provide a session with an expert, so I decided to call my supervisor for the next session. The main purpose of providing articles and telling participants to explore themselves is to engage them in the learning process to deepen their understanding. As constructivism suggests, we need to involve learners in learning so that they can construct their own knowledge.

The next session focuses on clearing up doubts about art-based pedagogy and on designing various art-integrated *lessons* in the classroom.

Exploring and Finalizing Arts-Based Pedagogy in a Participatory Approach

On August 5, 2024, we gathered in a classroom for a meeting to deepen our understanding of art integration and decide which method to use in our lesson plan. On that day, other teachers (apart from participants) from Grades 1 and 2 also joined to listen to our session, who were not there in the previous session. So, to frame and recap the session, as the lead researcher, I asked the teachers of grades 1 and 2 *what they knew about art-integrated learning and whether it was helpful in the teaching and learning process.* In response to my question, a Grade 2 teacher shared her perspective, stating that for her, art means showing videos, making drawings in the classroom, and reciting poems or rhymes. She added that these activities help keep learners engaged. Furthermore, a Grade One teacher shared a similar view, saying, *"I also think art involves hands-on activities such as painting, clay work, songs, poems, and more."* She emphasized that, as she teaches students aged 6 and 7, they truly enjoy these activities in the classroom.

Other teachers, who were new to the session, were hesitant to speak, but most of them agreed that art makes the classroom more enjoyable and engaging. Apart from them, a Grade 7 teacher offered a different perspective. She mentioned,

"For me, integrating art in teaching is not just about drawing and painting; it also depends on how we present *or deliver a lesson. Our facial expressions and gestures are also forms of art."* She added, *"If we incorporate more artistic elements into teaching and learning, our classrooms will become more interesting."* Through

this discussion, I realized that teachers at different levels perceive art-integrated learning based on their students' needs and perspectives.

After listening to them, I jumped into the main purpose of today's meeting and said, “Our understanding of art integration will be clearer after listening to our co-researchers, so who wants to share?” After my question, Kamala Shared,

> *While going through the paper you shared last week, I figured out that integrating art helps increase knowledge and understanding of the subject area and fosters a greater appreciation of art. The paper has defined art integration in learning in three ways: art as curriculum, art-enhanced curriculum, and arts-integrated curriculum. I also believe art means using different drawings and paintings in the classroom.*

While this discussion was ongoing, my mentor also came for observation. After welcoming him, we began our discussion of art-based pedagogy and how we can integrate it into teaching and learning. One of the co-researchers, Rashmi, shared that, “*After our last* session, *I viewed some videos on YouTube and Google, from there I came to understand that art integration is the approach to teaching in which students construct and demonstrate their understanding through an art form.*”

> Another co-researcher, Amit, shared that,
>
> *Before the last session, I thought art and games were the same, but now I have realized that art-based pedagogy uses various forms of art as a tool for teaching and learning. I hope I am on the right track. If we are going to talk about it, I* also *liked one article which argued that “Art Integrated Learning (AIL) is a framework of experiential learning which provides an equitable learning environment for all learners through their access points.*” (Srivastava, 2023).
>
> *“That’s great, sir. Does anyone else want to share anything?”* I asked.
>
> Another co-researcher, Prabesh, shared that,
>
> *As Amit said, I also read the* article *and understood that art adds an aesthetic dimension to other subjects and serves to engage learners and foster creativity. However, I am still doubtful about this. As a Science teacher, I use various drawings and videos in my teaching, and there is always art in science, so I believe it will be difficult to use art in science.*

"Thank you, sir, for your concern. We will explore together how we can go with this as well". I mentioned. "O*k, anyone else wanting to share their views*?" I asked again.

After listening to him, another participant, Dilu, shared that she explored various videos and realized that art is one of the methods of teaching and learning. Through this, she could teach students effectively. After Dilu, Riya Said,

> M*ay I share? First, I would like to thank you because the last article, which focused on art integration, is closely related to my subject, social studies, and gave me the chance to explore and learn more about the concept of art. I used to take BINGO as a form of art as well, but now I have been figuring out that they are different pedagogical methods of teaching and learning.*

After listening to the co-researcher, I request my mentor to share information on art-based pedagogy, which will make it easier to plan art-based lessons in the classroom. Following my request, my mentor shared various pieces of information regarding art-based pedagogy. Firstly, he introduced the emerging concepts of art in teaching and learning. Then he introduced the concept of how STEM evolves into STEAM and explained the importance of art in learning. He shared that, in today's classrooms, art is often used as a tool for memorization. However, the primary purpose of art is to make learning more motivating, creative, and meaningful.

He also provided insights into how art can address social issues and how different forms of storytelling and drama-based pedagogy can be applied in the classroom. Additionally, he explained that arts-based pedagogy, or arts integration, is an approach that incorporates one or more art forms, such as visual arts, music, drama, or dance, to deepen understanding and support both arts and non-arts curricular learning objectives (Lee, 2015). After listening to him, one of the co-researchers asked, "*I know we can use art in language subjects easily, but what about mathematics*?" Mentor shared that in teaching and learning, there are various ways to incorporate art; we can use debate in mathematics to teach the concepts of perimeter and Area. He also provided certain examples.

After the meeting, I asked a co-researcher: "*Are you clear on the art-based pedagogy and how we are going to implement it?*

In response to my question, Kamala shared that she had planned to address the grammar component, using visual art to teach prepositions to the learners.

After hearing from her, I asked the teachers, *"There are various forms of art, and are we going to implement all of them*?"

In response to my question, Riya shared that "*I think it would be better if we go with specific art because while choosing art, we must be more careful, sometimes, we might not be able to complete all of them on time. So, I prefer to go with the visual or literary arts."*

"Yes, I am also thinking *from the same perspective*. I *think it's better to go with the visual or literary art, or we can do both based on our subject demands*," was shared by Amit.

After we agreed to cover the visual and literary arts, we decided to plan some lessons together in the same meeting.

While going through this discussion, I reflected on our shared culture as it aligned with the research's main purpose, and I was satisfied with the co-researchers' responses. As Njenga (2023) claims, the TPD session helps bridge the gap between their existing competencies and prepares them for real-world teaching. Similarly, our participatory discussion session helped bridge our conventional teaching process and the progressive teaching process. Furthermore, I found that co-researchers explored more in art-integrated learning, rather than being confined to my suggestion. This shows that this session of Teacher professional development has enabled teachers to explore more on their own.

This session concluded by clearing doubts about art-based pedagogy and the collaborative planning of various lessons for a specific grade, aligned with the literary and visual arts. Thus, the next part of the chapter focuses on the development and implementation of art-based lesson plans across classrooms.

Developing and Implementing Various Forms of Art in Teaching and Learning

Tuesday morning on August 22nd, four teachers and co-researchers were in the staff room, discussing how to incorporate art into upcoming lesson plans. I was also sitting there correcting grade 6 mathematics copies. Rashmi asked us, "*I am thinking of making a model tree, which we have seen in the lesson plan of MAP shared by Dipti ma'am. I also want to use one in my class. Is there any suggestion on how to connect that to a moral subject?*

After listening to her, I asked her, "Which topic are you trying to incorporate that in?"

She shared that, "*In the moral subject, there is the topic of building personality. I want to teach that lesson through the obstacle tree. Where I am thinking of using root as a hubby, trunk as a journey, and fruit as their dreams or goals."*

Another co-researcher shared, "*Yes, of course. I think that's a good idea. I am also planning to do something with grammar*.

After listening to her, Dillu shared, "*I am planning to use art in the topic of simplification and exploring other topics as well. Oh, it's my class time, I am moving."*

And we all moved towards our classroom to take classes.

I believe that, unlike other research methods, participatory action research not only enhances one's own knowledge but also broadens it by listening to and sharing with others. PAR is done not with the targeted group or community, but with the Community by challenging conventional boundaries between researchers and participants (Jacobs, 2016). As a researcher, while discussing the problem with the co-researcher, from identifying the problem to the solution and reflection on the problems, I figured out that the PAR methodology develops a sense of ownership among the participants.

After discussing how we could incorporate art into teaching and learning, we met with all the co-researchers to share the implementation of the art lesson in our classes on August 25, 2024. On that day, I started the meeting as usual with a casual chat. After 6 to 7 minutes of the talk, I jumped to the purpose of sitting. To learn more from the participants, I asked h*ow they were doing, how they were integrating art into their teaching and learning processes, and whether it was helpful to them.*

In my question, everybody smiled and spoke together, "Yes. It was helpful."

After listening to them, I told them, a*s we had planned together, but during implementation, we applied it to our grade and lesson. So, let's listen to each other's plans and experiences.*

After my words, Reshmi stated, today I need to go early, so shall I share first. Everyone agreed with her statement. She shared that, "*I have tried some of the plans in my classroom, but I found some difficulties in planning more due to examinations and other tasks*." Among them, two co-researchers had not planned anything; they were still focusing on a game-based approach, thinking that it was art-based teaching. Apart from that, other co-researchers had planned and implemented various art-based lessons. There were altogether eight participants, among them three were particularly

focused on the literary art, 3 of them on the visual art, and 2 of them used both visual and literary art, and 1 of them chose the performing art, while grade teachers of grade 3 applied all the visual, performing, and literary arts in different subjects, which I explain in the following sections.

Visualizing Learning through the Visual Arts

Most of the language teachers used the methods of visual art for teaching subjects like health, English, and social studies, which are described below in the form of narratives:

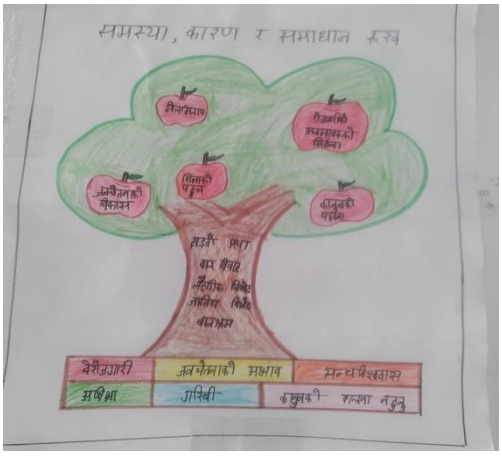
Table 3

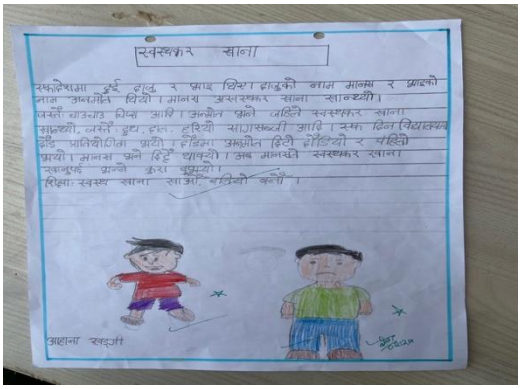
Narratives of Participants on Visual Arts

Teacher 1 shared that: "*I had never been able to teach phonetics theoretically, but today my students have memorized it through a song and applied it in their learning. This has not only improved their creative writing but also developed their problem-solving skills related to the subject matter."* In terms of challenges, she stated, "*While incorporating art into teaching or implementing artistic learning approaches, I have faced several challenges. For instance, when engaging all students in activities, the classroom becomes quite noisy, and students tend to move around, making it seem as though classroom management is lacking. From an outsider's perspective, the class may appear disorganized." However, while implementing this, I found I can make the classroom more engaging where every learner participates in the learning, and through this, my students who were not involved and who understand things quickly were also able to answer the question at last.*

Figure 8

Visual art Integration in the Language Subject

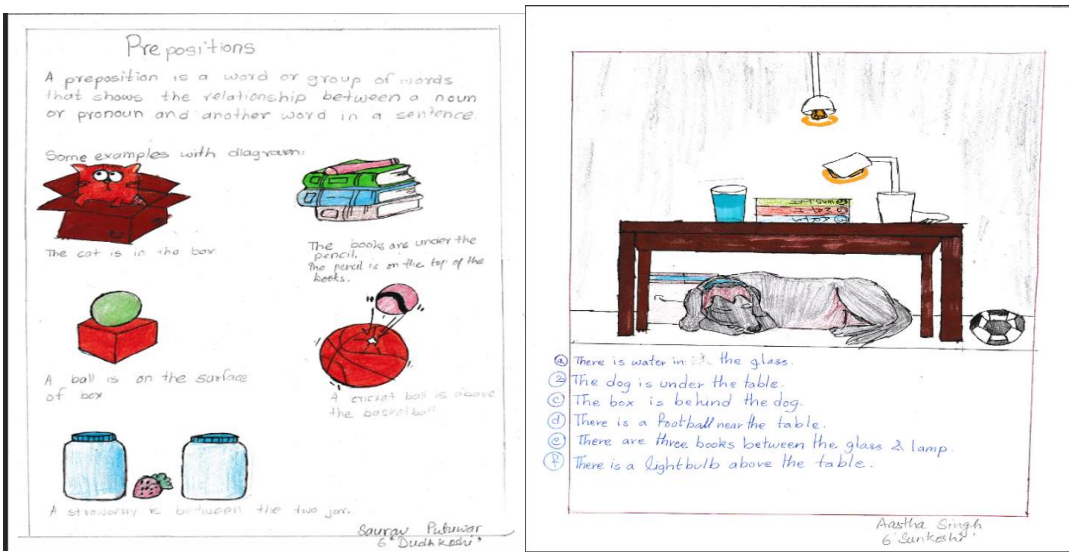




Similarly, Teacher II shared that, "Using *art in teaching and learning is a contemporary idea for me. This time, I had used art to teach different forms of grammar. For instance, to teach prepositions, I told learners to observe the classroom and present prepositions through drawing. Further, in the same assignment, I had integrated mathematics. In mathematics, students create a dialogue between friends to discuss the factors, divisibility test, and factorization method. Similarly, while doing dialogue, they had to color the different parts of speech*. "She further mentioned that, "*while using art, I figured out that learners were enjoying the class at the same time they were getting the concept of different topics. This method not only helps my learners to become creative, but I am also becoming creative because this pave me the way of thinking teaching pedagogy differently."*

Figure 9

Understanding Prepositions through Diagrams



Teacher III shared: "*I gave the project work of making 'My character tree' for grade 5 students where students categorized the tree into 4 different parts: Roots resembles the students' hobbies, trunk resembles their personal motto in which they describe about it in 2 to 3 sentences, branches resemble their role models, in which*

they write the reason for choosing their role models and why they admire their role models and lastly the fruit resembles the positive thing that they love about being themselves. While observing their task, I was amazed. In the class, I have given certain ideas, but they created work on their own. While seeing this, I figured out that our students are so creative, we just need to scaffold the ideas to make their ideas come out from their creativity."

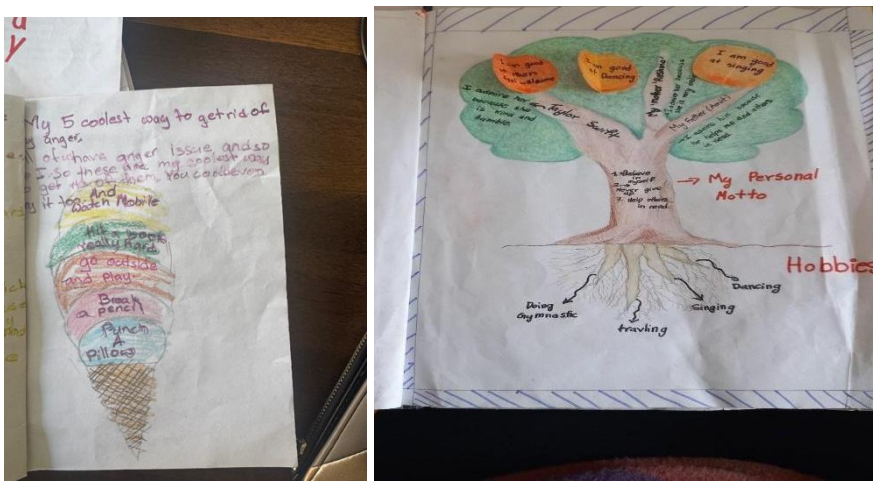
Figure 10

Art Integration in the Theme of Me and My Family



Figure 11

Representing Emotions and Hobbies through Art

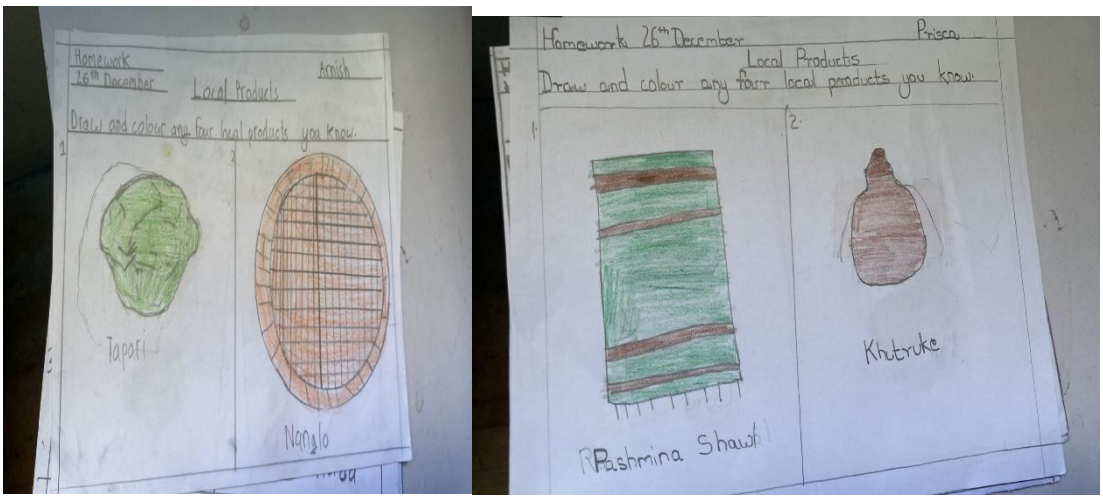


Teacher IV Shared: *I want to share some ideas on how we have been integrating art in the classroom. Before the art session, I used to think of drawing as a part of engaging, but in our classroom, I have used it to assess the prior knowledge of the*

child. For instance, while teaching 'Our Technology'. We asked students to draw traditional technology that they saw at home. While doing this, we found it useful to know the prior knowledge of the learners. Further, I also used it in teaching to revise things or to assess the learners' understanding. After the lesson, I told them to learn to draw their understanding and write some paragraphs about it. Furthermore, we have implemented it in our theme of "Me and My Family" as well, where learners need to express themselves about their family through the art form, and they are free to present it in their own way. While receiving the work of learners, we were stunned because we found lots of creativity in the learners, which we can see from the pictures below.

Figure 12

Representing Various Technologies through Art by Grade 3



While listening to the teachers, I figured out that Visual art learning not only helps learners engage with learning but also fosters creativity. In this work of art, it seems that learners express some content differently. As Silverstein and Layne (2010) claim, Arts integration is an approach to teaching in which students construct and demonstrate their understanding through an art form. During the process, students engage in a creative process and connect an art form with another subject area, and meet evolving objectives in both. While observing learners' work, it seems they present it with novelty and creativity, which is central to STEAM education. The integration of art into learning is connected to emotional inspiration. When using the

visual art in learning, learners can connect their ‘cognitive, emotional, and affective processes’ in the learning (Hunter & Frawley, 2023). As suggested, art serves as the cement in learning and teaching. While analyzing co-researchers' artistic lesson plans, I discovered that using art in teaching not only enhances learners' motivation but also connects learning with real-life problems.

Though I faced some difficulties collecting data for this part compared to the earlier one, I realized that during the integrated project, all the co-researchers were more excited than during the art integration. While we shared our views, experiences, and lesson formats in every meeting, some co-researchers preferred to listen rather than actively implement these approaches. However, we finally worked together to bring a fine art lesson to the classroom.

Bringing Learning to Life: through Literary Arts in Language Subjects.

Learning becomes meaningful when learners visualize and actively engage. Active participation provides opportunities for learners to construct and develop their understanding through experiences. When learners are engaged in learning activities such as showcases, role-plays, and storytelling, they visualize the learning process and construct meaning on their own. Similarly, in the process of art integration, co-researchers also used the literary arts in language subjects like teaching hamroserophero, Social, Nepali, English, and so on. One of the teachers from grade 3 shared that:

> *After the session on art integration, I often used it in my class in the form of storytelling. We used drama pedagogy to teach the landform, which was an insightful lesson. Moving beyond the traditional methods, we began the lesson through a small act, allowing students to immerse themselves in the learning process. We found that while doing the act on different forms of land, their concept and attitudes towards learning were changed. If we talked about the act, during the act, learners provide the characteristics of different forms of land through the acting, for instance, to describe the landforms of mountains, students made themselves into explorers. During the act, one of the students said I can see mountains around me, it feels so high. Only a few crops are available here. I am dry.” Other students explained about another landform as “ Look at this valley between the hills; it must have formed over time!”. Further, another student mentioned ‘We are surrounded by water on all sides. This must be an island! In response to his question, other students added:*

"Now, how do we get off the island?" In his prompt question, everyone laughed. This approach helped learners to get involved in the learning spontaneously. Further, we felt it makes learners more creative. While summarizing art-based pedagogy, overall, in this approach, learners not only grasped the concept based on different forms of landforms but also actively participated and contributed to the learning process.

This narration of the participant shows that, the integration of the visual arts in the learning not only help learners to get the content knowledge but also involve them in the learning actively. Further another teacher from grade 3 shared that:

> *As a grade teacher, I also wanted to share the experiences of teaching English*, she added. "*Similarly, while teaching English in my class, I used role play and storytelling methods. For instance, to revise an adverb, I used the method of role play, where students become the adverb and describe it through the sentence." I found this method wonderful because most of my learners listen carefully when students deliver their presentation through role play, and I found that this is quite memorable for them as well. Most of the time, while giving simple presentations, learners did not give full attention, but while using the role play method, they actively listened to other presentations. Similarly, while assessing students, I found that learners remembered all the topics that we learned through the role play rather than the simple teaching method.*

Figure 13

Students Describing Landforms Through Performing Art



Exploring the value of Mathematics and Science in Real Life through Literary Art: A Multidisciplinary Approach to Engaged Learning

We have examples of the use of art in language subjects, but most teachers claim it would be difficult to design an art-integrated approach in technical subjects such as mathematics, science, and core health concepts. In my research, four of the teachers were teaching mathematics and science. How they used art to teach mathematics and science is explained below in narrative form.

Table 4

Narratives of the Teachers on Integrating Arts in Mathematics Subject

One of the teachers from grade 3 shared her experiences of art integration, storytelling, and methods in mathematics. She explained, "I used to face challenges in helping students to understand the concepts of division and multiplication. As a teacher, I was always seeking any new trick or idea that makes teaching multiplication and division easy. As discussed in our TPD session, I used storytelling as a teaching method, and I was able to make them understand the topic effectively. I created a story about a birthday girl who wanted to distribute chocolates in the classroom. To make division easier, I took the example of Dairy milk, where big sized indicates the hundred place, small pieces of chocolate are used as a ten, which cannot be broken. Similarly, for one's place, I have used a small trophy. After the session of my class, I realized this approach helps learners to connect learning with emotions and real-life examples, which makes learning easier. After the class, while taking classwork as an assessment tool, I found 25 of the students out of 30 were able to solve the problems.
Another participant shared her experience of integrating art in the mathematical topic of data collection and representation. With the integration of art, students not only learned how to organize and interpret data using bar graphs but also developed creativity in presenting information. The use of colors, drawings, and craft

materials encouraged students to think beyond numbers and explore a visual approach to data representation.

Teacher II shared that he used art-based pedagogy in mathematics. He shared that, "*I designed an assignment for the learners in the collaboration of English, where learners had to create a dialogue between two friends. In the dialogue, they need to discuss the topic of prime factorization and divisibility tests. While writing their dialogues, they were required to underline or highlight the parts of speech they used. I realized that when we simply provide students with mathematical problems, they only focus on solving them without thinking about their real-life applications. However, while creating dialogues, they not only understood the mathematical concepts but also recognized their practical use in daily life situations. While asking to the students what they found different about learning mathematics in the form of dialogue, one of the students shared that through this method, I understand the divisibility concept clearly because during my writing, I need to make understand to my friend through dialogue rather than just solving problems and finding the answer. In my view, this approach helped learners to grasp the concept of mathematics visually and clearly."*

Mathematical debate is another example of integrating art into mathematics. The concept of debate facilitates students to understand the concept of mathematics and its uses in real-life situations. For instance, topics like mathematics in the theater, mathematics in football. Such topics helped students to see mathematics from their application part rather than theoretical. This method helped learners to internalize the concept of mathematics and forced them to think beyond the box. In the classroom, while teaching a particular topic, students only solve the problem related to the topic, but the debate allowed learners to understand the topic and the connection of other topics in a real-life example. Apart from this, he also shared his disappointment in the traditional teaching methods, he shared *"I understood the value of integrating mathematics with communication, but I felt slightly disappointed by the lack of focus on deeper mathematical theories in our teaching*

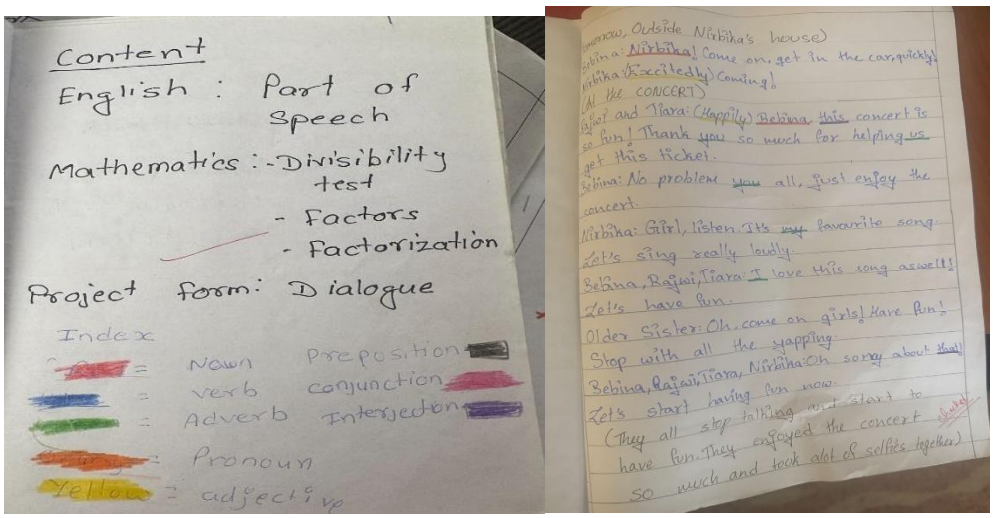
and learning. Balanced emphasis on both presentation and the underlying mathematics would have been ideal."

One of the participants from Grade 6 shared his experience:

"I learned how mathematics is integrated into every aspect of our daily lives, helping us with various tasks. Before participating in the Math Debate League, I used to think math was just about calculations, but now I see it as a set of concepts that we apply in real life".

Figure 14

Dialogue in Mathematics: an Integrated Art Project of Grade 6





Teacher II also shared that, "While I also used art in the same way in the classroom. As shared by my friend, I also used a storytelling method to teach the

concept of '+' and '-' in algebra. While teaching the concept, these students used to always be confused but connecting it with art made it easy for me to get the kids to understand the concept. Apart from this, after the session, I was wondering if we can use mathematics in poetry. To understand the learner's creativity, I assigned them the task to write short poems or rap whatever they like to represent the prime number. On the second day of my class, I was surprised that most of the students had written a poem so beautifully. From there, I realized we shouldn't underestimate the talent of the learners. After listening to her, everybody giggles, and other participants added, "Of course, nowadays kids are so creative and beyond our imagination".

Figure 15

Poem of Mathematics

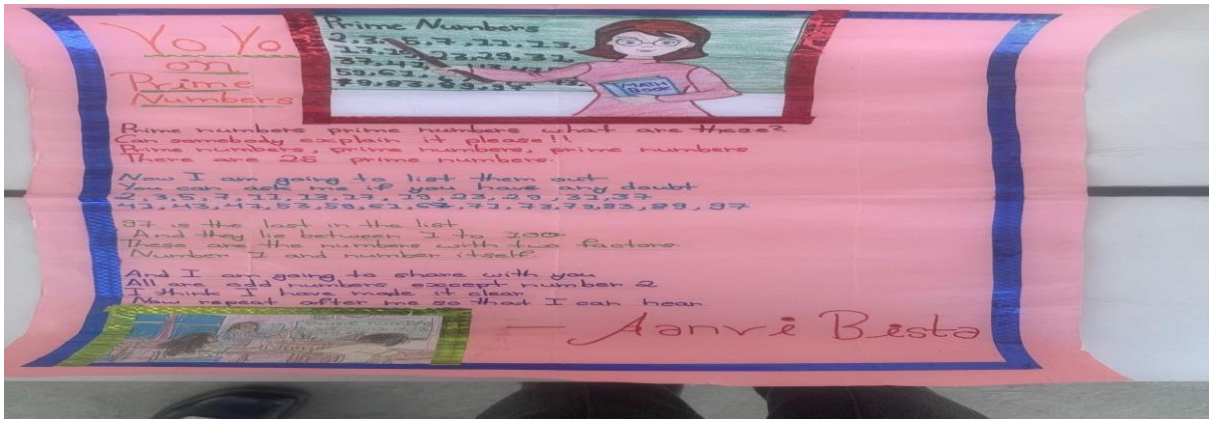


Table 5

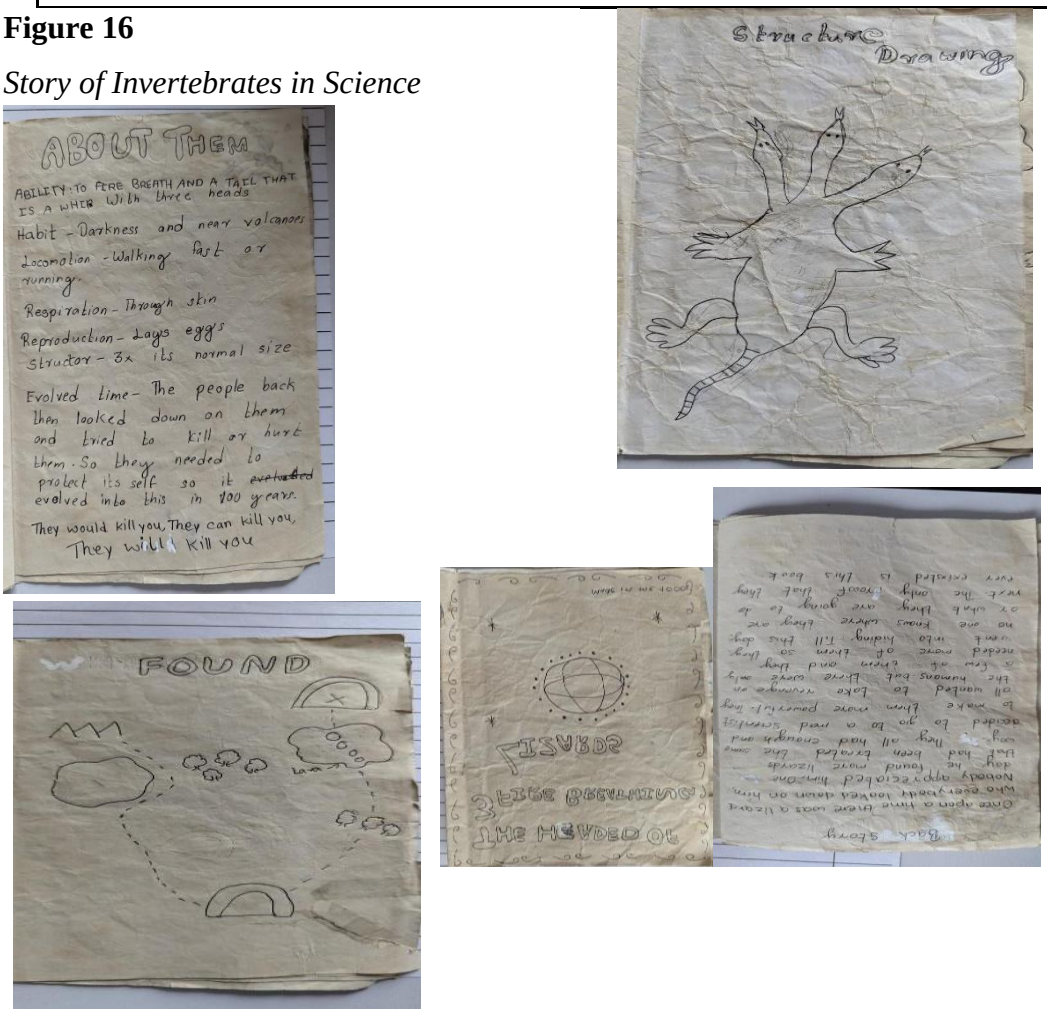
Narratives of Teacher on Using Art Integration in Science

Teacher IV shared that "This time I used something different in science subject, in my class of grade 5, students *used scientific concepts to design unique 'super animals', considering how different adaptations from fish, amphibians, reptiles, birds, and mammals could come together in one creature. In the beginning, I was quite skeptical regarding students' work, but when they submitted, I was surprised. Students had done exceptional work. This type of work not only enhances the*

learner's creativity but forces me to think beyond the box to make learners creative and logical."

Figure 16

Story of Invertebrates in Science



After going through all of my co-researchers ' narratives, I had the chance to explore the art-based approach to teaching and learning further. As stated by Pant et al. (2023), "The arts integrated pedagogy is an innovative pedagogical approach which offers a better alternative as an integrated and interdisciplinary approach to learning that encourages students to think more broadly and critically about the real-world problems." (p. 1). Based on all these narratives, I believe art is the pedagogy that enables multidisciplinary or integrated learning. Art is needed in all subjects, such as science, engineering, and technology, in the form of language or structural art, as stated by Yakman (2010). In recent days, various articles have claimed that using storytelling methods in mathematics makes learning more meaningful by helping abstract mathematical concepts become easier to understand (Nepal & Shrestha, 2023). Ekanayake (2023) claimed that Arts integration can teach the 'how' and the

‘why' in tandem, enabling learners to make sense of content deeply and creatively. (nd). Further, the use of visual art in learning mathematics or other technical subjects provides visual learning, leading learners to deeper levels of thinking and exploration. In our classroom, there are various types of learners. To explore their ideas and foster creativity, it is essential to use art-integrated learning in the classroom. If we provide artistic methods such as drawing, sculpting, painting, or writing stories to learners, they can explore and express their creativity and think outside the box.

Similarly, the co-researcher's narratives stated that art-based learning focuses on inclusive learning. In the classroom, there are various kinds of learners, and their ways of studying or absorbing knowledge also differ. One of the researchers stated that, “Art-based learning allows all types of learners to participate in the learning process. There is one boy in my class who hardly understands the things that we discussed in the classroom, but through the help of role play and obstacle trees, he explained the concept of festivals and social issues clearly in the class.” This type of statement claims that art-based approaches help all learners in the classroom.

Furthermore, I believe it helps to develop creative thinking in the learners. While using art-integrated learning in the classroom, learners take learning as a fun activity rather than a burden. So, when presenting ideas about family, various students express their ideas differently, which allows them to expand their creativity. The inclusion of arts education in STEAM education is justified by evidence that students' creativity, problem-solving skills, and engagement in STEM fields can be enhanced by the arts. Sälevä (2025) stated that “the integration of the arts into STEM education is advocated to provide a more comprehensive and holistic learning experience to the learners” (p. 18). Thus, art integration in learning helps to teach abstract and concrete concepts by adding an aesthetic approach in a meaningful and creative way.

Furthermore, after reviewing all the co-researchers' work and reflective writing, I am confident that I am on the right track. The main Purpose of my research is to engage co-researchers in the teacher professional development in STEAM education for the transformative learning through collaboration and participation. Throughout the process of designing and implementing art-integrated activities, teachers explore different forms of art. They used their observation and experimentation as scientists do. Further, they used various technologies to prepare the work for the learners. Similarly, they use the Engineering component to design various lessons, and teachers use the art component to express their reflections. As

stated by Dahal (2022), STEAM education aims to create unique and powerful synergies between the arts and STEM fields and encourages learners to integrate creativity with their technical knowledge to address curricular and global issues. Hence, integrating art into the learning process provides learners with content knowledge while adding aesthetic value, allowing them to engage in learning without pressure.

From Planning to Practice: Collective Reflections on Journeys in Art-Integrated Education

After the implementation of the second cycle of the PAR, art integration in the Teacher professional development, we decided to reflect on our learning. Thus, we decided to meet on September 10 at 2 pm. For this, we gathered in one of the classes and started our reflection. As we know, to navigate anything, there is a need for a sailor. For our meeting as a lead researcher, I asked the question to all of us,

> *As we have all sat together from the beginning until here, I believe we have learned or faced some challenges during our journey. So, let's reflect on our experiences throughout the session. Whether we learned something new or whatever we implement in the classroom helps to develop our teachers' professional skills, or it's more of a burden than our regular classes".*

In response to my question, everyone laughed. Though I faced some challenges collecting data for the second cycle compared to the first cycle of the integrated project, most of the teachers seemed to smile after my question. After my question, one of the co-researchers, Sabi, shared that,

> *While reflecting on my journey as a social teacher, throughout this art-integrated journey, I learned various things. Though we faced some challenges at the beginning, we approached game-based learning as an art integration and changed our lesson plan as well. In contrast, we learned various things from here. Obviously, rather than a lecture-based class, integrating such pedagogy in the classroom, it sometimes took longer than we imagined, but the result was beyond imagination. After completing and evaluating the lesson, I determined that my learners understood it. It makes me quite satisfied.*

Kamla Shared that,

> *As a teacher, I have been teaching for several years, but using such pedagogy in the classroom is completely new for me. In the beginning, I also had the*

> *same feelings as my earlier friend, but the learning experience was good. While planning the lesson, we sat together and discussed various ideas in a group, which helped shape my ideas, and I explored more on my own. Furthermore, while implementing it in the classroom, I found that using art made the class more interactive than regular classes. From here, learners can actively participate in the classroom. In the planning phase, my colleague was cooperative, so I didn't face many challenges. However, while collecting the children's work, I encountered difficulties because some of them had not submitted it on time. Overall, it was good for me*.

While listening to these participants, I figured out that, from the planning to the implementation of art integration in learning, we used collaboration as a tool, which is the main component of PAR. As suggested by Morales (2016), collaboration in the PAR empowers people through deep knowledge processing and helps them construct and use knowledge. In research as well, co-participants involved in the collaborative discussion reflect on their practices, question their teaching processes, and adopt new learning. To improve their own teaching and learning, teachers need to reflect regularly on their practice (Morales, 2016). Further PAR "seeks to bring together action and reflection, theory and practice, in participation with others, in pursuit of practical solutions to issues of pressing concerns to people, and more generally the flourishing of the individual and their communities" (Reason & Bradbury, 2008, p. 1). Thus, this study illustrates how the PAR became a transformative approach that bridges the gap between theory and practices

After Kamala shared her experiences, I told her, "*It was wonderful, ma'am. This is the main purpose of TPD. We need to adopt new learning, thus we can move further with the new insightful teaching and learning*". *"May I share my understanding now?"* asked Prabesh.

> *As I mentioned earlier in the art session, integrating art with science was difficult for me. However, after the session, I designed the lesson by integrating the science component with the art story component. At first, it took me some time to plan, but during implementation, I was unsure whether students could do it. I implemented it by taking it as a learning experience for me as well. In this project, students needed to create a story using the features of vertebrates. They used scientific concepts to design unique "super animals," considering how different adaptations from fish, amphibians, reptiles, birds,*

and mammals could come together in one creature. In the beginning, I was skeptical about my ideas; in contrast, students came up with such wonderful ideas that amazed me. From here, what I understand is that we need to implement new approaches to teaching by taking on a challenge, because as an educator, you never know what works for your learners unless you try it. This approach to art made my classroom enjoyable and interesting rather than rigid. While reflecting on approaches to art integration, I realized that instead of just memorizing the characteristics of vertebrates, students applied their knowledge in an innovative way. This approach not only deepened their understanding of animal classification but also encouraged critical thinking and creativity. From this onwards, I also noticed positive changes in my teaching style. This session helps me to move beyond textbook learning and create a hands-on, interdisciplinary experience. During the art integration project, students were excited to discuss their creatures, explain their features, and even compare them to real-world animals. Their engagement and curiosity showed that they were learning in a way that was both meaningful and enjoyable.

This experience reinforced the importance of integrating subjects to enhance learning holistically. For instance, although Science was the core of this project, other disciplines were also integrated. Creativity (art), problem-solving (engineering), logical thinking (math), and communication skills (language) came together in the same project. Seeing students connect these subjects naturally during their project work made me realize how valuable interdisciplinary teaching can be.

The co-researcher's statement highlights that the ‘A’ component of STEM fosters creativity and innovation in the learning process. From his words, it’s clear that art-integrated learning turns a boring classroom into an active classroom. The active involvement of the learners in art integration fosters creativity and inclusivity in the classroom. On the other hand, participants' same disclosure of the subjects' integrative nature clarifies the connectivity of the disciplines in real-life applications.

Furthermore, Rashmi shared that,

W*hile integrating art into the learning, I was surprised*! *Resham Dahal (name changed), a student who rarely speaks or pays attention in class, raised his hand and participated in the lesson. Similarly, another participant shared her*

experiences. She said, "In my class, while teaching the concept of pollution, I told it in the form of a story." To complete the story and explore more ideas of pollution, I asked various questions. After getting responses from some of the so-called active and knowledgeable students, I asked Narayan Shrestha (name changed), another student who doesn't usually participate, about the problems in his community. I was worried he wouldn't respond, but he said, "Ma'am, in our neighborhood, they play loud music at night, which makes it hard for us to sleep." He was right, noise pollution is a social problem. I was thrilled to see that, using art as a medium to teach and engage, even the less responsive students were able to understand and contribute.

Various statements by the co-researchers demonstrate that art-integrated learning not only enhances classroom enjoyment through activities but is also inclusive. Srivastava (2023) claimed that art integration in the classroom helps promote inclusion in various ways. Using art in learning helps to understand the uniqueness of the child. In our classroom, there are different types of learners: auditory, visual, kinesthetic, neglected, and so on. To include all learners in learning, art provides a language of expression through which learners can share their views and participate equally.

Furthermore, this statement by the participants also carries the theoretical notion of constructivism. Constructivism focuses on learning through scaffolding, hands-on activities, and the equal and active participation of learners. Woolfolk (1993) states that "the key idea is that students actively construct their knowledge: the student's mind mediates input from the outside world to determine what the student will learn" (p. 485). These types of art-integrated learning allow learners to construct knowledge on their own.

If I go through my reflection of planning to implement, there was a bit of confusion in the beginning about choosing the right pedagogy for the learners. After choosing the art-based pedagogy, all the co-researchers were excited and motivated to design and implement the art-integrated learning. From planning to implementation, we frequently suggested ideas to each other and built a strong bond among the co-researchers. However, I encountered some challenges while collecting evidence and reflecting on this cycle. When asked why they took so long, most co-researchers said that, due to the examination, result preparation, and work pressure, they were unable

to write their reflections. But in the end, I got all the reflection and evidence of the work.

Using Art as a Tool of Reflection by Co-researchers

In September, I was transcribing the data and realized that if we were able to make students use art in their learning as teachers, what if we could express our reflection and challenges through art? After realizing this, I immediately sent a message in our Viber group and told the teachers to gather the next day at 4 pm in one of the classrooms to discuss our art integration session and get any other updates.

On September 15, we gathered in the classroom. Due to personal interviews and other commitments, we were able to formally gather here after one month. So, I wanted to know how everything had been going and how everyone was doing. After listening to my voice, Rashmi replied, “We are all fine and doing great. We have been using various STEAM techniques in our social classroom. Prabesh shared, “We are all doing well, ma’am.”

After the casual discussion, I started my idea of sharing the reflection through art. After listening to that, Kamala shared, " *I am not that good at art, but I want to try this as it will be a great experience for me, but I need some time to gather all the learning from before now onwards.* After listening to her, Rashmi shared, “*Can I share through the drawing*?”

After her view, I replied, “*Of Course, we can use any form of art.”* Then we departed from there.

After 5 days, I got an email from Kamala, where she was sharing her understanding through the poem,

The Power of the STEAM Approach

I was wondering how to enhance my career
My way was traditional and full of barriers.
STEAM helped a lot, which was beyond my thoughts
Oh! It is fun to learn and integration to be sought.

Adverbs were sung in rap, and prepositions were painted
Adjectives had some lyrics, and voices were acquainted.
Maths and English can be blended, Science and Art interlaced
Infinite, gleeful, and visionary learning has been traced.

At the start, I was perplexed, astonished, and mystified
Ideas started to bubble from the depths and were amplified.
Holistic education has its significance and resonance
Together, learners explore, share, and take a chance.

Similarly, another participant shared her experiences and reflections in the following ways

Art in Every Little Heart (by Minu)

With brushes bright and crayons in hand,
A world of wonder at their command.
Shapes and colors, stories they weave,
Learning through art, what joy to achieve!
Songs that echo, dances that sway,
Lessons bloom in a playful way.
Cutting, folding, painting with cheer,
Math and science are so clear.
Hands at work, minds set free,
Art makes learning a journey to see.
A smile, a spark, a dream taking flight,
Art-filled lessons, pure delight!

Another participant shared her experience through the drawing. She claimed that, as shown in the picture, this colorful and integrated TPD session, as a teacher, helps us improve our teaching and learning.

Figure 17

Reflection of the STEAM journey through art



Integration of art is to create such learning environments that are aesthetically rich, where children encounter wonder moments, imagine alternatives, and feel pleasure and pride during learning

Poem Shared by one of the participants (Shanti)

In classrooms where creativity flows free,
Art becomes the bridge to all we see.
Through colors, shapes, and rhythmic lines, Lessons unfold in artistic designs.

To teach the essence of festive cheer,
We craft poems that draw students nearby. Verses that dance with cultural delight,
Bringing traditions vividly to light.

When social issues cloud young minds,
An obstacle tree helps them find
Roots of problems, branches of debate, Solutions bloom as they contemplate.

Exploring history's vast expanse,
A timeline chart gives events a chance
To narrate stories of days gone by,
Connecting past to present, eye to eye.

The Rana rule’s complex tales,
Unfold within the booklets' detailed trails.
Page by page, students engage,
Discovering leaders, their impact, and their age.

Sacred sites and spiritual grounds,
Turn it into a bingo game that astounds. Matching clues to places revered,
Through learning, knowledge is endeared.

These methods, diverse and full of art, transform teaching into a heartfelt part.
Professional growth through creative expression,
Empowers minds, fuels lifelong passion.

सिकाइमा कला **(Reshmi)**

दुर्गा म्यामले राख्नुभयो TPD को सेसन (Durga Maam conducted the session on TPD)

केही बुझिनँ सुरुमा त के हो यसको मिसन (At first, I couldn't understand what was the aim)

बुझ्दै जाँदा थाहा भयो अनुसन्धान रहेछ (While analyzing slowly understood it is a research)

शिक्षण कौशल विकासमा मदत पुग्ने रहेछ । (that helps teaching skill rise)

परम्परागत होइन साथी अब नयाँ सोच राखौँ (friends let us move beyond traditional thoughts)

शिक्षणमा कला मिसाऔँ सिकाइ दीर्घ बनाऔँ (lets integrate art into learning and make it sustainable)

एकतर्फी सिकाइले बोझ मात्रै बढाउँछ (one way learning only increases burden)

कला, खेल मिसाएमा सिर्जनशील बन्दछ । (integration of art inspire creativity)

सहकार्य,समस्या समाधान, जिज्ञासा बढाउन (to build Collaboration, problem solver, curiosity)

बालबालिकाको क्षमता अझ माथि उठाउन (help learner reach greater heights)

STEAM ले सहयोग गर्छ सिकाइ एकीकृत बनाउन (STEAM support to make learning integrated)

विद्यालयलयलाई कारखाना होइन पाठशाला बनाउन (Making school true learning center not factories)

नाम, सर्वनाम, विशेषण र क्रियापद चिन्न (To identify Noun, Pronoun, Adjectives and verb)

यो सेसनले सहयोग गर्‌यो व्याकरण बुझ्न (this session helped us understand a grammar)

भाषामा कला थपेँ सिकाइ भयो व्यवहारिक (By adding art in the learning, learning become practical)

सबै विद्यार्थी सहभागी भए मन भयो हार्दिक (all student participated, heart was full of joy)

STEAM सँगै जोडेर सिकेँ नयाँ कला (Explored new skills along with STEAM)

अनुसन्धान र प्रयोगले बढायो ज्ञानको तला (research and experiment helped me learned more)

विज्ञान र प्रविधिले कक्षा बन्यो रमाइलो (Science and technology made the classroom lively)

मैले त सिकेँ साथी अब तिम्रो पालो(I have learned, my friend- now it's your turn)

While reviewing the co-researchers' reflections through the art, it seems that using art in learning enables learners to be active in the learning process. An art integration lesson or classroom allows learners to actively participate in learning and meaning-making with full enjoyment and motivation. Participatory and arts-based approaches open democratic and dialogic spaces between learners and educators as part of a co-creative process (Ekanayake, 2023). It also promotes inquiry-based learning, which encourages learners to think critically and creatively while seeking multiple solutions to problems, phenomena, or questions.

While reflecting on the journey of the second cycle, I observed various developments in the co-researchers. One of the co-researchers shared that before these sessions, she felt a burden and found it difficult to design something different in her lesson, but these sessions gave her the strength to act and forced her to think about something different for the learners. Her thoughts demonstrate that these TPD sessions not only enhance teachers' overall abilities but also help transform the education system from Habermas's technical knowledge to emancipatory knowledge. On the other hand, it is more practice-driven rather than informative.

Furthermore, while analyzing the co-researchers' art, I realized that all of them are on a journey of transformation. Our dialogical and dialectical discussion helped co-researchers to rethink, examine, and sharpen their knowledge. As Mezirow (1997) suggests, Transformation starts with ourselves when we begin to question our "frame of reference," which is guided or shaped by our experiences, background, and so on (p. 1). For transformation, it's essential to critically view our practices, actions, and beliefs. I believe our reflective practices help us move towards the journey of transformation. During this phase of the second cycle of PAR, we will together examine, question, and try to incorporate various new pedagogies in the classroom. While doing this, teachers shared that when teaching difficult chapters in history, grammar, science, and mathematics, they used the arts, which help learners engage in the learning process. As Dahal (2022) claims, transformative education is viewed as a process of developing students' critical awareness of themselves and their environments.

Sustainability Intervention

In this technological era, how the education system is implemented or practiced plays an important role in measuring its sustainability. What we teach or do will impact the future. Sustainability is an essential factor of any research. How it continues and remains in the future is essential. In my opinion, sustainability in education is based on shaping learners with the values and skills to create a more equitable, ecologically sound, and economically viable future. For this, it is pivotal to develop teachers, the main pillars in shaping learners. These educators must be equipped with the knowledge and tools to instill these principles effectively. By fostering a culture of sustainability within the classroom, they can inspire students to engage with environmental challenges and contribute positively to society.

Since the purpose of my study was to bring about transformation in teachers' teaching and learning strategies through STEAM-based Teacher Professional Development (TPD), it is important to recognize that the motif is grounded in educational sustainability. Sustainable education develops progressive change through continuous learning, reflection, and adoption. In my research on sustainability interventions, I argue for sustainability from three perspectives: PAR shares the characteristics of sustainability, the STEAM approach aligns with the concept of sustainability, and the continuation of learning beyond the research. While reviewing the sustainability intervention of this research, it is focused on developing capable human resources, which aligns with the long-term vision and the features of sustainability. Firstly, the methodology of this research is based on participatory action research, in which participants are themselves change-makers, and it aligns with a bottom-up approach, a key characteristic of sustainability. Keahey (2021) argued that *participatory action research (PAR) supports sustainable development by providing the means to establish transformative frameworks for engagement.* (p. 1). Eelderink et al. (2025) claimed that PAR views all stakeholders involved in a particular issue as agents rather than objects. In deeper analyses of PAR and sustainability, we can see that they share features of power sharing and knowledge democratization. PAR focuses on collaboration, active involvement, equal participation, and participant reflection, which contribute to long-term change. In this research, participants are not passive recipients; they actively participate in the process from need identification to the study's reflection. As the shared sustainability vision suggests, PAR fostered a sense of empowerment among all participants; unlike

other research methodologies, it listened to their voices and involved them in an active role.

PAR is a social Justice methodology that aligns with the ethical dimensions of sustainability. Both Sustainability and PAR align with the common values of democracy, social justice, and respect for community life (Keahey, 2021). In summary, the concept of PAR aligns with sustainability by providing a reflexive, problem-solving modality that values stakeholder relevance and social change over value neutrality, ensuring that the human and ecological dimensions of development are addressed together

Sustainability Perspective of STEAM-based TPD

Similarly, the STEAM approach used in the Teacher Professional Development (TPD) also aligns with the concept of sustainability. STEAM education emphasizes interdisciplinary learning, collaboration, creativity, critical thinking, and real-world problem solving (Dahal, 2020), which are essential components of sustainable education. STEAM Education promotes holistic development rather than focusing only on content delivery. According to Singh and Negi (2026), STEAM education fosters an understanding of sustainability through collaborative inquiry and real-world problem-solving. Similarly, Djam'an (2025) argues that STEAM supports sustainability by integrating environmental, social, cultural, and economic dimensions into the learning process. Unlike traditional teacher-centered professional development practices, STEAM-based TPD encourages active participation, with participants involved from needs assessment to reflection. As we discussed earlier, many of the TPD in Nepal are expert-driven, with teachers' real needs neglected. In the STEAM-based TPD, teachers are directly involved in learning, and it provides participants with ownership, a prominent component of sustainability. The teacher's direct involvement in training sessions and a focus on various need-based, innovative pedagogies, in contrast to traditional TPD sessions, demonstrate that STEAM-based TPD aligns with the essence of sustainability.

From the participants' perspective, it also has a sustainability intervention. When the teacher came up with the idea of developing skills within themselves, it also indicated sustainability. Being sustainable means thinking about themselves for a better future. When teachers begin to think about themselves, they develop the skill of being reflective and transformational. Iqbal et al. (2025) argue that improving the quantification of human resources ultimately brings change to the education sector. In

this research, participants were observed after the completion of the study, and it was found that teachers continued to apply STEAM-based approaches. For instance, teachers remained actively involved in designing integrated projects and organizing exhibitions within the school. This reflects the sustainable shift in their pedagogical practices.

Continuation of the Learning after the Research

After the research is completed, learning continues. It shows the research's sustainability intervention. Although the research was completed six months ago, teachers are still using their knowledge, projects, and pedagogies in the classroom and teaching the same material to new teachers. This demonstrates the transfer and continuation of professional learning beyond the direct participants of the research. Moreover, sustainability was further evident in the integration of field-based learning. During the planning of field trips in the academic year 2083 (April 2026), teachers collaboratively discussed ways to integrate multiple subjects into field-based activities, demonstrating their ability to extend STEAM principles into new contexts. These practices suggest that the intervention has fostered a lasting impact on teachers' instructional approaches. Furthermore, sustainability was not confined to a particular classroom but was also evident at the institutional level. The integration of STEAM-related discussions among teachers and HODs during school events suggested that the intervention had influenced the broader school culture and community.

Similarly, another significant sustainability intervention is the development of a collaborative culture among teachers. After the research, teachers sat down to discuss various field trip plans, integrate the field trip worksheet, and map the curriculum collaboratively, demonstrating that the intervention was embedded in their professional practices. Similarly, the sustainability of the intervention indicates that the research did not remain a temporary training session but rather gradually reformed teachers' beliefs about the traditional teacher approach through collaboration and participation.

Chapter Summary

This chapter covered the overall research methodology section, from philosophical orientation to ethical considerations. This chapter further covered research design, Participatory action research, and its different cycles. While explaining the research design, it also explained the rationale for choosing PAR,

which not only includes the participants but also empowers them. It also discusses the quality standards and ethical issues employed in the research.

CHAPTER VI
REFLECTING THE RESEARCH JOURNEY

This chapter of my research is a reflective interpretation of my journey, offering responses to the research questions that I posed at the beginning of this study. It also serves as a meta-reflection on selecting Participatory Action Research (PAR) as the methodology, and provides evidence of how we collaboratively fostered teacher professional development within the context of STEAM education. Through sharing my reflections and those of the participating teachers, I attempt to illustrate how this collaborative journey has contributed to both professional development and meaningful learning. I also use this chapter to align my experiences with the theoretical orientation that guided my research. As emphasized by Kindon et al. (2007), the core purpose of PAR is not merely to gather data, but to empower co-researchers through shared inquiry and action. This chapter showcases how PAR supported that goal by creating space for transformative learning and development among the co-researchers.

As the lead researcher, I reflect on this journey from multiple lenses: as a mathematics teacher, a coordinator, and a researcher. These different roles provided me with a layered understanding of how PAR can influence classroom practices and professional development. In the findings section, I explore the key insights as learnings that emerged from this collaborative process. Finally, in the recommendations section, I discuss the practical implications of this work and how it can inform the efforts of educators, teachers, researchers, and policymakers committed to enhancing teacher professional development through integrative and reflective approaches.

Teacher Professional Development in STEAM Education as a Step towards Transformation

With the purpose of bringing certain changes to traditional teaching and learning practices through PAR, I had posed the question: “How can teacher professional development in STEAM education help to bring transformation in the teaching and learning practices?” As a STEAM educator, I feel that to bring change in the pedagogical approach, we need to collaborate with the other stakeholders who are directly involved in teaching and learning. As we know, teachers are the bridge

between learners and the educational vision and mission. Teachers are those actors in educational institutions who directly bring a change in the pedagogical setting. In the 21st century, various approaches and techniques have emerged in the field of education due to advancements in technology, AI, and consciousness. Recently, Cambridge claimed that 80 percent of learners are involved with technology, whereas the teacher ratio is only 20 percent (n.d.). Thus, I believe that to work alongside learners and prepare them for the future, teachers need to stay up to date. For that, teachers need to participate in various professional development sessions. Darling-Hammond (2017) defines professional development as structured professional learning that updates and changes teacher practices and improves student learning outcomes. Furthermore, Pokhrel and Behera (2016) mentioned that Teacher professional development is the process of improving teachers' academic skills and minimizing the obstacles that prevent them from effectively preparing learners to tackle future, unforeseen challenges. While reviewing the TPD session, I found our session helped to justify the research question from the perspective of the co-researchers' professional development. During the reflection and formal and informal sharing, various co-researchers shared extensive details about their professional development or transformation in their teaching and learning processes.

"*As we know, the teaching profession not only helps the students to learn, but at the same time, a facilitator also gets the challenge of implementing new and creative ideas which should be learned by herself/himself. As a part of this pedagogy, I have benefited from collaboration with the team members, innovative ideas like role play for tense in grammar*"(Field note, Sept 5).

"*From this TPD session, I came to realize that art-based pedagogy facilitates children to develop holistically. Singing rhymes to toddlers is another way to teach a kid vocabulary, as they learn by singing along. I figured out various changes in me before and after the TPD session. This not only helps me to analyze my teaching style but also helps me to update it. (field note, Sept, 22)*

The participants' feedback indicates that the TPD sessions aligned with teachers' interests and needs, thereby enhancing the teaching and learning process. The main purpose of the TPD should be for what teachers are taught to be reflected in their practices, so the actual positive difference should occur in student learning (Darling-Hammond et al., 2017). In my research, I found that these qualities, which we learned in the session, had been implemented in the classroom to make learning

meaningful for the learners. The first session focused on the integrated project, and the second on art integration, both of which had been implemented in the classroom and had a positive impact on learners, demonstrating that the TPD session on STEAM education is effective.

"*Most of the learners in my class have been facing challenges to understand the concept of division and multiplication; nevertheless, after using the storytelling method to teach the concept, students found it very easy, and as a teacher, this time I made less effort*." (Ashmi Sharring, field note, Sept 12, 2024)

"Generally, *I assign various works to the learners based on various festivals, but this time, while integrating socially with other subjects, I felt that subjects and learners easily figure out the real implication of those concepts.*" (Sabi Sharing, field note, Aug 14, 2025)

"A*rt-based pedagogy is one of the most fruitful pedagogies in teaching. While using art-based pedagogy, students are more attentive than before. Students enjoyed the class a lot. Students take the subject as their favorite. With this pedagogy, it's easy to communicate with students and teach difficult topics in a simple way. Students also easily learn the lesson while it is taught by using art-based pedagogy*". (Binu sharing, field note, Aug 17))

As Poudel (2024) notes, the main purpose of TPD should be to refine teachers' knowledge and bring about change in the learning and teaching process. In this line, the co-researchers' sharing above shows that, from this session, teachers reexamined their practice and made changes to their teaching. Furthermore, the main agenda of my research was aligned with STEAM education. As we know, although we are familiar with the concept of learning by doing, we still focus on the technical-interest type of teaching and learning, as Habermas (2005) states. As we know, our real-life problems are interrelated and require interdisciplinary knowledge, yet we still focus on compartmentalizing subjects, which leads to disengagement and decontextualization in the learning process (Pandey et al., 2025; Manandhar, 2022; Pant et al., 2020). The traditional approach to TPD was guided by the provision of knowledge by expert trainers (Pant et al., 2020), whereas in STEAM education, participants' involvement focuses on reforming and transforming rather than informing. As suggested by the STEAM approach, this TPD session was more focused on interdisciplinary and integrated concepts that emphasize creative and critical thinking (Dahal, 2022). As claimed by Manandhar et al. (2022), "the central

principle of STEAM education is to emphasize integrated learning through multi-, inter-, and trans-disciplinary curriculum integration which helps students to connect academic subjects/disciplines with their real-world and do continuous innovation in various areas." As suggested, our TPD session also focused on the inter- and transdisciplinary concept, where participants and learners gained knowledge of the interrelations among various disciplines to solve real-life problems such as managing food, environmental awareness, integrated assignments, Kalimati Visit, and so on.

The art-integrated model and the integrating project model help to enhance the teacher's personal growth. While designing various integrated projects, teachers learn about the integration modality; they plan, observe, implement, and reflect on their practices, as described by Bernstein's (2004) process, which includes steps of "experience, inquiry, creativity, and reflection". Cross-disciplinary professional development models bring together teachers, arts instructors, and artists to develop common strategies for differentiating instruction, stimulating multiple intelligences, and engaging multiple brain regions.

While analyzing this research from a theoretical perspective, I believe it strongly justifies both the research and the researchers' work. Firstly, this study adopts a social constructivist orientation, which emphasizes the importance of social interaction, collaboration, communication, and group learning to achieve effective learning outcomes (Saleem et al., 2021). As social constructivism suggests, learners construct their knowledge through social interaction, scaffolding, the zone of proximal development, and more knowledgeable others. In this research, the co-researchers interacted, discussed ideas, shared prior knowledge, and collaboratively constructed new knowledge on integrated projects and art integration in teaching. During the process of designing integrated projects and an art-integrated plan, teachers shared their ideas, collaboratively planned the lesson, and involved learners in constructing knowledge through interaction, collaboration, group work, and so on. Additionally, the concepts of scaffolding, MKQ, and ZPD were evident during the TPD session and afterward, among the learners as well as the teachers. During sessions to plan new projects or lessons, one participant was always ready to help other teachers, reflecting a genuine sense of social constructivism. In addition, knowledge becomes fruitful when learners apply it in other areas to develop or create something new. We also witnessed the same thing in the school. For instance, during a recent literature festival at the school, one participant used art in mathematics by

guiding students to create a fraction poem. This demonstrates that teachers are not only applying what they learned during the TPD sessions but also constructing new knowledge in creative ways.

This research also aligns with the theory of transformative learning, which emphasizes that knowledge is constructed through critical reflection (Mezirow, 1991, 1997). Throughout the research process, the co-researchers critically questioned their prior practices, re-examined them, and constructed new knowledge. For example, many teachers from science and mathematics backgrounds initially believed that art integration was possible only in language subjects. However, after participating in the TPD sessions on art-integrated learning, their perspectives shifted. Their point of view of seeing Mathematics and Science as technical subjects where integration is not possible has changed. Further, at last, after the implementation of the art lesson, they acknowledged that art integration makes learning more engaging and motivating than they had previously imagined. One participant even mentioned that designing projects in Nepali had always felt like a nightmare, as she struggled to find suitable content. However, through the integrated project approach, she generated new ideas and began designing meaningful projects for her learners. In this way, teachers were not only re-examining past practices but also questioning and implementing new ones. While listening to participants' views, it is clear that transformation has happened not only in the practices but also in the mindset and perception of the co- researchers.

While reviewing the overall cycles of the PAR, significant transformation seems to have occurred among the co-researchers. The co-researchers' perception that they were not able to do projects in language subjects has changed. They not only designed the integrated projects within the research timeframe but are still continuing these practices after the completion of the research. Recently, the participants designed collaborative Science projects with integration into English and Nepali. Further, teachers' perspectives of seeing subjects in a compartmentalized form have changed. The transformation also seems to be a movement toward integration through the skills of subject compartmentalization.

During the reflection meeting of the first cycle, the co-researchers discussed both the opportunities and challenges of integrated projects, including the need for greater collaboration, careful planning, clear subject-based objectives, and appropriate assessment strategies. This reflection indicated that teachers were moving beyond simply implementing a new method and were beginning to examine their own

pedagogical practices and consider how these practices could be improved. After the first cycle of the integrated projects, the co-researchers themselves decided to explore another pedagogical approach in the second cycle. This decision shows the transformation in teachers' willingness to question their own so-called safe space or established practices.

Moreover, after each PAR (Participatory Action Research) cycle, the co-researchers reflected together on what went well and what improvements were needed for upcoming classes. During the needs analysis, teachers also reflected on their past practices and expressed transformative insights. From this perspective, the research clearly justifies the application of transformative theory.

My Professional Development as a Lead Researcher

As a STEAM Scholar and Educator, I had the opportunity to become familiar with a range of insightful ideas during this research process. Although I had prior research experience while pursuing my master's in STEAM Education, the PAR approach yielded several insights throughout the research. In the beginning, I chose PAR as a methodology to develop a collaborative vision within the workplace and to bring about transformation in the field of teaching and learning. After becoming familiar with the various theories, perspectives, and pedagogies of education, I was determined to bring about change in the field. With this purpose, I have started my journey as a researcher in teacher professional development in STEAM education for transformative learning. In this section, I divided my learning into four perspectives: a skillful, transformative teacher journey, pedagogical initiators, development of the participatory notion, and a knowledge seeker through questioning.

Firstly, while reflecting on my STEAM journey as a lead researcher, I found various changes in myself as a transformative teacher. Before this STEAM journey, as a mathematics teacher, I viewed Mathematics as the so-called "main subject," often giving it greater importance than other subjects. My thinking was shaped by the compartmentalization of subjects, as discussed in John Dewey's work. Reflecting on my earlier teaching journey, I realized that I used to align with a technical view of teaching, in which it was seen as simply transmitting knowledge, much like the "banking model" of education (Shrestha et al., 2020). However, over time, as I became familiar with the concept of STEAM education, my perspective and teaching methodologies also changed. In this line, I can say I gradually moved towards Habermas's practical interest, which emphasizes that knowledge is co-created through

collaboration with learners. As a result, I started focusing on collaborative activities in teaching. Furthermore, while conducting this research during my MPhil, I gained a deep understanding of various perspectives on education and pedagogy. While focusing co-researchers on reflecting on their teaching and learning and on questioning their status quo, I have unknowingly also embarked on a journey of critical reflection. While implementing and reflecting on the PAR journey, I also reflected on my classroom from the learners' perspective. I began to talk to them about how mathematics class became more meaningful to them and how I could foster a sense of inclusion in the classroom. While doing this, I began to keep learners at the front of each topic, where every topic required learners to construct knowledge on their own. While doing this, I realized I was more aligned with Habermas's concept of emancipation, whose constructivist and critical perspectives empower both teachers and students to examine their beliefs and values and construct knowledge through critical self-reflection (Shrestha et al., 2020).

Secondly, during this journey of professional development, I found that my transformation occurred not only in my mind but also in my hands (as a pedagogical initiator). In other words, I figured out changes in the pedagogical adaptation. While designing integrated projects, I became familiar with the perspectives of various subjects. For instance, when working on a Grade 6 environmental project, I began to understand the types of content knowledge and skills students need to develop in a particular grade, apart from Mathematics. Furthermore, this provided me with the opportunity to connect mathematics with other subjects that align with real-life experiences. Before working on the Environment Day project, I had never imagined that the concept of Sets was also connected to the concept of Environment. Similarly, while designing art-based approach lessons with the teachers, I tried something new, integrating Mathematics with English. While reflecting on question patterns and evaluation rubrics in math, I noticed that many students struggle not with the mathematical concepts themselves, but with the language of the questions. If we look at the question format developed by CDC, it's now more language-based. Thus, to teach learners how to use mathematics in daily life, we designed an integrated English and mathematics project. Designing projects where mathematics was explored through dialogue helped learners grasp its real-world implications and encouraged them to think more critically and logically. I believe that when we internalize content knowledge by connecting it to real-life applications, learning becomes more

meaningful. As a researcher, before this TPD session, I used to think that my role as a math teacher was limited to helping students understand mathematical procedures so they could solve problems easily. However, through my research, I realized that my approach to teaching has been evolving. As with other language subjects, I focused on an inquiry-based approach to teaching mathematics. While doing this, I discovered that the more you involve learners in learning, the more critical and creative they become. The TPD session not only helped transform the co-researcher's ideas but also changed my perspective on teaching mathematics. As in all subjects, Mathematics is also guided by the STEAM concept. When teaching any new topic in mathematics, learners need to explore the concepts and present their views that are more aligned with the scientific component. Further, during the presentation and in presenting things in written or oral form, artistic value is added. Further, using various mathematical tools aligns with the concept of technology, such as building houses and calculating perimeter, area, and so on. After realizing STEAM in mathematics, nowadays my classroom is more aligned with the inquiry-driven approach, where learners are forced to create knowledge by themselves.

Thirdly, the journey of this research shaped my understanding of participation. The collaborative notion of the PAR focuses on empowerment rather than participation, which helps to reshape my perspective as a coordinator. Participatory action research combines theory and practice, action and reflection, and engages stakeholders who seek practical solutions to concerns and issues, fostering the flourishing of those stakeholders and their communities through the research process (Reason & Bradbury, 2008). Before this session, as a coordinator, I was more familiar with the operational side, and my task was to manage tasks and provide suggestions on the worksheet as needed. While working closely with the co-researcher, I built strong relationships with the teachers and blurred the line between the teacher and the coordinator. To understand teachers' classroom problems, as coordinators, we need to have comfortable relationships with them. This research journey provides me with the opportunity to bridge that gap and helps me to view and understand teachers' difficulties more closely. As the interpretivist paradigm suggests, through this TPD session I had the chance to put myself in a teacher's shoes. As stated by “interpretivism paradigm can provide an in-depth understanding of certain contexts, such as cross-cultural studies, factors influencing certain development”. While working closely with the teachers, I was able to closely observe the classroom

situation, teachers' needs and difficulties, and the training they required for transformation. I believe that, as leaders, we always need to think from the teacher's viewpoint to develop them and design training so they don't feel any boundary between teacher and trainee. As Dhungana et al. (2021) claim, participatory professional development enhances participants' professional autonomy by blurring the boundary between trainer and trainee.

Furthermore, during this process, I also identified the different kinds of learners across classes. As a coordinator, I saw this as a great opportunity to make the classroom more meaningful and to design academic and CCA activities for the learners. Most of the time, people in higher positions lack an understanding of teachers and classroom situations, such as TPD sessions in Nepal, which tend to be more top-down. As teachers are crucial to implementing the school's vision in the classroom, it's essential to design and deliver teacher training that is based on their interests and needs. During this research process, I was able to understand the real needs of the learners and teachers, which is essential for the transformation. In addition, during many sessions of teacher professional development, I came to realize that collaboration creates synergy in the workplace, which justified the saying that 1 + 1 = 3. In addition, this scenario helped me identify the teachers' strengths and weaknesses in teaching and learning. This helps me to guide the teachers in their weaknesses and motivate them. A facilitator can help teachers realize their potential to become better teachers by deepening their understanding and awareness of themselves and their learners. Collaborative practices that break down hierarchical forms of knowledge production hold great potential to foster active citizenship and participation in social change.

Lastly, the journey with the STEAM education has significantly reshaped my thinking and professional identity. Before stepping into the world of STEAM, I never imagined that my thought process would change in this way. When I first entered the education field as a teacher, I simply followed the curriculum as presented in the book, without much questioning. My role felt more like that of a content follower or deliverer than an innovator. However, as I became immersed in the ideas and practices of STEAM education, I gradually developed the habit of questioning, analyzing, and reflecting. As Mezirow suggests in his theory of transformative learning, critical reflection plays a key role in changing our frames of reference, and I experienced this in my field. While reflecting now, I see myself as a transformative

agent, someone who continuously seeks improvement in teaching and learning for myself, other teachers, and the organization. Two years ago, when I took on the role of ECA (Extra-Curricular Activities) coordinator at my school, I approached the responsibility in a very straightforward way, simply implementing existing ECA activities. However, after familiarizing myself with the educational norms and values and aiming to make ECA activities more meaningful and better aligned with broader educational goals, I began to rethink and redesign the way ECAs were planned and conducted.

Firstly, I determined the alignment between the ECA and the CDC curriculum. With that in mind, I introduced structured lesson plans and evaluation systems in which learners' understanding was fully assessed. After planning the structure and the evaluation system, we were able to track each learner's learning growth in the ECA. This shift helped me realize the potential for change within existing systems. After this, I started to question not only classroom practices but also the curriculum and evaluation frameworks that we had relied on. Rather than depending on pre-prescribed tools and systems designed by others, I began to re-evaluate and make decisions based on our own context. While analyzing and mapping our curriculum against the international curriculum, I discovered that much of our content isn't universally relevant, especially when comparing the realities of far-western districts with those of urban areas like the capital city, Kathmandu. It became clear to me that our evaluation systems also need to re-evaluate to address these issues. Overall, this transformative journey with STEAM education has made me a knowledge seeker and lifelong learner. I am now deeply committed to constructing knowledge through critical reflection and active engagement. Instead of simply accepting what is given, I strive to question, understand, and co-create meaningful learning experiences both for myself and for the community where I am.

Conclusion

During this research, we had the chance to explore many things. While analyzing the data generated through the PAR cycle, we found that the STEAM notion of TPD focuses on progressive education by challenging the status quo. While analyzing and interpreting the data, I found that Teacher professional development in STEAM education paves the way towards progressive education, moving beyond traditional education, in terms of the teacher's perspective, learner engagement, and curriculum. As noted by many scholars (Dahal, 2022; Manandhar et al., 2020;

Yakman, 2010), STEAM education adopts a multi- and transdisciplinary approach to teaching, emphasizing the holistic development of the child. Pant et al. (2024) stated that the interdisciplinary STEAM approach aims to provide students with a comprehensive understanding of the world around them by connecting theoretical knowledge to practical applications (p. 41). The further integration model of STEAM helps to blur the line of compartmentalization and pave the way for multidisciplinary and transdisciplinary concepts in the learning process. Implementing integrated projects allows learners to see subjects holistically and helps them realize the importance of all subjects in real life. For instance, art integration in science and mathematics helps to blur the boundary between hard and soft skills in the teaching and learning process. The conventional model of education doesn't recognize other subjects; however, progressive learning recognizes them equally. As stated, progressive education focuses on interdisciplinary knowledge aligned with thematic concepts.

Similarly, STEAM-based teacher professional development allows learners to reflect on their practices and re-examine their teaching and learning process. During the planning of art integration and integrated project-based learning, most participants developed the habit of rethinking whether their teaching and lesson planning were sufficient for learners. During the reflection phase, co-researchers began to examine their plan independently and develop the habit of rethinking their previous practices, which led them towards transformation.

This STEAM-based teacher professional development paves the way for creativity and innovation. As our TPD session was largely based on the inquiry-driven approach, co-researchers engaged in questioning and exploring aspects that had not previously been implemented in their teaching and learning processes. While doing the integrated project we collaboratively designed project about managing waste but later some co-researcher designed the summer vacation assignment on the theme of integration, where they integrated mathematics concept of area, perimeter and volume with the social concept of smart city and language subject paved the way for the creativity and imagination by asking reflective journal on what types of school will be in smart city and how can they get beneficial from IT in their students life. These types of work develop creativity not only in teachers but also in students. Further, in art, we also found the same notion, where students created different non-fictional characters discussing mathematics through Pictoblox, which was very innovative and

creative. These examples show that the STEAM approach fosters innovation and creativity in the educational sector.

In today's classroom or any sector, we are motivated to do something if we find it interesting. Similarly, in the classroom, there are various learners whose choices and habits differ. To include those learners in the learning process, it's the teacher's responsibility to make learning motivating and engaging, and to help them construct knowledge without feeling bored. For this, the STEAM approach is one.

This statement by the learners shows that the STEAM-based approach to teaching motivates learners and makes learning meaningful. Subject matter is presented to learners without regard to their interests. There is a gap in the learning process because teachers deliver content to learners without taking their interests into account. But this type of participatory TPD lesson plan will help design such lessons in collaboration with the learners. I believe that motivation to learn plays a vital role. No matter how well the teacher knows the content, if we are unable to engage learners in our teaching, the learning process is meaningless. Based on my teaching experience and information gathered from teachers and students, especially at the school level, where learners don't know how to use or understand the essentials of learning, teachers' methods of teaching motivate learners in their learning. As claimed by the wherein academic motivation is determined both by social (contextual) factors, as well as by the cognitions (thoughts) of learners.

Further, during the session, TPD teachers were engaged in designing and implementing various activities, thereby collaboratively creating knowledge. Thus, another finding of this research is the promotion of collaborative learning. This research foundation is based on participatory action research, which holds that knowledge is rooted in individuals' experiences and lives and is created through collaboration between the researcher and co-researchers. As claimed by Vygotsky all the learned have their special qualities, and as educators, our task is to identify and sharpen that ability. As the STEAM approach advocates collaborative, communicative, critical, and creative skills, these TPD sessions also align with these qualities. From design to implementation of art integration and integrated projects, seek collaboration among subjects, teachers, learners, teacher-learners, and so on.

Apart from this, we have also encountered certain challenges during the search process. Firstly, to bring change in the educational system, teachers need to be mentally ready. I believe that to transform ourselves, we need to recognize our work

and reflect on it. During this process, I encountered certain teachers who either did not want to change their teaching practices or did not adopt new pedagogies to make their classes more motivating and interesting. Further, another challenge we face is time constraints. In Nepal, especially, we are guided by the time frame for our teaching by the school management, parents, the curriculum, the evaluation system, and so on. Because of these factors, teachers are seeing this as a burden rather than focusing on covering the subject matter and securing good grades on learners' marksheets.

To sum up, in today's world, it's essential to develop a school-based Teacher professional development program to transform the educational system. In Nepal, we have seen that most training under teacher professional development (TPD) initiatives is often theoretical and/or shaped by the trainers' interests, rather than addressing teachers' actual needs and the challenges they face in classroom settings. For this, it's essential to develop participatory STEAM-based teacher professional development sessions that not only develop the teacher professional transformation but also transform the educational system.

Implication of the Research

This section focuses on the implications of the research and its findings. As this research is based on teacher professional development in STEAM education through a participatory approach, it has yielded several transformative insights into teacher professional development, curriculum integration, and pedagogical shifts. The design of various TPD sessions on STEAM education through participatory action research not only enhances teachers' skills and reshapes their identities but also engages and motivates the classroom. Based on the findings discussed in the previous section, this section outlines the implications of this research for various stakeholders, including teachers, co-researchers, curriculum developers, policymakers, and me.

Implications for the Teachers

From a teacher's perspective, the interdisciplinary pedagogical approach of STEAM provides space for teachers to deepen their pedagogical concepts and fosters professional transformation. As a co-researcher, our teacher is a teacher themselves; their difficulties and sharing will be useful to other teachers. For instance, during the planning and implementation of interdisciplinary projects, art integration co-researchers had been questioning the effectiveness of their previous lessons, pedagogy, and teaching strategies. They critically reflect on their practices, whether they were based on learned needs or not, and whether they are from a student or a

teacher perspective. The PAR notion of STEAM-based TPD helped shift teachers' perspectives from knowledge transmitters to facilitators.

Implications for the Teacher Educators/Trainers

Furthermore, this research will be helpful for the teacher educators, who are continuously working in the field of updating and transforming teachers. This will be helpful for the teacher educators who have been preparing future educators with interdisciplinary competencies. STEAM-based teacher education should go beyond technical and content training to include opportunities for teachers to experience integrated learning themselves.

In addition, this research holds a significant impact for curriculum developers and policymakers. As this research advocates the benefits of innovative pedagogies, especially the integrated project and art-integration teaching approaches, it provides a strong foundation for rethinking and redesigning how the curriculum is conceptualized and implemented. The findings of the research can guide the curriculum developer in designing integrated-approach projects and classes in higher grades, as well as in the context of Nepal, by promoting holistic learning rather than isolated subject matter. The implementation of art integration and integrated projects offers curriculum developers insights into how the STEAM theoretical framework can be applied in the classroom to develop today's learners' capabilities.

Implications for Policymakers

This research provides valuable insights for the policymakers of Nepal, who aim to transform the education system towards an innovative, context-responsive, integrated, and STEAM-aligned system. The findings of the research show that to transform the education system beyond traditional compartmentalization, it is essential to focus on an integrative, interdisciplinary, and continuous teacher professional development program. So, the research findings will help policymakers design a new TPD structure for teachers, which will be really useful for them. By demonstrating the effectiveness of STEAM-based TPD, this study provides concrete evidence that educational policies should encourage flexible, collaborative, student-centered, and teacher-demand sessions on teaching rather than export-driven. It offers practical guidance on designing in-service and ongoing training programs that foster teachers’ professional growth and transformative learning. Policy makers can use these insights to support professional development frameworks that are iterative,

reflective, and embedded in real classroom contexts, rather than purely theoretical or one-off training sessions.

Additionally, this research underscores the importance of including various innovative pedagogies in the classroom, such as art-based pedagogies, the STEAM approach, and integrated project- and inquiry-based approaches to learning. It argues that in today's world, when designing educational policy, we need to consider the perspectives of learners and teachers.

Lastly, this study can serve as a reference for policymakers seeking to reform the education system, benefiting both teachers and learners. By incorporating evidence from participatory action research and interdisciplinary pedagogy, policymakers can reform policies to be more responsive to classroom realities. The evidence and findings of the research can promote lifelong learning among educators and ensure that students develop the critical thinking, creativity, and collaborative skills needed for the 21st century.

Implication for the Co-researchers

The experiences, findings, and evidence collected throughout the research session have significant implications for the co-researchers. During this journey, co-researchers engaged in various forms of learning, including discussions, sharing perspectives, and experimenting with pedagogical approaches such as STEAM, art integration, and integrated projects. This process not only enhanced their understanding of innovative teaching practices but also empowered them to critically reflect on their own classroom practices and strategies. In this collaborative journey, co-researchers gained valuable insights into diverse perspectives on STEAM education, a collaborative approach to teaching and learning, and familiarity with innovative pedagogies, among other areas. Further, they recognized the importance of interdisciplinarity in learning, of art-integrated learning, and of moving beyond traditional subject-specific teaching. The research also provided opportunities for them to practice collaborative planning, peer learning, and co-construction of knowledge, which fostered a stronger professional learning community within the school.

Furthermore, engagement in reflective practice allowed co-researchers to examine their assumptions, question their own practices and strategies, and explore alternative methods of instruction. The collaborative research journey allows teachers to advance their professional growth by broadening their pedagogical thinking and

equipping them with strategies to make classroom teaching more engaging, student-centered, and contextually relevant.

In addition, the co-researcher's experiences had implications for enhancing their professional development. By actively participating in the research design and implementation, co-researchers developed a sense of ownership and leadership. Furthermore, they designed various art-based and integrated projects independently and sought additional approaches to make learning more engaging and better aligned with real-life applications. In this line, the co-researchers developed as change agents rather than practitioners.

Implication to Me

As the lead researcher on this study, I have found that it has had significant implications for my personal and professional journey. Throughout the research process, I became familiar with the various challenges and opportunities in the educational sector, particularly those related to teacher professional development. While reflecting on my journey, I realized that at the beginning, I tended to focus on positive feedback and often avoided critical perspectives. However, after implementing this research, which gave me the chance to become familiar with the different phases of Participatory Action Research (PAR), I gained a unique opportunity to understand the difficulties and experiences of both teachers and learners in a vivid and meaningful way.

This research allowed me to develop a stronger sense of empathy and the ability to view teaching and learning from multiple perspectives. During the research, I realized my perspective on various topics, such as learners' achievement, their needs, engagement levels, and the role of teachers, had changed. Collaborating closely with teachers to design and implement lessons gave me the opportunity to experiment with new strategies, approaches, and activities tailored to learners' interests and capabilities. This process encouraged me to think creatively and innovatively about teaching and learning processes.

Previously, my satisfaction as an educator was primarily based on learners' high grades on copies. However, through this research, my understanding of effective teaching has evolved. Rather than grades, I have now begun to prioritize learners' active participation in the classroom, the types of questions they raise, their creativity, and their ability to engage critically with the content. In this line, I can say my

expectations of teaching have shifted from a focus on outcomes to a focus on the learning process itself.

Moreover, previously, I used art integration mainly within my own subject. In contrast, now I have embraced a more collaborative approach. I design lessons that integrate multiple disciplines, consider learners' interests and levels, and emphasize meaningful connections across subjects. This research journey has transformed not only my teaching practice but also my professional mindset. In addition, this has fostered growth in my ability to plan, reflect, and facilitate learning in more inclusive, creative, and effective ways.

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