STORYTELLING-AIDED SCIENCE CLASSROOM FOR LEARNERS' MEANINGFUL ENGAGEMENT: A CRITICAL ACTION RESEARCH

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AN ABSTRACT

of the dissertation of *Ramesh Chapagain* for the degree of *Master of Philosophy in STEAM Education* presented on 9 *January 2025* entitled *Storytelling–aided Science Classroom for Learners' Meaningful Engagement: A Critical Action Research*

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In my experience as a professional science teacher at the secondary level, teaching science is regarded as a challenging job by most science teachers. The abstract nature of science contents, traditional lecture-based pedagogical approaches, and assessment-focused teaching and learning activities are major disempowering forces hindering students' science learning and meaningful engagement in their science class.

Critically reflecting upon my learning journey and pedagogical practices, students' outcomes, and learning attitudes, I concluded that there must be an intervention in traditional pedagogy for students' meaningful engagement. For this study, I chose storytelling pedagogy, a form of Arts, as an intervening tool to engage my students in meaningful ways. Intending to solve the problem on my level and transform myself from the traditional teacher as a transmitter to a constructivist teacher, I chose critical action research design, Vygotsky's social constructivism, and Mezirow's transformative learning theory as referent theories along with critical research paradigm as my philosophical view of knowledge construction.

I conducted my study by narrating stories based on science content, observing students' classroom engagement (Emotional, Cognitive, and Behavioral), and reflecting upon my actions throughout the study. In this study, my students studying in grade 9 in one of the private schools in Kathmandu are research participants. There were 18 participants, including 10 girls and eight boys students. Regarding the philosophical assumptions, my ontology is that there are multiple realities associated

with the past, epistemology is knowledge as subjective and generated by interaction with others and critical self-reflection and axiology are value-laden.

This study discovered some wonderful impacts of storytelling intervention in the science classroom. After the intervention of storytelling pedagogy, students' engagement in the classroom was enhanced; the classroom was turned from a passive to an active learning environment and transformed me from a lecture-based teacher to a constructivist co-learner. This study explored the role of Arts in science classrooms and the importance of emotional engagement for fostering cognitive and behavioral engagement of the learners. Students 'conformity with traditional pedagogies, difficulties in preparing stories, observing students' behaviors while narrating, and time management were some challenges encountered while conducting this study.

…… 9 January 2025

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शोध सार

स्टिम शिक्षामा दर्शनशास्त्रको स्नातकोत्तर डिग्रीको लागि रमेश चापागाईंको शोध प्रबन्धको शीर्षक "विद्यार्थीहरूको अर्थपूर्ण संलग्नताको लागि कथावाचन-सहायता प्राप्त विज्ञान कक्षा: एक समालोचनात्मक कार्य अनुसन्धान" २५ पुष २०८१ मा प्रस्तुत गरिएको थियो।

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उप प्रा. रोशनी राजवंशी, पीएचडी

शोध निर्देशक

माध्यमिक तहमा एक विज्ञान शिक्षकको रूपमा मेरो अनुभवमा धेरैजसो विज्ञान शिक्षकहरूले विज्ञान पढाउनुलाई चुनौतीपूर्ण कामको रूपमा लिन्छन्। विज्ञान विषयवस्तुको अमूर्त प्रकृति, परम्परागत व्याख्यानमा आधारित शैक्षिक दृष्टिकोण, र मूल्याङ्कन-केन्द्रित शिक्षण र सिकाइ गतिविधिहरू विद्यार्थीहरूको विज्ञान सिकाइ र उनीहरूको विज्ञान कक्षामा अर्थपूर्ण संलग्नतामा बाधा पुर्याउने प्रमुख शक्तिहरू हुन्।
मेरो सिकाइ यात्रा र शैक्षिक अभ्यासहरू, विद्यार्थीहरूको नतिजाहरू, र सिकाइ मनोवृत्तिहरूको समालोचनात्मक रूपमा विचार गर्दा विद्यार्थीहरूको अर्थपूर्ण संलग्नताको लागि परम्परागत शिक्षणबिधिमा हस्तक्षेप हुनुपर्छ भन्ने मेरो निष्कर्ष रह्यो। यस अध्ययनको लागि मैले कलाको एक रूप कथा वाचन शिक्षणबिधि हस्तक्षेपकारी उपकरणको रूपमा रोजें। जुन विधि मार्फत मेरा विद्यार्थीहरूलाई अर्थपूर्ण तरिकाले संलग्न गराउन सकियोस्। मेरो स्तरमा समस्या समाधान गर्ने र परम्परागत शिक्षकबाट आफूलाई रचनात्मक शिक्षकमा रूपान्तरण गर्ने उद्देश्यले, मैले समालोचनात्मक कार्य अनुसन्धान डिजाइन, भाइगोत्स्कीको सामाजिक रचनावाद, र मेजिरोको रूपान्तरणकारी सिकाइ सिद्धान्तलाई सन्दर्भ सिद्धान्तहरूको रूपमा रोजें र ज्ञान निर्माणको मेरो दार्शनिक दृष्टिकोणको रूपमा समालोचनात्मक अनुसन्धान प्रतिमानलाई रोजें।

मैले विज्ञान सामग्रीमा आधारित कथाहरू वर्णन गरेर, विद्यार्थीहरूको कक्षाकोठामा संलग्नता (भावनात्मक, संज्ञानात्मक, र व्यवहारिक) अवलोकन गरेर र अध्ययनभरि मेरा कार्यहरूमा प्रतिबिम्बित गरेर मेरो अध्ययन सञ्चालन गरें। यस अध्ययनमा, काठमाडौँको एउटा निजी विद्यालयमा कक्षा ९ मा अध्ययनरत मेरा विद्यार्थीहरू अनुसन्धान सहभागी छन्। १० केटीहरू र ८ केटाहरू सहित १८ जना सहभागी थिए। दार्शनिक धारणाहरूको सन्दर्भमा, मेरो ओन्टोलोजि भनेको विगतसँग सम्बन्धित धेरै वास्तविकताहरू छन् भन्ने हो, इपिस्टेमोलोजी भनेको व्यक्तिपरक ज्ञान हो र अरूसँग अन्तरक्रियाबाट तथा समालोचनात्मक आत्म-प्रतिबिम्ब बाट प्राप्त हुन्छ। एक्जियोलोजि मूल्य-भारित हुन्छ।

यस अध्ययनले विज्ञान कक्षाकोठामा कथा बाचन हस्तक्षेपका केही अद्भुत प्रभावहरू पत्ता लगायो। कथा वाचन शिक्षणको हस्तक्षेप पछि कक्षाकोठामा विद्यार्थीहरूको संलग्नता बढ्यो; कक्षाकोठा निष्क्रियबाट

सक्रिय सिकाइ वातावरणमा परिणत भयो र मलाई व्याख्यानमा आधारित शिक्षकबाट रचनात्मक सह-शिक्षार्थीमा परिणत गर्यो। यस अध्ययनले विज्ञान कक्षाकोठामा कलाको भूमिका र विद्यार्थीहरूको संज्ञानात्मक र व्यवहारिक संलग्नतालाई बढावा दिन भावनात्मक संलग्नताको महत्त्वको अन्वेषण गर्यो। परम्परागत शिक्षण बिधिहरुसँग विद्यार्थीहरूको अनुरूपता, कथाहरू तयार गर्न कठिनाइहरू, कथाहरू वाचन गर्दा विद्यार्थीहरूको व्यवहार अवलोकन गर्ने, र समय व्यवस्थापन यो अध्ययन सञ्चालन गर्दा सामना गरिएका केही चुनौतीहरू थिए।

..... २५ पुष २०८१

रमेश चापागाईं

उपाधि उम्मेदवार

This dissertation entitled *Storytelling–Aided Science Classroom for Learners' Meaningful Engagement: A Critical Action Research*, presented by *Ramesh Chapagain* on *9 January 2025.*

APPROVED BY

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I understand and agree that my dissertation will become a part of the permanent collection of the Kathmandu University Library. My signature below authorizes the release of my dissertation to any readers upon request for scholarly purposes.

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Ramesh Chapagain
Degree Candidate

DECLARATION

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

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DEDICATION

This dissertation is dedicated to my parents, Khageshwor Chapagain and Renuka Chapagain, who understood the value of education, provided me with learning opportunities and supported me continuously.

Furthermore, I would like to dedicate it to all my respected teachers throughout my learning journey so far and all educators and my students.

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Ramesh Chapagain
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ABBREVIATIONS

CDC	Curriculum Development Centre
COVID	Corona Virus Disease
CT	Computed Tomography
KUSOED	Kathmandu University School of Education
LPG	Liquefied Petroleum Gas
SEE	Secondary Education Examination
SLC	School Leaving Certificate
STEAM	Science Technology Engineering Arts and Mathematics
STEM	Science Technology Engineering and Mathematics
USG	Ultrasonography

LIST OF TABLES

CHAPTER I
INTRODUCTION

I welcome all the readers to this wonderful and exciting journey of constructing knowledge. This study utilizes storytelling pedagogy in science classrooms to improve learners' engagement in the science classroom. In this research study, I presented myself in dual roles: a researcher and a science teacher. I taught my students science content using storytelling pedagogy. In parallel, I observed my classroom as a researcher and revealed students' engagement.

This chapter begins with a reflection on my learning journey, followed by an analysis of the teaching approaches that I encountered as a student from elementary school to University. Then, I reflected on my career as a science teacher, considered how to improve my science teaching in my classroom, and stated the problem. I raised research questions and discussed the purpose of the study and its significance concerning my research topic.

Background of the Study

After a decade of teaching science to school children, I realized that my science classroom was ineffective at providing a meaningful learning environment to the science students. There might be a variety of variables responsible for science learners' disengagement in the class, such as the nature of the science curriculum, the evaluation system and teaching techniques, learners' socio-cultural background, classroom setting, and the nature of content taught, but I believe the most important aspect is the pedagogy that we use in our classroom.

The prevalent methodology in Nepali classrooms is conventional lecture-based "Chalk and Talk" pedagogy molded by behaviorism. The instructor distributes information about the content to passive and quiet students in a one-way flow. The teacher remains active in the classroom, whilst the students remain silent and do not engage in the learning process, with the only purpose of covering the syllabus and preparing for a paper-based test. Given the disengagement of learners, it could be worthwhile for teachers to alter their methodology and convert themselves from lecture-based teachers to constructivist instructors. There may be several techniques and approaches for student-centered teaching and learning; however, this study employs a form of arts, storytelling, in the science classroom to ensure that students

enjoy the class and engage in classroom activities in a meaningful way so that learners can understand science contents and connect them with their contexts.

My Journey as a Learner

My educational journey began in 1993 AD when I enrolled in a remote government school in the hilly region of western Nepal. My residence was far from the school. It took around 3 hours to get to school one way. We used to spend more time traveling than we did in school. In my childhood, I learned much more from nature than formal education. I don't have more in memory about my school life during primary education except for some exciting moments when I heard stories from Bijay Sir. He used to narrate stories in class frequently. I still remember the story of *Banduke*, a gunman who was able to kill a tiger with the help of buffalo dung, mustard oil, and soybean seeds and protected life of many villagers and cattle. Besides these moments, I remember one special childhood story in school, which goes as follows:

> *When I was just promoted from grade 4 to 5, in a new class, we were shifted to the newly built building. In my new class, there was no blackboard; therefore, teachers used to teach only verbally. After about two and a half months, we realized the difficulty of learning without a blackboard, especially mathematics. We asked teachers, and they suggested writing an application to the head teacher. I wrote an application on behalf of the whole class demanding a blackboard in the class as soon as possible. The head teacher replied that he was aware of the problem; there was a shortage of sand for making board and told us to compromise for a few more days unless the workers brought sand from Setibeni, bank of Kaligandaki River. We took his reply seriously, discussed it together, and decided to bring sand from the river bank ourselves.*
>
> *One day after arriving at school, my other three friends and I left to go towards Setibeni to bring sand. We brought sacks from each of our homes to store sand. After about 2 hours of walking on the hill road, we reached the river bank and collected sand full of four sacks, about 30 kg each. It was very heavy to carry the sand for us at a young age. We poured sand on the road and moved gradually towards the school. Finally, after walking for about 3 hours with the continuous process of throwing little sand from the sack after intervals of 10 to 15 minutes, we reached the school with about only half a*

kilogram of sand in each sack and kept in the school near guard room. The school was already closed for that day. We realized that sand wouldn't be enough to make the blackboard and felt guilty for bringing sand without informing our teachers and parents. The next day, I was surprised to observe that a blackboard was being built. The head teacher called us into his office, scolded and instructed us not to repeat such activity. However, I was happy to see the blackboard.

Reflecting on this story, I assume we struggled to learn with lecture methods using basic teaching material such as blackboard. If I reflect upon the teaching techniques and assessments during my primary education, I have very little to remember. One incident that always strikes my mind is when I was scolded badly by one lady teacher in grade 1 for taking the exam answer sheet home in the very terminal examination after attempting the exam paper. I think I was unaware of the process for submitting the exam sheet after completing the writing, or it could be that I forgot to submit it, but I remember the teacher's response very soon was very harsh. My relationship with my teacher during my childhood always remained formal. As a small child, I envisioned that the teachers knew everything and were the ultimate source of information.

After 6 years of primary education, including *Sishu Kachhya*[1], my formal education continued in a government school in western Terai of Nepal, where my family migrated permanently from a hilly region. This school had good facilities and basic infrastructure such as classrooms, furniture, and a playground compared to the previous one. However, it was challenging for me to adapt to the new environment as most of the students and teachers in that school were from the Terai community, and only five were from the Nepali language-speaking community. I was a little bit smaller than my classmates in height, so it felt awkward to make friends. Classmates almost used to speak their mother language, Bhojpuri, in school. Except for the Nepali language subject, teachers were from the Terai community who used to speak in Bhojpuri mostly while teaching except while reading books. They used to give examples and contexts that used to be unfamiliar to me. One time, when I told *Kitpatang* means fallen leaves of plants during science class when a teacher asked me,

[1] one year of class before grade one, now early childhood development class.

the whole class, including the teacher, laughed at me, considering my poor understanding.

During my basic and secondary level education, the image of a teacher was like a reservoir of knowledge, one who is very powerful as they can make students do what teachers want. Giving physical punishment in school for not doing/completing home assignments or talking inside the class was common. The student who used to raise opposing ideas or perspectives contradicting the teacher's statements was considered disobedient and punished for disrupting the class and diverting the topic from the context. Science and mathematics were thought to be tough disciplines. Teachers used to behave as knowledge powerhouses, and we students used to get topic information, read it, repeat it many times, and memorize it for exams. For me, learning meant reading information repeatedly, memorizing it, expressing it in a test, and upgrading to the next class. I do have a reminiscence regarding my teacher's maxim, “I will deduct your practical marks.....” as follows:

> *It was a day when I was studying in one of the secondary-level classes. In 5th period, Just after my tiffin break, Mr. Strict, our science teacher, entered our classroom. The class became silent because Mr. Strict had instructed us to learn and memorize answers to 10 questions from the chapter "Electricity," which he had written on the blackboard the previous day and committed to asking us. He started asking questions randomly. I was frightened and leaned down, hoping he wouldn’t ask me. He made one of my friends, Sudan, stand and asked, "What is electromagnetic induction?" Sudan tried but couldn’t give a simulation of the answer word by word, which was what Mr. Strict had written on the board. "Stupid! You gave an incomplete answer. If you have to pass the exams, strictly follow my instructions and write what I have written," Mr. Strict said. When the teacher was busy asking questions in the first row, some students whispered on the last bench. The teacher knew and said, " You last benchers, make noise now. I will show you all in the SLC results, and I will deduct your practical marks for science in the SLC examination".*

My above story may help unpack how science is taught in our classroom in a controlled and silent environment and how assessment is focused more than the teaching process. During my time in school, I used to believe that the objective of learning science was to pass the final examination; science is a rigid subject and can

be learned only by rote memorization. I assume teachers are an authoritarian and ultimate source of knowledge.

During the secondary level, Grades 9 and 10, we students were racing to store information to deal with the so-called greatest obstacle of life, usually called the Iron Gate, SLC (School Leaving Certificate). SLC used to be given the highest priority in the context of teaching and learning, questions used to be asked from both classes, and parents used to link the family's prestige with their child's SLC result. Only about 30% of students used to pass the SLC during those years; those who couldn't pass used to reappear in SLC for multiple attempts to crack the examination. After two years of rigorous racing, I finally completed the Iron Gate with a good percentage (nearly distinction, 80%). I was happy along with my family. From the day of the result, who met me and my parents and knew about my results, everybody congratulated me with the common suggestion: *"This is a very good result! You have to choose the science stream for higher studies."* Although I was not fully aware of the scope of learning science, I listened to the suggestions from the people around me and got enrolment in I.Sc (Intermediate in Science) at one of the government colleges.

College life was very different than school as there were many teachers: 3 physics teachers, three chemistry teachers, two mathematics teachers, three biology teachers, and one/one English and Nepali teachers with different schedules used to come and teach and provide notes for preparing to face another race towards board examination. The image of these teachers was just those job holders assigned to provide notes to the students. The teaching job was just a usual task for the teachers. They didn't have concerns with whether the students were understanding or not or whether students felt their class was compatible. Other issues I encountered during my intermediate level were syllabus volume and my English language. As there was a huge change in curriculum compared to grade 10, we were supposed to write long derivations and long answers instead of short answers during the examination. I was not good at English as my background was from a government school with the Nepali language. Due to these difficulties, I could not attempt all the questions during every examination and used to write a quote on the last page of answer sheets for every paper for self-satisfaction and to impress the examiner:

Who walks slow, he/she reaches first.

Who walks fast he/she reaches at the last.

Anyhow, I completed my intermediate level with average marks. Then after, I shifted to Kathmandu for a BSc in physics and was admitted to one of the popular government campuses in the capital city. The campus was more like a playground for politics than an academic institution. Even for normal information about the campus, we needed to depend upon various student unions of different political parties. I think I got a good opportunity there to understand Nepali politics more than what I earned academically. I rarely used to go to campus for lectures except for practical sessions. We used to buy photocopies of content notes from the stationery shop near campus, which was assumed to have been prepared by previous campus toppers. We studied at home by rote memorization and attempted examinations to earn a degree at any cost during my B.Sc (Bachelor in Science) In my third year, I realized that going to campus to study was worthless, so I decided to do some work and help my parents financially. So, I started searching for jobs through daily newspapers. I got a job suitable for me then as a secondary-level science teacher in one of the private schools in Kathmandu.

My Experiences as a Science Teacher

I started my teaching career when I was studying for my bachelor's degree in the last year. I used to teach science subjects at the secondary level in one of the renowned private schools in Kathmandu. As the phrase goes, "Morning displays the day," a person's upbringing impacts their adulthood. My learning journey has influenced my professional job as a teacher. There was a great reflection of my learning journey on my teaching process. I applied the same traditional didactic method of teaching. The didactic teaching approach is a method of teaching in which information is shared directly from the teacher to the student, in which the teacher picks the topic of teaching, controls instructional stimuli, requires a response from the child, evaluates the child's responses, and reinforces correct responses and feedback for incorrect ones.

In my teaching, my focus was to prepare students to face final examinations. I used to read and memorize the content at home and discuss it in the classroom. I used to believe that I was a good teacher. Instead, I used to try to give the class my full control while teaching; many of the students did not seem to be so attentive towards my lecture. The performance of some students in the examination also was not satisfactory. Such disengagement of students always pinched me to find the solution to it. Parallel with another race of preparing students for SLC/SEE, making them pass

and repeat the same thing for another batch, I completed my MSc in physics from a campus in Kathmandu with good marks.

COVID-19 Outburst as Turning Point in Changing My Perception of Teaching and Learning

As I mentioned earlier, my role as a secondary-level science teacher began during my bachelor-level study and continued till the outburst of COVID-19 completely as a lecture-based teacher. During that period, I never realized the pedagogy I was using could not engage my learners meaningfully, nor did anybody question me regarding my way of teaching. I used to feel superior to other subject teachers such as Nepali, Social Studies and HPE (Health and Physical Education). I felt so because I was paid more than them for the same work hours, as it is still common in private schools in Nepal to provide higher remuneration to mathematics and science teachers than other teachers. School administration praised me, considering my class more disciplined than others. Several times, I have been given awards such as the Teacher of the Year, the Outstanding SEE Result Award, and other rewards for being an excellent science teacher.

In 2020, when Coronavirus started to spread in Nepal, the government decided to close educational institutions temporarily. When our physical classes were stopped, I was quite leisurely from my busy schedule and stayed at home thinking about how the free time could be utilized. One day, while scrolling through social media on my cell phone, I encountered a post about a webinar on STEAM (Science, Technology, Engineering, Mathematics, and Arts) education organized by Kathmandu University School of Education. Although the session was about two and a half hours long, the day was one of the milestones in my professional life. The session compelled me to question who I am as a teacher. Do I have to teach science or my students? After being part of some similar sessions and exploring further on YouTube, I realized that the pedagogy that I was using in my classroom was teacher-centric and such pedagogy was not engaging my students meaningfully. It was not enough to prepare learners equipped with the scientific skills to deal with the challenges in real life of learners. As a teacher, I focused only on the cognitive part of learning and prepared students to face written examinations. I realized I should be a teacher of students before becoming a science teacher.

Now, when I look back to the time of the COVID outbreak, though the time was most difficult for all people in the world as many people lost their lives, the time

was highly fruitful for my professional career. This time changed my perception of pedagogy, teaching and learning, learners, and teachers. Then, I decided to open the door for my further formal education; I enrolled as a learner of M.Phil. in STEAM Education at Kathmandu University- School of Education. My new learning journey provided an opportunity to reflect on my learning journey and my work as a teacher, and it taught me various dimensions of teaching and learning.

My ongoing learning journey made me realize that the main cause of students' disengagement in my science class was my teaching methodology. I then decided to implement an intervention in my teaching pedagogy to make my class more interesting, conscious, and interactive. Teaching science is not just about delivering the collection of information to passive learners and explaining and defining scientific terms. However, it is also about inculcating the habit of inquiry and developing concepts to understand natural phenomena. Students do not enjoy science class because science learning is mainly considered an objective approach. Students cannot easily understand the extended chain of reasoning in scientific theory (Johnstone et al., 1997), which requires a student-centric constructivist approach in our classroom for conceptualization of these theories and meaningful engagement. In this research, I used storytelling pedagogy as an intervention in my science classroom.

Storytelling technique is not a new method of formal and informal education in our Eastern philosophy; almost all historical and philosophical scriptures, such as the Vedas, Upanishads, Bhagavad Gita, and the Mahabharata, are written in the form of stories. Storytelling has been used in teaching pedagogy in our context in different ways, especially in language subjects such as Nepali, social studies, and English. However, this technique was rarely used in science teaching due to the hegemony of the Western belief system of teaching science, which believes that science is based on scientific laws and facts and should be taught with the Newtonian notion that believes in a single objective reality. In the name of modern teaching and learning, our classroom overlooked and adopted teaching methods that are guided by Western worldviews. I realized the technique of storytelling, which acted as a means of teaching and learning from generation to generation in our ancient times, should be revived and included in our classroom pedagogy. In this research study, I employed ancient means of educating people, such as storytelling and pedagogy, to improve students' engagement in my science classroom.

Problem Statement

My experience as a science teacher for a few years shows that science is regarded as a difficult and abstract subject in our classroom. Students do not show keen concentration in science class when the teacher uses lecture-based pedagogy – a teaching method in which the teacher explains the contents in front of silent and passive learners. According to Bajracharya and Brouwer (1997), science teachers in Nepal emphasize the development of the cognitive ability of the learners. Pedagogies are teacher-centric, and textbooks are taken as a major source of learning, but teaching is far from the learner's and teachers' real context. Khanal and Park (2016) claim that teaching in our classroom is mainly shaped by negative reinforcement, where learners perceive punishment as a culture. In my experience as a science teacher, students get frightened to raise questions on their queries. The science curriculum in Nepal is decontextualized as science contents and activities ignore the social settings of Nepali contexts (Bajracharya & Brouwer, 1997); such a curriculum can not engage our learners meaningfully.

The assessment system in Nepal majorly emphasizes paper-based, time-bound examinations, which encourage learners to rote recall and memorize the contents to pass the examination. There is no space for critical thinking and creativity in science class due to the dominance of teacher-centric pedagogies (Bhandari, 2017). The effect of a decontextualized curriculum and the disengaging of lecture-based pedagogy has been reflected in the achievement level of the learners as well. The Education Review Office (ERO) (2019) report reveals that the achievement level of students in SEE results is very low in science compared to other disciplines. 37% of students achieved proficiency below basic with an achieved curriculum of less than 5%, whereas only 2% of students have achieved advanced proficiency with an achieved curriculum of 90%. Similarly, about 62.3% of students achieved below the basic proficiency level in the Basic Level Examination (BLE) (ERO, 2022). These data show the ongoing teaching pedagogy is not enough to address the learning needs of current learners.

Besides the pedagogies, there could be multiple factors causing students' disengagement from their classroom. Academic gaps, relations with peers and teachers, nature of content taught, academic workload, classroom environments, and parent's role could hinder students' meaningful classroom engagement. According to the United Nations Children's Fund (UNICEF) report (2019), only 27 % of students complete secondary school, while most leave their school before upgrading to

secondary level for various reasons. In my opinion, one of the prominent reasons for such a dropout rate of students could be the pedagogy applied in school, as students do not enjoy their classes.

Due to the failure of conventional *Chalk & Talk* pedagogy, in which the teacher writes on board and explains the content to passive learners to engage learners in their science study, there is a need for new pedagogical tools to promote learners' meaningful learning involvement in science class. As the major concern is to address the disengagement of the learners and empower them to conceptualize scientific concepts, this requires constructivist pedagogy - a teaching approach that assumes that learners actively construct knowledge instead of passively receiving information. Various kinds of literature explore that including art in science class promotes a learner's meaningful engagement. Among various forms of arts, storytelling is one of them that would be effective in helping learners to understand science concepts easily and connect these to learners' real lives. The intervention of the storytelling approach to lecture-based pedagogy promotes students' learning (Egan, 1986; Koening & Zorn, 2002; Suzuki et al., 2018).

As a science teacher, the storytelling approach intervention in my science classroom helped science learners crack abstract scientific concepts and internalize them. Learners who understand science concepts enjoy the class and participate in the learning process meaningfully.

Purpose of the Study

The main purpose of this research was to improve learners' meaningful engagement through storytelling in my science classroom. The research study also aimed to explore how storytelling pedagogy helps learners to conceptualize science content.

Research Questions

As my research mainly focuses on the use of storytelling in my science classroom, I expected to respond to the following questions after this research project:

Main Question

How does the storytelling approach to teaching science engage students in the classroom?

Subsidiary Questions

1. How does the storytelling approach motivate learners to learn science?

2. How does the storytelling approach help learners conceptualize scientific concepts?

Significance of the Study

The main purpose of this action research was to use storytelling pedagogy in the science classroom to enhance learner's engagement in a meaningful way. This study's findings will benefit not only the researcher but other stakeholders as well. The significance of this study can be elaborated in the following ways:

Pedagogical Significance

The finding of this study will be beneficial to all science teachers to know and apply a narrative way of teaching to improve learners' participation in their class and change their pedagogy. This research study will also explore the merits of storytelling in the science classroom. This research will be one of the milestones in challenging traditional pedagogy to enhance learner engagement through a constructivist approach in Nepal. This study will encourage the teachers to do action research and use an interdisciplinary approach to teaching and learning.

Curricular Significance

The findings of this research will be helpful to curriculum designers in ensuring whether storytelling pedagogy and related activities should be included in the curriculum. This research will also help curriculum designers plan curricula, including interdisciplinary aspects, to simplify science teaching and learning.

Delimitation of the Research Study

This study included students as research participants who were used to be taught by the lecture-based method. In this research study, stories prepared by the researcher were used only based on science content under the CDC (Curriculum Development Center) curriculum. The study concentrated on teaching some topics related to physics. This research has focused on learners' cognitive, emotional, and behavioral engagement in their science classrooms.

Chapter Reflection

This chapter began with my reflection on my learning journey from the elementary to the university level and my critical self-reflection as a secondary-level science teacher. As a learner, I reflected on how my learning journey was guided by the notion of the learner as a passive receiver and my deep-rooted meaning of learning as preparing to face assessments. As a science teacher, I reflected how there was a reflection of my learning journey in my professional role as a teacher, and I presented

myself as an authoritarian teacher with a lecture-based teacher responsible for students' disengagement. I also explained the role of the COVID-19 pandemic as a turning point for pedagogical transformation. Then, I envisioned storytelling as a pedagogical tool to intervene in my science class for meaningful engagement. Then, I stated problems regarding students' engagement with my science class and our nation. I chose research question purposes and explained how my research would be implacable after accomplishment.

Reflection on my school life made me remember my childhood memories. I just realized that I traveled to my past almost 30 years back through a time machine and explored the incidents that happened there, just as presented in the Bollywood movie 'Action Replay', in which the lead character, Aditya Roy Kapoor, travels to the past, resolves the conflicts that arise between his parents, and improves the relationship between them. However, I just could explore the incidents but couldn't resolve them. Reflection on my role as a science teacher helped me to be more clear about the objective of this research study, as I could distinctly view the disempowering forces on students' engagement. I realized how authoritarian a teacher I was, whose aim was just to pour the content knowledge into empty vessels and fill them for a while.

CHAPTER II
LITERATURE REVIEW

In this chapter, I have reviewed a variety of literature that are relevant to my research issue. This part covers a review of journal articles on learners' engagement, science teaching, and the use of storytelling in the science classroom, a review of the current science curriculum as a policy review, an empirical review of research articles that utilized storytelling as pedagogy, as well as theory alignment with this research study.

Thematic Review

In this section, I have analyzed some themes related to my research agenda based on the literature.

Engagement of the Learners in Their Classroom

According to Kuh (2003), classroom engagement refers to the amount of time and effort students dedicate to educationally sound activities inside and outside the classroom, as well as the policies and procedures institutions use to encourage students to participate in these activities. The student who is meaningfully engaged in the classroom puts a lot of effort into his/her work, enjoys challenges, and does not give up on the work (Klem & Connell, 2004). Disengagement from learning is a scenario in which a student does not feel involved, does not participate in classroom activities, and has poor class attendance. Disengagement from the classroom is related to individual attitudes or values. It can be impacted by friends, cultural aspects, the nature of the subject taught in the classroom, and the methodology used.

According to Reschly and Christenson (2012), students' engagement is like an adhesive substance that connects important contexts-family, classmates, and community to the students, resulting in students' interest in classroom activities. Various studies show three learning engagements: cognitive, behavioral, and emotional.

Cognitive Engagement

The degree to which one is thinking about the learning activity, or attending and focusing on the task, involved and applying effort in learning is called cognitive engagement (Blumenfeld et al., 2006). It is the involvement of students engaged in deep learning, including their ability to connect concepts, ask probing questions,

analyze and evaluate the information, and apply their knowledge. If the students are engaged cognitively, they develop their conceptual understanding of the contents and analytical skills. Cognitive engagement addresses the learner's need for the cognitive learning domain. In our contexts, the cognitive domain of learning is more prioritized than the affective and psychomotor domains. In my observations, I found that students and teachers use learning as a synonym for cognitive development.

Behavioral Engagement

Behavioral engagement indicates the learner's classroom participation and his/her attendance during learning time. The students with behavioral engagement show active participation, follow instructions and rules (Olivier et al., 2020), and exhibit observable characteristics in their actions. Behavioral engagement involves students' active classroom participation through various activities such as readiness for learning, regularity & punctuality, asking questions and participation in the classroom discussion, attentiveness, and willingness to engage in classroom activities. In my observation, behavioral engagement is taken as the basis of classroom discipline in our classroom, and students are forced to shape their behaviors using positive or negative reinforcement.

Emotional Engagement

Emotional engagement in learning refers to the feeling of excitement, interest, empathy, and personal connection that learners respond to during the learning process, particularly when they are attached emotionally to the subject matter**.** According to Ben-Eliyahu et al. (2018), emotional engagement refers to whether a learner is motivated towards a particular class. Emotional engagement is related to the affective domain of learning. This engagement is mostly overlooked in our classes, especially while teaching science and mathematics. Various factors may be responsible for the emotional disengagement of the learners in the classroom, such as relations among classmates, family issues and parents' roles, the nature of content, and the type of pedagogy. Fredricks et al. (2004) assert that emotional engagement is the foundation for the overall engagement of the learners with learning materials fostering cognitive and behavioral engagement.

Being specific to science classrooms, the learners in our classroom seem more disengaged due to various factors. While teaching science in the classroom, I experienced that many students do not fully immerse in the study as they feel science content to be more objective and logical (Verran-Watson, 1991). I believe that the

major cause of the students' disengagement is teaching techniques in our classroom. We apply teacher-centered teaching techniques that disengage students. In my experience, students find science classes uninteresting since they believe science content is more objective and devoid of context. As a result, it is essential to consider if there are measures that reduce the potentially negative correlations of students who perceive science class work to be more challenging than usual.

Storytelling

Storytelling is an ancient form of art that acts as a means of human communication to convey cultural values, traditions, beliefs, and experiences from generation to generation. According to Brakke and Houska (2015), storytelling is a dynamic and interactive process not only limited to recounting a chain of events but also creates a connection between storyteller and audience by conveying ideas, emotions, and experiences through narrative structures. Storytelling is a strong means of cultural transmission (Bruner, 1991). I remember a story told by my grandmother when I was 6 years old in which a lead character, "*Dharmanand,*" exchanged his horse with one "*Mana* “grain for his family’s survival during wars with neighboring countries.

As I mentioned in chapter one, I have very rare memories of my educational journey at the primary level, except for some stories narrated by teacher Bijay, sir. I used to wonder about incidents presented in the stories, and many questions arose in my mind. Stories serve as tourism so that one generation can look around the previous generations and help connect with past generations and how ancestors responded to the challenges. Stories allow us to experience a range of emotions and feelings without encountering the actual events that cause such emotions and feelings.

Storytelling as Arts-based Pedagogy in Science Classroom

As an educator, specifically a science teacher, my major concern has always been making my teaching more effective and engaging my students in meaningful learning. Therefore, I was in quest of tools, pedagogies, and methods so that learners in my class would be more engaged and better understand the concepts I teach.

"Poet can reach the place where sunlight cannot reach.” This renowned quote tells how powerful art is in revealing the realities of things that are not distinct from the external world. The things and phenomena of nature are not as simple as seen outwardly. Abstract and complicated natural things cannot always be dealt with only with the help of science. To unpack hidden realities, we need to take help from the

arts. Science is not purely logical, as there are always rational laws only, but it depends on different art forms, such as inspiration, imagination, and intuition (Ibarra & Sommerstad, 2019). Art helps to transform immaterial things into material. Arts humanize science (Donnelly, 2004). Science and arts are inseparable and indispensable aspects of the strange universe. In dealing with a problem, arts creatively ask eternal questions and analyses, whereas science solves that using different theories. In classroom teaching, various forms of art can also effectively support learners in understanding the concept of the content. In this regard, Pant et al. (2023) claim that Science and Arts work as complements of each other as ways of knowing for inclusive learning. In my case, I used storytelling, a form of art, as an intervening tool in my science classroom.

Storytelling itself could not be solely a part of any science chapter. However, it can be one of the pedagogical tools used to connect the science content with the learners for deeper understanding and better learning outcomes (Landrum et al., 2019). It is believed that art has a strong power to influence our mind and bind it towards the matter of context. We may feel bored listening to and watching 40 minutes of the lecture but easily spend 3 hours on a sensational drama or movie by watching it. In teaching, art also greatly enhances the learner's attention to the study and makes the learning more meaningful. Storytelling is one of the kinds of ancient art that would be an effective means of approach to science teaching. Science contains various laws, principles, and facts. Understanding and memorizing the facts and principles may be difficult as they do not make meaning by themselves. However, stories and other narratives help make facts meaningful (Gabriel, 2004).

According to Kyriacou (1992), a wide range of stimuli are to be presented to the learners to make teaching effective and student-centered. Storytelling could be a stimulus that helps to unpack the reasoning behind science theory and make students more engaged in the science classroom. The storytelling blended science classroom could be more motivational and joyful to the learners. Rowcliffe (2004) claims that many teachers would benefit from the usage of stories, including non-subject specialists who rely on lecture-based methods, newly qualified teachers who are struggling to make their teaching more interesting, and older teachers who may be demotivated themselves and are no longer motivating or interesting their students. Many studies have shown that storytelling may give an enhanced learning experience and that students appreciate (and are more eager to attend) classes with an

entertaining or historical component. There is also physiological evidence that using stories can improve long-term retention of ideas.

By integrating storytelling with our teaching pedagogy, we could make our classes more effective and learner-centered. Suzuki et al. (2018) claim that skillful storytelling helps learners understand the meaning of complex concepts and ideas in meaningful ways. It develops empathy as we experience various emotions of others through the narratives in the stories. According to Egan (1986), storytelling enhances our power of memorization and provokes imagination. I feel that we encounter lots of information every day. However, only a few of them remain in our minds longer. Information only cannot change the reluctant mind. The information that I encounter today may not be in my mind after a few days. However, if any information we encounter is connected with our emotions, it leaves an impression for many years, and we remember it.

The story's contexts, characters, and events trigger our emotions and remain in our minds for a longer time. Seese and Haven (2015) assert that different components of narratives during storytelling activate various parts of our brain and enhance memory recall and processing. With the inclusion of storytelling in science classrooms, science theories can be contextualized, and the subject matter becomes more meaningful. Storytelling helps to connect theory with practice, which provides learners with a deeper understanding of the matter (Koening & Zorn, 2002). Storytelling as Arts based pedagogy in science class helps to contextualize the learning and connects learning with real-life (Maharjan, 2023). According to Howe and Johnson (1992), storytelling can be used in the science laboratory in a variety of ways, including presenting a scientific problem in the form of a story for students to solve, providing an accessible explanation of a complex process, and providing an element of human interest in a topic, such as through role-playing and incorporating real-life scientific issues related to that people face in everyday life.

Empirical Review

In this literature review section, I have reviewed some recently published research articles based on the intervention of storytelling pedagogy in science classrooms.

Collins et al. (2023) conducted a descriptive case study titled 'Storytelling as Pedagogy: The Power of Chemistry Stories as a Tool for Classroom Engagement'. This research study evaluates the impact of storytelling pedagogy on undergraduate

students' understanding of the importance of JDEI (Justice, Diversity, Equity, and Inclusion) with chemistry concepts in a social seminar course under the theme 'Equity and History of Science.' This research study was conducted at Lawrence Technological University with 13 participant students. In this research study, authors utilized narrative films based on chemists as pedagogical tools, whereas data were collected through students' reflection interviews with students and instructors.

The authors of this article claim that storytelling pedagogy helped to develop students' understanding of JDEI in STEM (Science, Technology, Engineering and Mathematics) and fostered engagement of the students along with an inclusive learning environment. However, the authors failed to explain the types of student engagement through storytelling pedagogy, such as emotional, cognitive, and behavioral engagement.

Maharjan et al. (2024) claim in the research article entitled 'Meaningful Engagement of Preschoolers through Storytelling Pedagogy' that an author conducted action research employing storytelling pedagogy at the upper kindergarten level. This study used social constructivism as a referent theory and interpretive and critical research paradigm. Authors argue that storytelling pedagogy enhances the students' engagement in the learning process. They also contend that storytelling pedagogy enriches students' imaginative and creative skills and helps their understanding of content knowledge. This research article emphasizes the usefulness of storytelling pedagogy. However, the authors haven't clarified what kind of stories were used during the storytelling intervention.

Bohara (2023) also conducted collaborative action research entitled 'Incorporating Digital Storytelling in Secondary Mathematics for Engaged Learning'. In this study, digital stories were used in Mathematics classes for the secondary level as an intervening tool. The author used interpretive and critical paradigms as research paradigms. In this qualitative study, the author claimed that the use of digital storytelling enhanced the engagement of learners in their mathematics class. However, this study fails to clarify the effect of digital stories in other classes besides mathematics.

Csikar et al. (2018) conducted a test only in a quasi-experimental research study titled 'The Utility of Storytelling Strategies in the Biology Classroom.' This research study was conducted for undergraduate students in biology classes with the course Anatomy and Physiology, dividing students into two groups: an experimental

group taught with storytelling pedagogy and another controlled group taught by lecture-based teaching method.

In this study, data were collected through assessment of students; assessments included quizzes, multiple choice questions, and critical questions, and narratives on zombie apocalypse were utilized as teaching tools for the experimental group, whereas the control group was taught using PowerPoint slides using lecture methods.

The authors of this article assert that this research helped students' engagement and fostered critical thinking skills for the experimental group. However, there was no difference in content retention among either group. In this research, the authors could not explain how learners were engaged in the classroom through storytelling pedagogy.

The research article entitled 'Teaching children science through storytelling combined with hands-on activities – a successful instructional strategy?' by author Walan (2019) is based on the implementation of storytelling as pedagogy in science classrooms along with hands-on activities. This research was conducted with five preschool teachers from various cities in Sweden as research participants using narrative inquiry as research design. This study utilizes stories as a teaching tool taken from a Swedish children's book about Berta the Dragon, which combines stories and chemical experiments by Gunnarsson and Södergren (Eng. title Berta's Book of Experiments: Exciting Chemical Fairytales from the Dragon Land). In this study, data were collected through interviews with preschool teachers who utilized Berta stories as a pedagogical tool, observations of students' activities, and collected data were collected through narrative analysis.

The authors of this article contend that storytelling pedagogy combined with hands-on activities helps children for meaning-making and engages them in their classroom. However, this research study cannot provide the impact of storytelling alone on students' engagement. In this research, 5 participants put different opinions in their narratives on the utilization of storytelling pedagogy along with hands-on activities, so this article fails to give a concrete generalization of its findings.

Saritepeci (2021) argued in his research article 'Students' and Parents' Opinions on the Use of Digital Storytelling in Science Education' that storytelling implementation increased learners' satisfaction during the learning process. Similarly, he claimed that parents found digital storytelling exercises engaging and appealing, which resulted in favorable improvements in children's attitudes toward science

teaching. The author believes that the digital storytelling process helps the growth of learner engagement and efforts made in this process to obtain new information and technology abilities, as well as to contribute to the personal and social development of learners. However, the article is deafeningly silent on the value of traditional stories in the learning process.

According to Hu et al. (2023), in the research article entitled "Once Upon A Star": A Science Education Program Based on Personification Storytelling in Promoting Preschool Children's Understanding of Astronomy Concepts', storytelling as a beneficial pedagogical tool in the science classroom. Authors argue that abstract astronomy concepts can be taught to preschool children by introducing personification storytelling. Storytelling improves students' grasp of scientific topics and inspires them to pursue science education. This article contends that conventional historical stories are utilized in science classrooms to engage and encourage students, but imagined fiction stories enhance comprehension of complicated scientific ideas. This article is mostly based on personification storytelling applied in Astronomy class; however, it does not state whether or not this approach applies to other science fields.

Rahiem (2021), in his research article 'Storytelling in Early Childhood Education: Time to go Digital' argues that teachers in early childhood education should use digital technology in their classroom to enhance the effectiveness of storytelling to make the class entertaining, captivating, engaging, communicative and theatrical. In this article, the author overlooks the complexity of digital technology in the classroom and their access to the teachers in terms of cost. Research is unable to address the importance of real and contextual teaching materials to aid classroom teaching and the possibilities of the detachment of students from the real world to the virtual.

Policy Review

In this section of the literature review, I have reviewed the present curriculum for Science and Technology subjects for Grade 9 in Nepal, emphasizing the physics part concerning my research study.

The present curriculum for Science and Technology in Nepal was published in 2078 BS by Curriculum Development Center (CDC) Nepal. This curriculum was designed and published under the National Education Framework (NEF) 2076 to prepare the human force with scientific aptitudes, skills, and knowledge to understand

and utilize scientific facts, principles, and technology. NEF 2076 included Science and Technology as a compulsory subject for Grades 4 to 10 as previously there was Science subject only. This curriculum was developed based on some fundamental principles of science education, such as national objectives of education, national need, International practices, traditional and advanced technology, feedback from stakeholders, knowledge construction, and vertical and horizontal balance.

This curriculum expects 10 competencies to be developed by students after completion of grades 9 and 10, which are listed below:

- Develop skills, strategy, and attitude for scientific research.
- Demonstrate understanding of the application and limitations of Science and Technology.
- Demonstrate an understanding of the interrelation between aspects of the environment and contribute to the conservation of the environment.
- Understanding concepts of classification of organisms, life process & evolution, and application.
- Analyze physical processes and phenomena and their application in daily life.
- Basic understanding of the origin of the universe, present status, and future.
- Understanding of Information, Communication, and Technology (ICT) and utilize in the learning process.
- Observe and analyze properties of matter and demonstrate their scientific use.
- Identify chemicals used in daily life and use them.
- Utilize scientific concepts on traditional practices.

In this curriculum, Science and Technology has given five credit hours (3.75 for theory classes and 1.25 for internal) and 160 working hours in an academic session of 1 year, which was four credit hours with 136 working hours in the previous curriculum. The science and Technology curriculum includes five fields of Science and Technology, Scientific Studies, Biology, Physics & Astronomy, ICT, and Chemistry, with 19 chapters in each grade 9 and 10 having different teaching hours as compared to the previous syllabus for grade 9 and 10, a new field (chapter) ‘Scientific Studies’ has been included intending to provide basic knowledge of scientific learning

process whereas ‘Astronomy’ has been integrated with ‘Physics’ excluding ‘Geology’ field.

Physics Contents

In this curriculum, Physics along with Astronomy contains six chapters, of which five chapters with total working hours of 52 (slightly higher than curriculum 2071B.S (2014 AD), which was 136 hours) are from Physics and one from Astronomy. Following are the chapters included in the Physics curriculum for grade 9 with respective working hours from which I selected topics to teach using storytelling intervention:

Table 1

Physics Contents & Working Hours

Chapter	Working hours
Force and Motion	11
Machine	5
Energy	8
Wave	16
Electricity	12
Total working hours	52 hours

(CDC, 2078)

In the previous curriculum, there was an additional chapter, ‘Measurement,’ which was excluded in this curriculum. However, the ‘Scientific Studies’ chapter includes key topics and concepts of measurements. In the Force and Motion chapter, new topics, elasticity and plasticity, are included, keeping the same. In the chapter Machine, the concept of a complex machine is added, excluding the concept of moment. The chapter ‘Energy’ has been included in the replacement of ‘Work, Energy and Power’. Three chapters, ‘Light’ and ‘Sound’ from the previous curriculum, are merged into this curriculum, with the chapter ‘Waves’ keeping ‘Light’ in grade 10. The last chapter is ‘Electricity,’ and the concept of magnetism is vertically balanced in grade 10.

Pedagogies

Pedagogies refer to teaching methods applied by teachers in their classrooms. Pedagogy is important for connecting teaching and learning and simplifying complex relations (Loughran, 2013). In the present Science and Technology curriculum, more student-centered pedagogies are suggested. Pedagogies are suggested separately for different learning outcomes. Explanation, discussion, question-answer, etc., are prescribed for content knowledge. Similarly, for scientific skills, observation, project work, lab experiments, field study, and demonstration methods are suggested.

In classroom activities, discussion and hands-on activities are given more emphasis on addressing cognitive and psychomotor domains of learning. Although the suggested teaching methods can engage learners cognitively, emotional and behavioral engagements are overlooked in this curriculum. Another important part is the implementation of pedagogies in daily lesson plans. In my experience as a teacher, most science teachers use teacher-centric lecture-based teaching pedagogy due to the nature of assessment and heavy written exercises from textbooks.

Evaluation

Evaluation is the process of assessing students' learning. Evaluation is very important in learning as it helps to measure the effectiveness of the learning process and identifies the areas for improvement in the learning process. In the present curriculum of Science and Technology for the secondary level, the evaluation process is divided into Internal Evaluation and External Evaluation. Internal Evaluation covers 25%, and External Evaluation covers 75% of weightage (marks it carries in the examination).

Internal evaluation includes students' classroom participation, practical and project work, and terminal examinations. Participation carries three marks, Practical and project work carries 16 marks, and the remaining six marks are assigned for terminal examination results. This curriculum intends to make internal evaluation formative and continuous, including classroom participation, terminal examination results, and attendance. However, concrete rubrics for evaluating these elements haven't been suggested, which creates ambiguities when assessing students' learning.

External Evaluation is a summative evaluation that covers 75 marks out of 100 and is based on a written examination conducted at the end of the academic session. This examination is based on the rubric provided by the CDC, which has four levels of learning skills: knowledge, understanding, application, and higher ability.

Knowledge level items cover 15%, Understanding and Application levels cover 30% each, and Higher Ability is assigned 25% of the total marks. In questions, four types of items are included: multiple choice questions, very short answers, short answers, and long answers. There are 10 multiple choice questions with one mark each, nine very short answer questions with one mark each, 14 short answer questions with two marks each, and seven long answer questions with four marks each. Physics has been assigned comparatively more weightage in external evaluation with 24 marks.

In my experience, external evaluation written examinations are given higher priority in our school and the nation. Teachers and stakeholders assume quality learning only when judging the external evaluation. Due to the lack of concrete rubrics and the portfolio format, internal evaluation has become just a formality. The curriculum claims that it addresses the issue of inclusion of higher-order skills but lacks open-ended and critical thinking questions in the question model provided. In the model questions provided, different context-based questions are included; however, the pedagogies recommended mainly focus on content and activity rather than different contexts and situations. Although the content load has been reduced compared to the previous, there still seems to be more content for teachers and students, which compels teachers to complete the content syllabus on time, resulting in students' disengagement.

Using Theories as Referents

In this part, I have used two learning theories as referents: Vygotsky's social constructivism and Mezirow's transformative learning theory.

Social Constructivism

Constructivism is a theory about how individuals construct knowledge and learn, and it is based on observation and scientific research. The constructivist theory has greatly impacted education, changing how we think and becoming a vital part of the intellect of students, teachers, and researchers. Constructivism is a popular learning theory that teachers use to help students learn. Constructivism is based on the idea that people actively construct or build their knowledge. Learners, on the whole, build on their past knowledge and then supplement it with new material. As a result of their diverse experiences, everyone's learning is unique to them. According to Bereiter (1994), people develop their understanding and knowledge of the world through experiencing things and reflecting on those experiences. Learning in constructivism is active rather than passive. Learners examine their understanding of the new learning

scenario. When learners are confronted with situations that contradict their current thinking, their understanding can shift to incorporate new information. Throughout this process, learners stay active: they apply present understanding, take note of relevant components in new learning situations, judge the consistency of prior and developed information, and revise knowledge depending on that judgment (Phillips, 1995). Constructivists think that the environment in which a concept is taught and the learners' ideas and attitudes influence learning. Constructivism provides several advantages over traditional approaches. Children learn and enjoy more when they are actively involved rather than passive learners. In a traditional classroom, the teacher's role is directive and based on authority, but in a constructivist classroom, the teacher's role is interactive and based on negotiation.

On reviewing my role as a teacher in the science classroom, I found that it was an instructional teaching method that I used to convince my learners through long lectures, which resulted in learner disengagement and prevented conceptual understanding. My teaching methods were strongly shaped by behaviorism learning theory, which emphasizes stimulus-response-based cognitive development of learners, ignoring higher-order learning abilities such as reasoning, critical thinking, and creativity. For this research purpose, I prefer constructivism. This learning theory believes knowledge can be constructed in the learner’s mind with the help of their own experiences and individual beliefs.

Constructivism was introduced as the traditional stimulus-response conditioning approach governed by behaviorism promoted learning by memorization and rote recall couldn’t engage students in meaningful learning (Taylor, 2015). Constructivism suggests that humans construct knowledge and meaning from their experiences. Learner's mind is not like empty vessels, but they use their prior knowledge as a foundation and build on it with new things that they learn. Caine and Caine (1991) claim that each individual has his or her peculiar brain, and the environment, culture, and climate influence his/her learning. Teachers simply cannot transmit their knowledge to their students during teaching, but learners need to construct knowledge in their own minds. Jonassen (1994) asserts that constructivism provokes the learner's innate curiosity about the world and how things work in nature. Various forms of constructivism can be applied as needed for the subject matter and our objective. For this research project, I mainly focused on social constructivism. Constructivist classrooms allow learners to interact with each other, work in groups,

share values and ideas, and gain knowledge through collaboration. Learners can enhance their meta-cognitive skills in reflective thinking by actively participating in discussions or listening to others' queries and responses (Taylor, 2015). Peer learning is one of the strong socializing methods, and engaging discussion and shared ideas play an important role in constructing knowledge in the learner's mind. Constructivism allows learners to determine, challenge, change or add to existing beliefs and understandings through engagement in tasks (Brooks & Brooks, 2001). Constructivism makes educators aware of the human dimension of science and its connection with society, culture, and interest.

According to Vygotsky, the human mind is produced via a subject's interactions with the environment and is a property of the subject-object connection" (Verenikina, 2010). Language, according to Vygotsky, is the most important instrument. Language evolves from social speech to private communication to covert (inner) speech. The cultural transfer of tools (language, symbols) is how humans grow (Adam, 2017). According to Olitsky and Milne (2012), if instructors want to see good classroom improvements, they emphasize the need to provide a shared experience that is open to everybody within a framework with defined limits that exclude outsiders. I agree with Vygotsky's contention that society and culture greatly impact the knowledge construction process. People interact with each other, construct their narratives, and develop their understandings. I believe that narratives help people connect their feelings and reflections with the real context of their society.

Narrative-based learning is a learning approach based on the idea that humans describe their experiences via narratives, which serve as cognitive frameworks, a method of communication, and a tool for framing and interpreting their impressions of the world. Humans encounter various lived experiences that greatly impact our learning process. Our learners have diverse family backgrounds and cultures and may have different life experiences. Narrative learning aims to move the focus of learning away from the prescriptivism of a rigid curriculum and toward personal narrative styles, encouraging engagement and motivation in the learning process (Goodson et al., 2010). In my view, narratives help science learners contextualize abstract concepts of science they learn and make meaning. According to Nelson (2018), life history and individual identity are perceived as stories because narrative is crucial in human meaning formation.

Transformative Learning Theory

Transformative Learning is "The process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience in order to guide future action" (Mezirow, 1997, p.162). This is the extension of awareness that allows a person to evaluate their feelings, beliefs, assumptions, and perspectives on their purpose. As a science teacher, I believe that my responsibility is not only to impart scientific content knowledge to my students but also to prepare them with the curiosity and skills necessary to address global challenges in creative and innovative ways. As teachers, we must review our teaching experiences and ask ourselves, "Does the methodology we use in our classroom meet current-generation learners?" As Mezirow (1997) points out, we must create our interpretations, which necessitates changing our mental habits and points of view through critical reflection. Current science educators should establish a classroom environment that encourages cooperation and critical dialogue on scientific topics to arrive at a common solution that is agreeable to all humans as well as other natural species. Of course, advances in science and technology have enriched and prospered our lives. Overexploitation of natural resources and excessive use of fossil fuels, on the other hand, is causing biological and geological systems to deteriorate, putting natural ecosystems under threat of human control (Taylor & Taylor, 2019). Science teachers today have a huge responsibility to instill critical and autonomous thinking skills in their students so that they can make decisions and participate in activities that help conserve the environment and natural resources. Rather than producing learners who would have good careers, we need to prepare socially responsible science learners with moral values and beliefs. I agree with Mezirow (1997) that educators should assist learners in becoming more aware and critical of their own and others' preconceptions, and students should identify their frame of reference through imagination and dialogue. Science teachers should use diverse forms of art to establish a communication atmosphere among students so that they may achieve a consensus through critical discussion rather than having opposing views and perceptions.

Research Gap

After reviewing various literature, it is explored that many research studies on storytelling in science classrooms have been done. However, there appeared to be a dearth of research studies in the context of Nepal, where distinct narratives are utilized in storytelling relevant to Nepal's socio-cultural environment. The above

literature shows that most of the research studies concentrate on primary and early childhood learners but fail to address secondary-level students to enhance their understanding through narratives. Literature shows that most studies are based on quantitative research design, whereas this study utilized qualitative research design. Many research studies have overlooked the critical self-reflection of the researcher, but my research is concerned with my critical self-reflection and learners' engagement in my class.

Chapter Reflection

I reviewed various literature thematically and empirically on different headings in this chapter. In the thematic review, I reviewed key concepts of my research agendas, such as students' engagement, storytelling, and storytelling as pedagogy, whereas, in the empirical review, I reviewed recently published research articles on utilizing storytelling as a pedagogical tool. After reviewing the literature, I explored the research gap and claimed that my research is relevant to my context.

The literature review task was a very challenging task for me during this chapter writing. After finding the relevant research article from the literary world, it was difficult for me to focus on reading, leading to disengagement. I realized that I was conducting research on the theme of disengagement and I was disengaged from reading. Later, after reading some articles with some difficulties, my objective of this research motivated me to focus on reading and exploring various themes and outcomes of various research on the agendas concerning my research. Initially, I was thinking this research issue was new. However, I found much research on the use of storytelling pedagogy in different contexts by different researchers. This chapter enriched my understanding of the various terms related to my research and helped me to find the research gap between existing research articles and my classroom context. Reviewing the theory provided me the insight into which learning theory, my research agenda aligned.

CHAPTER III
RESEARCH METHODOLOGY

In this chapter, I discussed the road map of my research, which includes the research paradigm, philosophical assumptions, and research method that governed my entire research process. Finally, I introduced my research participants and discussed how data were collected and analyzed, followed by quality standards and ethical issues.

Research Paradigm: Critical Research Paradigm

A research paradigm is a set of beliefs, a wide general view, or a framework for solving research issues using philosophical assumptions. The research's objective, motive, and expectations are all determined by the paradigm used. Without first naming a paradigm, there is no foundation for future methodology, literature, or research design decisions (Mackenzie & Knipe, 2006). Each research paradigm has its own philosophical assumptions that drive the whole study. According to Taylor and Medina (2011), a paradigm is made up of a researcher's perspective on reality (ontology), a technique of producing knowledge and how knowledge claims are validated (epistemology), the role of human values in research (axiology), and the strategy that regulates the research process (methodology). In research, there are different paradigms, some of which are older and others more recent, but all of which are equally important. Every paradigm has a specific goal of building unique knowledge using philosophical assumptions.

The critical research paradigm governed my research. The critical paradigm was the best match to guide my research method since the objective of my study was to enhance student engagement in learning through critical action research that integrated storytelling in the science classroom. I intended not only to understand the engagement of the students but also to improve their quality of engagement in the class. According to Taylor and Medina (2011), the researcher's role in the critical paradigm is to advocate for, serve as a change agent for, and strive for an equitable, fair, and sustainable society rather than immerse themselves in prolonged engagement with participants. The critical researcher engages with participants fully and empowers them to take responsibility for their well-being. Critical researchers expose the oppressive structure and empower marginalized groups (Rehman & Alharthi,

2016). It's a transformational research paradigm that reveals the truth about the research problem and enables research participants to solve the issues ethically. Traditional research paradigms confirm the status quo, but critical paradigm challenges the status quo and try to make a balanced and democratic society (Asghar, 2013). The main objective of the critical paradigm is to work with less powerful individuals to solve their problems through critical action research. The critical researcher's conscious attempts to address concerns of power, oppression, and trust among study participants (Kivunja & Kuyini, 2017). As a facilitator, advocate, and change agent, the critical researcher plays an important role in improving the research participants.

As a researcher, my purpose was to investigate the students' problems and enable them to participate in meaningful classroom interaction through critical action research. Students participate in action research by analyzing their understandings, abilities, values, and interpretations of the world and how they frame and restrict their actions (Creswell et al., 2007). This type of study is useful and collaborative. As a researcher, I advocated for students' well-being and used storytelling pedagogy to effect change. In my research, I used storytelling pedagogy to engage students in their learning process, undertake critical self-reflection on my behaviors, and empower them for academic advancement, deeper knowledge, and meaningful participation in my class.

The philosophical assumptions of criticism also support my research study, so I chose it as a research paradigm. Because qualitative research is subjective, knowledge may be produced via critical self-reflection and evaluation of previous experiences. Knowledge is created from the participants' frames of reference by questioning present power relations. As a result of the knowledge, the participants are empowered, and their way of life is altered. In my situation, there are several socially constructed realities that are both visible and hidden behind several layers. The realities are always shifting. The past is closely tied to these realities. Reality may be recreated via careful critical reflection. Individuals are change agents in and of themselves. Because my values and those of the participants are so important in research, research is value-laden.

Epistemology

Epistemology is a part of philosophy that is concerned with the theory of knowledge. It is a human's way of acquiring genuine information. In this study,

knowledge is believed to be subjective. Knowledge can be generated by interaction with others and critical self-reflection. Challenging current power dynamics from the participants' frames of reference, knowledge is constructed. Participants are empowered, and their manner of life is transformed due to the knowledge.

Ontology

Ontology is a philosophical assumption about existence, reality (Yilmaz, 2013), and the fundamental categories of being and their relationships. In my case, numerous socially created realities are superficial and concealed in distinct layers. As a researcher, I assumed reality exists and is shaped by cultural, political, ethnic, gender and religious factors. The realities are always changing. These realities are inextricably linked to the past. Through deliberate critical contemplation, realities may be rebuilt. I believe that this research issue was concerned with the issue of power. I, as a teacher and my pedagogy, represent the oppressor, whereas students belong to an oppressed group and are change agents in their own right.

Axiology

Axiology is a philosophical viewpoint that deals with value (Yilmaz, 2013). It is an umbrella phrase for ethics and aesthetics. Ethics is the study of the notions of right and wrong in both individual and social behavior. Aesthetics is the study of the notion of beauty and harmony. The idea of worth might change depending on this research, as axiology is value-laden rather than value-free. Research is both a moral and a political endeavor. Some value positions are correct, while others are incorrect. This study is always value-laden since it is concerned with critical reflection on human values and their empowerment. I believe that this research study is affected by my values, assumptions and frame of reference to view students' learning process and my point of view on the teaching and learning process.

Research Design: Critical Action Research

For my research, I chose to conduct a critical action research project to leverage storytelling to create a more engaging science classroom along with self-transformation. Critical action research is not just a problem-solving strategy associated with the participants; it is also a research method that examines the underlying social and political factors affecting the problems, promotes social justice, and empowers the participants. The researcher challenges the deep-rooted assumptions, develops a plan to address the problem, puts the plan into action, observes and empowers participants, and reflects through an iterative process. Critical

Action research is 'the self-reflective collective self-study of practice, how language is used, organization and power in a local situation, and action to improve things' (Kemmis & McTaggart, 2007, p.273). In my issue, I was confronted with a lack of engagement and comprehension among my students in my science classroom. I was to discover how storytelling may influence student views of science and meaningful participation. I chose critical action research because I wanted to improve my students' meaningful involvement in my classroom while also empowering them to question traditional teaching methods. During the study project, I modified my pedagogy while enabling my learners. This research design followed the steps and cycle of action research.

Planning

Planning is the very first step in action research. As shown in Table 2, in this stage of my research, after deciding my research topic and methodology, the first step was topic selection and preparing a lesson plan. Initially, I planned to cover major topics from the science curriculum, such as physics, biology, chemistry, geology, and astronomy. Due to this reason, I prepared some stories based on content from these fields. However, my course facilitator in my third semester of MPhil study suggested researching one field only; therefore, I chose physics topics only as my major subject of learning at my bachelor's and master's level was physics. At first, I prepared 8 lesson plans from the eight topics of the major physics chapters for eight classes, including storytelling pedagogy, each for 45 minutes daily. The lesson plan included major activities that were conducted while teaching in the classroom. After preparing the lesson plan, I started brainstorming to create stories based on the chosen topics, which was a really difficult task for me initially. Finally, I prepared eight stories on Inertia, Balanced and Unbalanced forces, Newton's second law of motion, Newton's third law of motion, Inclined plane, Sources of energy, Energy Crisis, Biomass and Reflection of Sound. Out of 8 stories in the first cycle, seven stories were fictional stories that I created by imagining the event, characters, and contexts and blending the contents. In contrast, one story on the energy crisis was my own real story, including the challenging situation of the blockade[2]. While preparing stories, I took the help of social studies and English language teachers at my school.

[2] Undeclared blockade in Nepal in 2015 AD when there was scarcity of petroleum products due to disturbance in supply.

After completing the first cycle of storytelling pedagogy, I planned for the second cycle, and I reflected upon my planning and classroom observations. In the first cycle, I was satisfied with the storytelling sessions as I felt students engaged meaningfully. However, as a researcher, I was experiencing difficulty in observing my class, and I found that I was lacking in developing stories to foster higher-order learning skills. For the second cycle, I created four stories on four topics: Electric resistance, Combination of electric loads, Ultrasonography (USG), and CT scan. I included open-ended questions, comparisons, and envisioning questions in this cycle.

Table 2 *Stories and Topics Covered*

Research Cycle	Story Title	Topics Covered
First cycle	*Sundarbasti*	Inertia, Balanced & Unbalanced Force
	Newton and Cricket	Newton's Second Law of Motion
	Action and Reaction: Power of balance	Newton's Third Law of Motion
	Race to the Peak of Hill	Inclined Plane
	Energia Kingdom	Sources of Energy
	My own Story: Hardship during Blockade	Energy Crisis
	The Energy Saver	Biogas
	Echos of Victory	Reflection of Sound
Second Cycle	A Detective of our Body	CT Scan
	USG: A Noninvasive Medical Test	USG
	The Electric(Cycle) Race: Overcoming Resistance	Electric Resistance
	Deepawali: The Festival of Lights	Combination of Loads

Action

This is the implementation phase of the lesson plan that has been prepared. In this step, students were taught using storytelling pedagogy in the science classroom. I divided the 45-minute class into two segments; the first was a storytelling session that lasted approximately 20 minutes, whereas the second was a discussion and evaluation session that lasted 25 minutes. Each day after entering the class, I narrated the story first. Then, I conducted a discussion session where students were allowed to share their opinions and thoughts, ask questions, and envision based on the elements of stories and contents. Finally, the class used to be wrapped up with an evaluation part, including some verbal questions followed by writing assignments and reflective writing regarding the class.

Observation

This phase went parallel with the action. In this step, the effect of storytelling pedagogy was observed through different means. Although it was the most challenging task of this research study, Students' activities during the storytelling and discussion sessions were observed. I observed students' engagement through their classroom participation, group discussion, and verbal and non-verbal expressions in the live classes and analyzed their reflective notes.

Reflection

In this phase, the consequences of applying storytelling pedagogy were evaluated critically through an analysis of the observation findings and interaction with the learners. Then, the prepared plan was checked to see whether or not the action implemented was effective.

Research Participants

For my study, the research participants were all ninth-grade students who were used to traditional teaching methods such as the lecture-based Chalk & Talk technique. I selected these research participants because I have taught these students for the last 3 years and know about their learning habits, participation in the classroom learning process, and cognition level.

Site of the Study

Because my project is based on changes in teaching techniques and student responses to those changes, the most convenient location for my research was the school where I have been teaching for the past five years. A private school located in Kathmandu was the site of my research study.

Data Collection Tools

Data collecting tools are crucial in every research. In my study, I employed interview questions, assignments, descriptive observations, reflective notes of students, and self-reflection notes. The classroom observation included observation of participants' perceptions, behavior, and responses when using storytelling in the science classroom. Interview questions were developed for interviews, as well as frequent feedback and self-reflection. Similarly, descriptive observation conveys narratives of what happens in class daily, as well as my personal experiences and reflections.

Data Collection Procedure

Using the tools mentioned above, I collected data for my research study. Field notes were written records of actual observations made in the classroom. The observations were carried out in two ways. Field notes were taken to record the events of the day. I used a tiny diary while teaching to record any field notes for that time and before a class. Furthermore, interviews with students, responses, and their reflections on the class and assignments were methods of collecting data for my study. The data gathered were collated, controlled, and evaluated, revealing my study results concerning storytelling in the science classroom.

Data Analysis and Interpretation

Data analysis is the act of carefully examining and organizing interview transcripts, field notes, and other materials that you gather to enhance your knowledge of them and convey what you have discovered to others. According to Graue (2015), qualitative data analysis includes describing, classifying and interconnecting phenomena with the researcher's assumptions. In qualitative data analysis, the collection of words obtained by various methods, such as interviews and observations, must be described and summarized (Lacey & Luff, 2001). In this study, data obtained from diverse sources and instruments were evaluated in various ways in my research project. First, field notes from daily observations and student reflections were transcribed and triangulated to confirm the data. To extract significant concepts from the data, the obtained data were coded, and specific themes were generated based on the assigned codes. The replicated data had been subjected to descriptive analysis connected with the literature review using a qualitative methodology.

Quality Standards

Because the critical research paradigm drove my research, some of the quality standards included in my research are Critical Reflexivity, Praxis, and pedagogical Thoughtfulness. Critical Reflexivity represents self-awareness concerning the study context and social milieu. According to Van Manen (1991), some reflections are oriented to the future, whereas some are past experiences. A Reflective practitioner reflects on his/her actions through constant rational moral decision-making and practical reasoning. As a teacher, I critically evaluated my past role as a teacher and learner and envisioned my position in the future in relation to teaching and learning. Praxis signifies transformational action, in which the researcher's desire to change and empower the oppressed is tested. My research has maintained this quality standard by enhancing learners' engagement in science learning and improving my teaching practice. Educational thoughtfulness refers to how much current and future readers of my works are prompted to question, reflect, and analyze their pedagogical methods. It investigates whether or not the researchers choose to write in a style that elicits critical awareness and comprehension in their readers (Taylor & Medina, 2011). To maintain this quality standard, I wrote about the findings of my dissertation that arose from my critical reflection and observation of my learners and presented learners' reflections in narrative form.

Ethical Considerations

Because research is about discovering new information, the knowledge discovered mustn't jeopardize the welfare or rights of anyone involved in the research. Research ethics is a collection of principles that help researchers do research in a just way that does not hurt anybody in the process. Research ethics are essential for making research tasks socially responsible. It is the researcher's responsibility to guarantee that the research is carried out under-recognized ethical standards. During this research, I followed all the ethical guidelines proposed by the research committee of Kathmandu University School of Education. I did everything to guarantee the safety of my participants. To protect the children and the school, the names of participants and the venue have been changed to a pseudonym. A consent document was prepared and signed by the school administration and the individual parents. Students signed a consent letter that included information about the study and authorization for classroom observation and implementation of storytelling pedagogy for educational research purposes. The privacy and confidentiality of the data were

maintained. Proper attribution has been provided to the sources from which ideas have been drawn, and plagiarism was strictly prohibited. All data were maintained in a safe, secure area away from the classroom.

Chapter Reflection

This chapter was the overview of how I carried out my research journey. This chapter begins by introducing a critical research paradigm, which is my view as a researcher, to guide my research. I presented philosophical assumptions for constructing knowledge, explaining the nature of reality, ways to construct knowledge, and the role of my value as a researcher. I presented critical action research as a methodology in this research study. I explained how I planned and acted on this journey. I introduced data collection tools, processes, and data analysis methods. Finally, I chose critical reflexivity, praxis, and pedagogical thoughtfulness as quality standards and their relevance to my research study and some ethical guidelines.

This chapter guided me in the proper direction during the fieldwork and helped connect theory to practice. While engaging with this chapter, I gained various insights regarding the critical aspects of research, as my research paradigm is critical. Although my learning journey before MPhil study and the teacher’s role was guided by the notion of objective and single reality, I realized how multiple realities are associated with every issue and how my and my participant's values are important and affect the research findings. Writing on quality standards and ethical considerations made me cautious about how I need to ensure authentic and reliable findings and that this research is socially responsible without harming anyone.

CHAPTER IV
LET'S SCRUTINIZE ONE WAY STREET: SCENARIO OF MY SCIENCE CLASS PRIOR TO STORYTELLING INTERVENTION

In this chapter, I have discussed how the scenario of a science classroom before the storytelling intervention was done. Here, I have analyzed my reflection, classroom observations, and field notes under certain themes and subthemes generated, which include methods of teaching science, classroom environment, students' and teachers' perception of teaching, and the realm of students' motivation and engagement towards my science class before employing storytelling pedagogy. This need analysis revealed how I was moved to decide to work in my classroom through storytelling pedagogy.

Pedagogical Approach

This section of the chapter reveals teaching methods employed for grade 9 and students' and teachers' perceptions of teaching and learning before the intervention of stories in the classroom.

Lecture-based Pedagogy: Complete the Syllabus First and Conduct Revision Classes!

Pedagogies refer to how students are taught in the classroom and include various teaching techniques used by teachers in their classrooms. In the context of my school, the teaching methods were teacher-centric and lecture-based. In the lecture-based teaching method, the teacher conveys content knowledge to the students in a controlled classroom environment. Such a teaching method encourages passive learning and doesn't address other types of learners other than auditory learners (Woodring & Woodring, 2011). However, in our classroom, there were other types of learners, such as visual and kinesthetic learners, who were not engaged meaningfully in my science class. As the pedagogy used in our classroom was teacher-centric, there was little chance for students to interact with each other. Informal talking during the class was not allowed. School administration expected silence in the classroom environment during the class. The social studies teacher once shared with me that he was warned by a person from the administration for some noise during his class. However, he claimed that in class, there was a group presentation by students on the topic of the provinces of Nepal and the federal system.

In the interview with my students, I asked how your class starts. One of my students, Biraj, said, *"Teacher comes to the classroom, we greet our teacher, he/she writes the topics on a whiteboard and explains in detail, and we memorize it for the examination (April 2023)."* As I reflected on my learning and teaching journey in chapter one, I realized that it was shaped by teacher-centric teaching methods. In my opinion, the cause for implementing lecture-based pedagogy is that teachers are not only responsible. There could also be other factors, such as curriculum, assessment system, and school administration, such as headteachers, school founders, and trustees. In my school, I found school administration to be a major control factor as they used to pressure the teacher to complete the syllabus early so there would be enough time to conduct revision classes. One day during our school's tiffin time, when I was heading towards the canteen for lunch, I heard the conversation of my colleagues on the school's notice to complete the SEE syllabus before the Dashain festival. Mathematics teacher Sagun said with high disagreement with the notice, *'Still there are 6 months for SEE, they are pressurizing to complete the course. The entire Geometry portion is left. How is it possible?* Social studies teacher Hariram added, "In my subject, about 40% of the *course is remaining. I planned to implement group discussion and presentation. However, now I have to teach superficially, introducing the topics only so that I will meet the deadline and later students will learn in detail during revision classes' (August 2023).* This scenario reveals how teachers were compelled to use lecture-based pedagogy although they were aware of student-centric pedagogy. Traditional pedagogies compelled teachers to participate in the race of completing the syllabus and limited the learning process to rote memorization rather than the construction of knowledge. The traditional teaching model, the banking model, behaves the students as empty containers, passive receivers of information imparted by teachers who do not engage critically and meaningfully in their classes (Freire, 2018). Such teaching methods intend only to complete the content syllabus in one way; content delivery cannot make the class joyful and engaged. Finn and Zimmer's (2012) also emphasize that cognitive engagement appears superficial in traditional teacher-centric classes as students primarily focus on retention of the contents rather than engaging themselves in in-depth understanding and problem-solving. Although the science curriculum suggested various learning skills to be incorporated during assessments, such as knowledge, understanding, application and higher ability, pedagogies applied in the classroom

were similar, focusing on knowledge and understanding skills only through rote learning and recall.

Unconscious Acceptance

Unconscious acceptance in learning refers to the students' passive conformity to the traditional lecture-based pedagogy without questioning and examining these techniques. From the interview, I found that students had accepted the prevailing teacher-centric approach as the only pedagogy that should be used in classroom teaching. I observed that students were disengaged from learning, but in the first phase of the interview, I asked my students whether they enjoyed their class or not and whether any improvement was needed in teaching methods. Most of my participants expressed that the pedagogies teachers use are good and no further improvement is required. Further, when I asked my participants to write about their ideal class, most wrote about a class with a disciplined environment where students do not make any noise. One of my participants, Rejina, wrote in this way:

'My ideal class would be the class where students remain silent and listen to their teacher carefully … students do not disturb others while learning … Classroom is equipped with well carpet and furniture enough for each student.

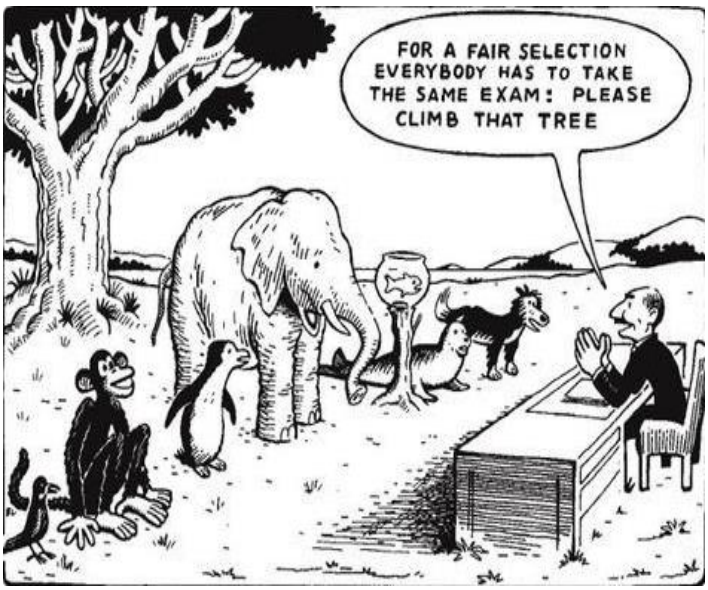
Similarly, in the interview, I asked them to talk about some activities that they think should not be accepted during class time. Biraj, one of the participants, answered, *"During the class, students should not violate classroom rules and regulations."* I asked him for further clarification. "Can you tell me more details about such rules and regulations*?"* He replied, *'.....such as leaving seat and side talk during the class should not be accepted.'*

The above views of my participants reveal how students unknowingly accepted the traditional lecture-based class where a teacher delivers content to passive listeners. They had accepted a more structured and formal classroom as a good classroom. I feel that the reason behind such unconscious acceptance of students is due to various hegemonic factors such as pedagogy itself, competitive assessments or power relations with teachers. The teacher-centric teaching methods play a vital role in the conformity of students as they are habituated to the pedagogy for a long time, and they assume teachers are a central part of teaching and learning who plan and decide what, how, and why to learn. Another factor could be competitive assessments such as paper-based written examinations, which are major means of evaluating students in our country, Nepal (Shah, 2023). Paper-based written examinations

require students to be equipped with content knowledge, which they gain with the help of the lecture-based teaching method. The other reasons for students' unconscious acceptance of such pedagogy could be that students do not want to show their dislike verbally because of power relations with teachers or administration, or maybe they haven't encountered other progressive student-centric pedagogies so they were assuming the lecture-based method of teaching the best way of teaching. As a learner at my school and university level, I always thought that teachers were the power centers of the learning process. I used to believe that questioning a teacher's actions and raising voices contradicting teachers' perceptions were unethical activities and were just violations of discipline and disruptions of the class.

Students seemed to be engaged in learning, but the engagement was only outwardly assuming that remaining in silence and listening would be learning in a better way. Liu et al. (2023) emphasize that unexamined compliance with traditional teaching techniques resists the learner's meaningful engagement with the learning materials. Gordon et al. (2022) add that students who do not question teaching methods are less likely to participate in the learning process. The very next day, after interviewing students regarding their ideal pedagogy, I introduced some other methods of teaching, such as arts-based pedagogy, group projects, and presentations. After knowing about other alternatives, some students shared that they enjoyed learning in junior classes when teachers taught them using songs and rhymes. Participant student Riya said, '*It was a wonderful memory while learning in grade 2 when Shamjhana maam used to teach mathematics using songs. I used to expect the bell not to ring in her class."* As Riya said, forms of Art such as music, dance, stories, and poems could help learners engage meaningfully in their classes. Ewing (2018) asserts that Arts as pedagogy enhances social and emotional well-being and fosters students' learning engagement. In my experiences as a teacher, those students who remain passive during the whole class time while teaching content become active and focused when teachers let someone sing a song or do a caricature in the class. Not only do students engage in Arts-aided classrooms, but they also keep that moment in their mind for a long period, which fosters the retention of the knowledge of contents in the learner's mind associated with the Arts forms presented in the classroom.

Non-Individualized Teaching: One Size-Fits All Approach



(Gng, 2016)

Our classrooms have students whose learning abilities are not the same. There are students with diverse family backgrounds, different cultures, and mother languages; they belong to different geographical regions. However, the curriculum, syllabus, language used while teaching, methods, and assessment system are the same for all. The figure illustrates how all animals are evaluated using the same method of assessment, although each of them has unique skills.

I observed some students who were good at English speaking were poor in Mathematics, and some who were excellent in Mathematics were struggling with languages. Those students who were from the *Newari* community were excellent in their mother language but had problems reading and writing the Nepali language. As I mentioned in chapter one, I also became a victim of this language barrier during my school-level learning when I was in grade 6 because I was struggling to understand the *Bhojpuri* language spoken by teachers while teaching content.

After observation, I found that such undifferentiating teaching hinders inclusive learning in the class. For inclusive and equitable learning, personalized learning should be incorporated into the classroom (Pratt, 2002). One of my participating students also said in an interview, *"Sometimes teachers take some examples while teaching, which we never encountered or sometimes never heard about before. "*Tomlinson (2001) highlights that one-size-fits-all pedagogy lacks differentiation in teachers, hinders the classroom from being inclusive and doesn't address the diverse needs of students. I found that if we use terminologies or contexts that are not related to the contexts of the students, they feel difficulty understanding and get disengaged in the classroom. Gay (2015) also emphasizes the need for

culturally relevant pedagogy to foster greater engagement of the students and connection with the learning materials.

Learning Means Preparing for Assessment

Assessment is regarded as one of the important parts of the learning process. Assessment evaluates whether the learning process is positive and whether learning outcomes are achieved. In my school, examinations are highly emphasized. There used to be eight formal tests (four pre-term exams and four terminal exams) in an academic year. Students were compelled to get high grades in such examinations focusing only on cognitive learning. Teachers conduct revision classes and let students do rote learning and get high scores on the examination. I think we teachers are forced to conduct the revisions and promote rote learning because, in our country, parents have the perception that if the BLE (Basic Level Examination) and the SEE (Secondary Education Examination) Grades of students of particular schools are good, these schools are good quality schools. There will be better learning for their kids. BLE and SEE examinations are given high-priority standard examinations and teachers, students and parents put the effort needed for the preparation. In my teaching career as a science teacher, the questions that most of the students asked while teaching are *"Will this question be asked in SEE?"* and *"For how many marks questions will be asked from this chapter in SEE?"* These questions reveal how examinations are prioritized compared to the learning process and learners' learning needs. In this context, Nichols and Berliner (2007) claimed that more prioritized standardized tests inhibit teachers from implementing personalized learning and learners get disengaged in their classroom. In support, Kohn (2015) argues that instructional practices focused on grades and assessment fail to motivate learners intrinsically, and learners disengage from deeper inquiry and conceptual understanding.

Classroom Environment

The classroom environment has a greater impact on students' learning. It includes classroom infrastructure, learning materials, learning activities, and relationships between students and relation with teachers. Here, I explored whether students' classroom environment during my science class is in favor of students to engage them meaningfully or not.

Passive Learning Atmosphere: Formal Setting of Classroom

As I observed, the classrooms in our school were not students; the physical infrastructures were kept in a formal setting, such as one big whiteboard at the front, two columns of desk benches for one side of boys and one side for girls, parallel seating arrangements with 13 to 14 rows of desk-bench and one big window at the back. Seats were fixed for each of the students. On the wall, there was a big chart paper on which rules and regulations were written by a sign pen in big letters. Changing seats by any student at any time during school was regarded as a punishable act. Students were not allowed to go outside during the class. In my class, some students used to go outside frequently, requesting an emergency toilet. As teachers, our expectation used to be pin-drop silence during the class so that every student listened carefully and understood what we explained. However, many students couldn't tell or brief the topics taught the next day. A CCTV (Closed Circuit Television) was kept in each class to monitor the activities of students during the class. Barrett et al. (2015) indicate that a physical classroom setting is crucial for the learners' meaningful engagement. The formal setting of the classroom promotes a passive learning environment for the students. I think the classroom setting should be student-centric-having enough space for classroom activities and group discussions.

Student's Motivation

Motivation is an important factor that drives us to do something. Motivation is essential for meaningful engagement of students in the classroom. In this section, I am exploring whether my students were motivated or not towards their learning.

Motivation Deficit

From the classroom observation before storytelling pedagogy, I observed that students were not motivated to learn. Students used to be excited during extra-curricular activities outside the classroom. They had informal and close bonding with sports, dance, and music teachers. However, those who used to be more active during extra-curricular activities seemed to be passive during content-based classes and had formal relations with subject teachers. Students used to show their happiness if science or mathematics teachers were absent from the class. In an interview, when I asked, "*What is the thing that prevents you from being motivated in the classroom?"* Rejina said, *'Sometimes we feel bored by continuous reading inside the classroom from 9 to 4 just reading and writing.*' Biraj added, *'We had one day one ECA (Extra Curricular Activities) class till grade 7, but from grade 8 we don't have any ECA such*

as dance, music, sports and drawing considering our academic progress.' From the student's answers, I feel the monotonous setting of the classroom, aided by lecture-based pedagogy, is one of the major factors of students' disengagement in the classroom. Heavy content load and assignments, priority for examination only, and lack of opportunity for interactions and sharing one's own opinion in the classroom could be the factors responsible for the students' demotivation. If the students are not motivated, they cannot be engaged meaningfully in the class. Dörnyei (2001) argues that motivation is an essential driver of engagement; if students are motivated, they get a connection with the content and invest themselves academically. Although students perceive forms of art as entertainment, if included in pedagogy, I think it can motivate learners for their classroom engagement. As a learner, I remember when I was in secondary school, the prizes such as Copies, Geometric boxes etc., also motivated me to focus on classroom activities to secure a position as the quality of materials prizes was much better than what we had at that time. I feel now our learners are not motivated by such prizes provided by schools as more expensive and high-quality things they already have. I remember the result day conversation of some students where they expressed dissatisfaction with the exercise copies and pencils, saying that at least there should be medals for position holders as exercise copies are not good for prizes. This shows that there was a lack of both extrinsic and intrinsic motivation in the classroom.

Chapter Reflection

This chapter needs an analysis of this research study. In this chapter, I explored and analyzed everything about my science classroom on various themes and sub-themes. I unpacked the scenario of a science classroom before the storytelling intervention with themes such as pedagogical approach, classroom environment, and student motivation. This chapter justifies why this research was carried out.

This chapter took me again to my previous science classes and presented me as an authoritarian teacher who believes teaching is transmitting content knowledge to learners who are passive receivers. This chapter helped me to reflect on the disempowering forces of students' engagement in my science class and made me aware of the need for storytelling intervention in my classroom and its urgency. I realized that I was a teacher who emphasized a product more than a process, as my focus was exam results over learning processes and students' engagement.

CHAPTER V
UNWRAPING THE NURTURING COCOON: SCENARIO OF CLASSROOM DURING STORYTELLING INTERVENTION

In this chapter, I have discussed the scenario of the science classroom during the storytelling intervention. Here, I have analyzed the data collected during the implementing phase of storytelling pedagogy, which includes my reflection, classroom observations, students' reflective notes, and interview reports after the storytelling session under the themes of storytelling for building emotional bonds, engaging the minds through storytelling, storytelling to influence classroom actions and storytelling as an inductive approach of teaching.

Storytelling for Building Emotional Bonds

Emotional engagement in learning refers to the feeling of excitement, interest, empathy, and personal connection that learners respond to during the learning process, particularly when they are attached emotionally to the subject matter. When storytelling pedagogy was implemented in the classroom, these sessions evoked strong affective responses from students as students were emotionally invested in the characters, events and contexts of the stories. Not only during the learning process, all the tasks require emotional engagement because unless the person is fully interested in doing any task, the person doesn't invest fully in that task and the learning outcome won't be as expected. Emotional engagement plays a crucial role in how we interact with the world, complementing the habitual (working in routine) and material engagement (physical ways of engagement) of the person (Brinck & Reddy, 2020).

When different stories on science content were shared in the classroom, the students revealed the moments that evoked excitement, personal connection and sometimes frustration. These emotions seem to correlate with the level of engagement of students during the lessons. In this context, my participant student, Rejina, wrote in her reflective writing, *"When sir was sharing the story of Sundarbasti, I found myself as I am in my real village at Arghakhachi because the village in the story was similar as my own, very rural and lack of basic infrastructure." Sundarbasti* is a story used in storytelling pedagogy based on the science topics inertia, balanced and unbalanced force from the Force and Motion chapter (Appendix-Story 1). The reflective writing of *Rejina* reveals how the context of the story presented triggered her emotions. She

found the story's context similar to her village and remembered her own village, being affected emotionally. She could have found similarities in geographical structures, socio-economic status of the people, and infrastructure development between her village and that presented in the story.

During the same story session, when all passengers blame the driver (a character in the story) for assuming him to be responsible for the accident, a student, Rina, said, *"This is so unfair. What kind of villagers are these? They don't sit on their seats, dance, and enjoy inside the moving bus but finally blame the innocent driver."* This dissatisfaction reveals how the incident in the story *Sundarbasti* affected her emotions, evoking empathy for the driver. She could have felt the problem of the driver as her own and shown her dissatisfaction with the claim of villagers to point toward the driver as the cause of the accident.

I observed a similar kind of empathy from students toward me when I was sharing my real story entitled 'My own Story: Hardship during Blockade' (Appendix-story 6) for the energy crisis topic. This story was based on my own experience when L.P.G gas was scarce in my own house and the trouble I faced during a day of Nepal blockade in 2015 A.D. During the storytelling session, students seemed curious but showed a pathetic face towards my situation, expressing empathy.

In my experience as a teacher, the major lack among present-generation school students is the attitude of empathy. Empathy is the quality of a person to understand and share the feelings of another person. An empathetic person recognizes what someone else is experiencing emotionally. Many students do not show concern regarding others' matters or problems. They are becoming self-centric. I think educators, primarily teachers, are responsible for inculcating habits that foster empathy in students. Davis (1990) claims that skills or attitudes of empathy cannot be taught. However, the process of empathy can be fostered by developing other behaviors and attitudes; here, storytelling pedagogy played a crucial role in facilitating empathy among students, providing the situations when the incidents, contexts, or circumstances of characters in the stories trigger their emotions, resulting in promoting their empathy level.

From classroom observation, I also found that students were engaged in the story emotionally as they showed some observable emotional reactions such as widened eyes, leaning forward, and laughing at loud sounds. When there was a situation in the story where a villager from *Sundarbasti* went for urination during the

Tug of War game, all the students laughed very loudly. The circumstances in the story produced a humorous situation in the classroom; students responded with laughing. Humor played the role of a positive catalyst to draw the students' attention, reducing the gap between students and me as a teacher. This is aligned with Erdogdu and Cakıroglu (2021), who claim that humor is an important factor that fosters emotional engagement of the students in the class by capturing their attention and creating a relaxed atmosphere. Students showed such emotions when the events or characters in the story touched their personal feelings, which fostered their engagement with the class.

One of my participants, Saurav, after the storytelling session on Newton and Cricket (Appendix-story 2), a story based on Newton's Second law of motion from the chapter Force and Motion, shared his feelings in an informal discussion in this way:

> When there was an incident of injury on the hand of the fielder by the ball hit by Newton in the story, I remembered the game that we played in my village last year, Chaitra, where I got a similar injury while catching the ball to protect it from reaching to the boundary for six runs. I preserved the six runs by catching the ball,l and the batsman was out. I got a hand injury which caused swelling for 2 days. We lost the game on that day.

Here, Saurav could have felt the sense of pain as he remembered the incident of his hand injury by a cricket ball. In this context, Bimal, another student, added: *" Now onwards Saurav never forgets how he has to catch the ball while fielding; he always catches holding his hand back as holding hands back increases the time and reduces the force on his hand, isn't it sir?*" I leaned my head forward, supporting him.

From Saurav's sharing, it is explored that the incident of hand injury while catching a cricket ball was in his memory as the incident was hurtful for him. During the story's narration, Saurav remembered a similar incident of his past experience. That memory affected his emotions and led him to reflect on his past experience and he didn't remain without sharing the incident through which he was encountered. This proves that he was engaged with the story's elements emotionally and meaningfully. This is supported by the claim of Sheppard (2023) that when students relate their past experiences with the content material being taught in the class, their emotional

engagement is enhanced significantly. The response of another student, Bimal, to Saurav's sharing reveals that Bimal conceptualized the scientific reason behind the incident, and Saurav's sharing compelled him to put his opinion in favor of his understanding of the science concept taught in the class. He seemed interested in the story and participated in the interaction, exploring his cognitive and emotional engagement.

As I compared my storytelling sessions with previous ones that were lecture-based lectures, I observed a special kind of excitement in students towards the class during storytelling sessions. Previously, those students who used to be punished for side-talking with bench partners seemed to listen attentively to the stories during the storytelling session. In this regard, one student, Binod, said in the interview, "*I always look forward to physics class now because I know there will be a new story to unpack in each storytelling session."* Another student, Bishal, said, "*In storytelling classes, I feel the 45-minute period is very short and wait for the next day's class as stories help us to learn science without being bored"*. These statements underscore the impact of storytelling on fostering a sense of excitement and anticipation among students, thereby cultivating a conducive environment for active learning.

Due to various factors, students lack concentration during the learning process; boredom is one of such factors. Boredom is an unpleasant and transient event associated with emotions that cause a lack of interest and difficulty focusing on the current activity. Several things can lead to boredom, including low levels of external stimulation, absenteeism, academic anxiety, lack of motivation to study, and nervous and upset students. Boredom-stricken people view their jobs as uninteresting, demanding a lot of mental effort and asking them to execute duties they are uncomfortable with or under compulsion to complete (Adesola et al., 2019). The students experiencing boredom in the classroom are found to be paying less attention to the classroom and lacking meaningful engagement. My participant students Binod and Bishal might have experienced boredom during their classes while teaching through lecture-based methods before the storytelling intervention. Storytelling pedagogy is a factor that contributes to the quality engagement of students and reduces their boredom during class.

The qualitative data presented above suggested that students were engaged emotionally through storytelling pedagogy. Therefore, their connection with science content was enhanced as they were emotionally attached to it on a personal level and

were engaged in their class meaningfully. When students were taught by lecture method, only contents were focused on. Students found such contents abstract and out of context, so they were disengaged in the classroom. However, the narrative structure of the story provides contexts and connects the contents with students' daily lives, and they are engaged in the classroom.

King and Chen (2019) assert that the emotional part of the learning process shouldn't be overlooked, as emotions stimulate the learner's attention and trigger the learning process, impacting what is learned and what is being learned. In this regard, Fredricks, Blumenfeld, and Paris (2004) claim that emotional engagement is the foundation for the overall engagement of the learners with learning materials fostering cognitive and behavioral engagement. Reyes et al. (2012) also agree that students' emotional engagement in their classroom positively impacts academic performance.

Stories include various components such as context, conflict, suspense, and resolutions of the conflict. These components trigger the learners' emotions, sometimes making them sometimes happy, sad, or hopeful. These emotional responses from the students bind them during classroom activities, reducing their distractions from the classroom. Sometimes, they imagine in response to the events of the stories, and sometimes, they are personally affected by the events, engaging emotionally. In my observations, while learning science content, students feel the content to be more objective and abstract and easily get distracted from the class. However, the story's context and the humanization of the content through stories helped students grasp the science concepts easily and feel these concepts were real and relevant, resulting in engagement in the class.

Motivation is an important factor associated with emotional engagement that drives learners to be oriented to achieve their learning goals, to be more engaged in learning and to show a learning attitude in their classes. As I mentioned in Chapter 4, student engagement was not as expected in my science classroom when I used to teach by the lecture-based method. The reason could be that they were not motivated towards learning. Motivation plays a vital role in students' engagement. If the students are motivated, they make an effort to be engaged in the class (Nayır, 2017). My priority during those classes was to deliver the contents strongly, and I intended to make them prepare for the assessments. I was unaware of how my students felt at that instant and what was running in their minds then. It could be that they were not

emotionally affected by the contents delivered and did not find the contents resembling their contexts.

According to Al-Shara (2015), implementing learning resources and teaching techniques are major factors affecting students' enjoyment during the class and distracting them from the learning process. When students feel that their teachers use engaging teaching methods and receive social-emotional support from their classmates, parents, and teachers, they are more engaged in their learning on an affective, behavioral, and cognitive level. They also show high levels of engagement in school when they endorse learning objectives, exhibit strong self-efficacy, and credit their dedication to their academic success. Most significantly, children who are actively involved in learning often feel happy and achieve higher academic achievement (Nichols & Dawson, 2012).

During storytelling sessions, I observed my students motivated towards the science classroom. It could be because the events, contexts or characters in the story resembled the emotional feeling, and they were motivated intrinsically. The context of the story *Sundarbasti* (Apendix-Story 1) was similar to the village of my participant student Rejina, which helped her to be engaged meaningfully in the class and connect with the contents delivered with the help of the story. According to Ryan and Deci (2004), emotional connection enhances intrinsic motivation, which fosters deep and sustained engagement in the learning process. In the collected data through classroom observations and students' reflective notes, it is observed that many students showed personal attachment with the characters of the stories, either showing empathy towards them or showing strong disagreement with what the character says verbally or his/her activities.

The empathy of the participant Rina towards the driver in the story *Sundarbasti* (Appendix-Story1) shows how deeply her emotion was stimulated. The response shown by her was not only the result of emotional engagement but also the development of awareness of social justice and empowerment. She felt that the driver was voiceless and hence blamed by villagers who belong to a powerful and privileged group. The voice raised by Rina indicates how storytelling pedagogy fostered emancipation, as proposed by Jurgen Habermas (2005). Storytelling pedagogy could have compelled the students to challenge the dominant power in favor of the marginalized and raise their voices for equality. I think the blame on the driver, who represents the voiceless group, was blamed by the passengers, who represent the

dominant power, which made my research participant emotional and aware of human rights and social justice. Saurav's reminiscence in response to the story Newton and Cricket, in which he remembered the accident of his hand injury by hitting a cricket ball, shows that he was emotionally affected by the character and events of the story shared in the classroom. The emotional impact of the storytelling pedagogy fostered the students' engagement in their class.

I agree with the claim of Pekrun and Linnenbrink-Garcia (2012) that teachers should design the academic setting so that such setting helps students adapt emotionally to that learning environment. Here, in my context, storytelling pedagogy played a crucial role in providing an adaptive environment for the students to adjust themselves to the contents emotionally. These emotional resonances with the characters of the stories extended beyond the level of empathy or hatred; they helped students to see science contents as human endeavors rather than abstract concepts based on scientific laws, which they could connect emotionally and construct knowledge. Immordino-Yang and Damosio (2007) support this regard and argue that emotions and cognitions are deeply interconnected. Students who show emotional reactions in response to stories are more likely to demonstrate cognitive engagement by seeking additional information, asking higher-order questions and completing their academic tasks.

Engaging the Mind through Storytelling

Cognitive engagement always remains the central focus of (formal) teaching and learning. It refers to the involvement of students engaged in deep learning, including their ability to connect concepts, ask probing questions, analyze and evaluate the information and apply their knowledge. According to Blumenfeld et al. (2006), the degree to which one is thinking about the learning activity, or attending and focusing on the task, involved and applying effort in learning is called cognitive engagement. If the students are engaged cognitively, they develop their conceptual understanding of the contents and analytical skills.

The data collected through classroom observation, students' reflective notes, and interviews reveal that storytelling pedagogy in the science classroom enhances their learning through cognitive engagement. As I mentioned in Chapters 1 and 4, my teaching previously was guided by behaviorism and mainly focused on topic description and rote memorization. I believe now that the kind of teaching shaped by behaviorism draws the students' attention mainly through reinforcement punishment

or showing grades of examinations/results. At the actual level, students could not engage in their class meaningfully. When I used to teach any topic previously, I observed students pretending to listen attentively and understand the concepts clearly. However, they used to struggle when they had to face problems related to content either at the time of assessment or during discussion sessions in the class.

Prior to the storytelling intervention, I found it difficult to get students to engage cognitively since they appeared inactive while discussing what was being taught. They often watch the clock in anticipation of the bell ringing, yawning, and talking with bench partners on topics out of context. Students in my observation had a variety of distractions, including an addiction to internet devices and video games, boredom, and a lack of desire since they used to believe that studying was only necessary to pass an exam and prepare for it. They used to wait for the routine to be published before beginning their rote memorization preparation for the test.

However, I observed the changed scenario during and after implementing storytelling pedagogy. In this context, when inertia was introduced and explained in the story *Sunalulo Gaun* through the context in which a moving passenger bus stopped suddenly, leading to the accident, my participant student Sambhavi shared her similar experience and said, *"When I was returning to Kathmandu from Manakamana during New year 2080, with my family in a bus; the bus suddenly stopped in Dharke and we all fell forward and struck with front seats due to inertia of motion".* This shows how she connected the incident of the story with her real-life experience by conceptualizing the term inertia. The incident of the bus accident in the story was a similar incident to the one that she experienced in the past. After hearing the story, she observed the context and incident as her own; she remembered the incident that she had encountered. She connected that incident with the science content and conceptualized its reason. Inquiry into the event was sparked by a similar incident in the story to her previous encounter. She might have engaged intellectually and asked herself questions. Blumenfeld et al. (2006) claim that learning science principles like inquiry, collaboration, and authenticity encourage students to reflect carefully on what they are learning and develop an understanding that involves applying and integrating the main concepts of the subject matter.

During the storytelling session, in the scene when the tug of war remained unmoved (Appendix-story 1), although both the teams were pulling the tug, I asked, *"Why does tug remain in the rest state, although the force is applied?"* Most of the

students said that two equal forces act on the same body from opposite directions and these forces cancel each other, resulting in no motion. This was when students understood the concept of balanced and unbalanced force with the help of a story without defining it. In this case, story components contributed to the inductive teaching technique and created a student-centered atmosphere. An example of a tug of war was used instead of a word-for-word description to better understand the meaning of balanced and unbalanced forces. Such an inductive method of instruction improves students' interest, encourages critical thinking, and helps them retain concepts over time (Gulsanam, 2024).

Before teaching about Newton's second law of motion, I was doubtful about the story Newton and Cricket (Appendix-Story 2) that I prepared as I had to establish the relation between variables through the story. It seems like a mathematical relation is being developed with the help of narration. Anyway, I prepared the story Newton and Cricket. After presenting the story to the class, I felt the story worked in a better way, beyond my expectations. In previous classes, while using the lecture method, I began with the statement of Newton's law: The acceleration produced on a body is directly proportional to the applied force and inversely proportional to its mass. And write mathematically:

$a \alpha F$……..(i) keeping mass constant

$a \alpha \frac{1}{m}$……(ii) keeping force constant

Finally, the relation $F=ma$ used to be derived and explained based on various examples. While teaching this way, students seemed to understand the mathematical formula but couldn't connect the formula with real-life situations. However, through storytelling pedagogy, without stating the law, I narrated the story in this way: *Once upon a time, Sir Isaac Newton, during his childhood while studying in grade 9, went to play cricket by bicycle. The cricket ground was about 15 km from his home …* (Appendix-Story 2).

After narrating the story, I asked some questions, assuming some examples; many of the students raised their hands and gave the answer correctly. In this context, the story helped me understand the science concept connecting day-to-day life activities and the cricket game that most students love playing. Students engaged meaningfully with the story and recognized how the content was relevant to their real-world setting. Relevance is one of the key elements influencing students' participation

in the class, claim Parsons and Taylor (2011). Instead of acquiring the theoretical viewpoint of the materials and text-based knowledge, students want to engage with real-life circumstances as they are learning. They are actively involved if they believe the subject issue is authentic and relates to the interests and concerns of the students.

To teach about the topic of Sources of Energy, I created a story with the title *Energia Kingdom* (Appendix-Story 5). I took the contexts of two states, Petroland and Greenland, to help my students understand renewable and non-renewable sources of energy. In the reflective note after the storytelling session, a student Barun, wrote:

> The story of the Energia Kingdom made me realize how important renewable energies are. The story helped me to think about reducing the use of non-renewable sources of energy, such as petroleum and gas, and using renewable energies, such as hydroelectricity and solar energy, wisely.

This showed that the story shared in the class compelled the student to think critically about using energy in his daily life, fostering his cognitive engagement. According to Andenoro et al. (2012), narratives, including storytelling are crucial tools in the struggle to bring experience to conscious awareness. Someone can better comprehend themselves through narrative. Because narratives can go beyond the surface and take listeners on an adventurous trip toward a deeper understanding, they provide opportunities for critical thinking about life and the agency that goes along with it.

In the interview with students after the storytelling session on electric resistance, Electric (Cycle) Race (Appendix-story 7), a participant, Kalpana, said, *"I never thought that electric resistance is similar to the traffic on the road. This helped me to understand how different substances have different electric resistances and conduct electricity differently."* In this response, I feel that metaphors used in the story helped students to link unseen and abstract things with the visible and the things of their part of life, enhancing their cognitive engagement. As Lakoff and Johnson (2008) assert, metaphors play a crucial role in cognition because the human conceptual system is metaphorically structured and defined. The personification metaphors help to represent a physical object as human and help to comprehend the experiences with a physical entity in terms of human experiences. Either personification of renewable and non-renewable sources of energy in terms of

metaphors ‘queen renewa’ and ‘king fossils’, respectively, in the story ‘Energia Kingdom (Appendix-Story 5) or representation of electric resistance with metaphor road traffic in the story ‘Electric (Cycle) Race’ (Appendix-story 7) helped my students engage meaningfully and conceptualize the contents in a more effortless and simplified way.

I observed that the storytelling method of teaching fosters cognitive engagement of the learners, connecting the science concepts with their daily lives and sparking curiosity and critical thinking so that learners can use their knowledge in different contexts. The data aligns with Chi and Wylie’s (2014) claim that cognitive engagement involves generating inferences, making connections and applying the knowledge in different contexts rather than memorizing the contents.

The narrative structures from the stories based on complex scientific concepts helped the students restructure these concepts in a simple and accessible way. As Lev Vygotsky suggests, learning is a social process and knowledge can be constructed by social interactions. In storytelling pedagogy sessions, the contexts, characters, and events provided the social setting, promoting interactions among students, teachers and various elements of the stories. During these sessions, stories acted as a means of scaffolding learners’ cognitive levels to achieve a higher Zone of Proximal Development (ZPD) as coined by Lev Vygotsky (Vygotsky, 1962 as cited in Kalina & Powell, 2009). According to Bruner, J. (1991), stories act as a cognitive framework through which students can structure and process information simply. For example, understanding electric resistance as traffic on the road helped students visualize how electrons flow through the conductor and grasp the science behind it in a simple and applicable way. The use of different characters, events and contexts in the stories helped the scientific concepts to be more humanized and dynamic rather than abstract and static, as suggested by Osborne and Dillon (2008).

As a teacher, I realized that my teaching technique before the storytelling intervention was able to address lower-order thinking skills, as suggested by Bloom (Bloom’s Taxonomy, 1956), such as knowledge and understanding by recall and rote memorization only. When the Curriculum Development Center (CDC) introduced a new Science and Technology curriculum in Nepal in 2076 B.S., a new model question was suggested. The items included in the question model provided a piercing jerk to me because many of the items included were context-based. I, as a teacher, was worried seeing the questions and felt that rote memorization and recall would not

work further in science teaching and learning. I was uncertain about the solution to this problem. However, storytelling intervention addressed the issue because the contexts of stories helped students to understand the concepts easily and apply them in new situations and contexts, fostering higher-order skills such as evaluation, imagination, and critical thinking.

The finding aligned with Shrestha (2024), who claimed that storytelling pedagogy is a pedagogical tool to foster higher-order thinking skills such as critical thinking among students. Classroom discussions after each storytelling session, sharing students' opinions with the help of reflective writing and the open-ended questions asked in the classroom helped students to develop higher-order thinking skills.

Storytelling for Shaping Classroom Actions

Behavioral engagement in learning means the engagement of students in the learning process so that they exhibit some characteristics that are observable in their actions. Behavioral engagement involves students' active classroom participation through various activities such as readiness for learning, regularity & punctuality, asking questions, participation in the classroom discussion, attentiveness, and willingness to engage in classroom activities.

When I introduced storytelling pedagogy in the science classroom, I observed that students showed active participation and attentiveness to my class verbally and non-verbally. In my usual classes before storytelling intervention, some students used to be outside of class pretending for various purposes, such as washroom, toilets etc. and came only after 4 to 5 minutes of class began. Those who used to be inside the class during my arrival also seemed to be uninterested in the class because they used to ask whether to go. E-classes-where students are taught with the help of a computer and projector showing videos or go to the science lab; some engage in low sound side talk and, some use to drink water frequently or ask to go outside for water or urination and some show duplicate attention towards my class with dull face and yawning. Most of the students wanted to escape the class anyhow.

Contrary to previous expressions, students showed their attentiveness when storytelling pedagogy was introduced. Some evidence of student engagement, such as waiting for class, raising a hand, and immediate response to any issue raised by stories, were observed in the classroom. In the classes before storytelling, there was less curiosity in students about how class starts as there was a similar structure for

everyday class: write a topic on the whiteboard, explain the topic in detail in the English language and assign tasks related to the topics. However, there was a unique kind of excitement in students during the storytelling session; students seemed to be waiting for how the class started and how the story went forward.

On April 9, 2023, in the third period, I entered grade 9 as a science teacher. Students were greeted with a voice of good morning. I replied to them loudly, "*Good morning! How are you all?* They replied, *"We are fine, Sir. How are you, Sir?* I replied, "*I am absolutely fine*. Today, we will hear a story with the title "Sundarbasti." Most of them excitedly said, "W*ow! Stories? "Yes*". I elaborated on how we could learn about one of the science topics through a story. Students seemed to be happy and curious about how the story would start. Students participated actively during the discussion session and question-answer session after each storytelling session. In each session, during and after narrating the story, I asked some questions related to contents and sometimes related to characters or events to put their opinion in favor or contrary; students seemed to participate actively. For instance, I asked, "What would you do if you were the driver of the bus that went into the accident, as mentioned in the story *Sundarbasti?*" Students actively expressed their opinions. Some showed empathy with the driver, and some showed empathy towards the passengers, while some students viewed the situation with neutral eyes, pointing to the situation as being responsible for the incidents.

I observed a special kind of enthusiasm and attentiveness by students when I was sharing the story *Race to the Peak of Hill* based on the topic of inclined planes (Appendix-story 4). In a classroom discussion, a participant student, Rishav, excitedly shared his memory, *"In last year's hiking to Ghyampe dada*[3]*, We traveled from winding road just like Arjun* [4]*in the story traveled. We enjoyed the hiking a lot*". I was surprised by the sharing of Rishav as Rishav used to be regarded as introverted and a shy student in the classroom; however, that day, he shared his experience without any fear or hesitation. It explored how a similar situation in the story helped him break his silence.

Reflecting on my classroom observation, I feel that storytelling pedagogy can be a powerful tool to encourage students to be mentally ready for the class and participate actively. Different events in the stories and the narrative structure fostered

[3] A place at Bhaktapur district
[4] A character in the story presented

the active listening and patience of the students, allowing them to reduce their distractions and engage meaningfully.

In reflective notes, students wrote how the story shared in class helped them feel more connected with the contents and participate actively. A student, Anil, expressed in his reflecting writing:

> I used to feel afraid to answer questions in class because I was wrong. However, today's story was on cricket, my favorite game, and I felt myself as part of the story and more attracted to the storytelling. I shared my opinion when Sir asked.

Reflecting upon my classes before the storytelling intervention, the hegemony of lecture-based teaching and the flow of content in one way on science topics compelled students to pretend to listen carefully as passive receivers. They were not given a chance to share their opinions or did not want to share as they could have thought that the contents were irrelevant to them or there were no contexts for sharing. However, storytelling intervention helped to break the pin-drop silent environment (Caruthers, 2006), allowing students to share their opinions and thoughts concerning stories or contents, as claimed by my participants, Rishav and Anil. The story's relevant contexts helped the students be affected personally and put their opinions in front of the teacher and classmates, making the class more inclusive.

Another student, Abiral, in response to the story A Detective of Body (Appendix-story 8) based on the topic of CT scan (Computerized Tomography).

> The story A Detective of Body on CT Scan made me remember the incident in my childhood when I was hospitalized when my leg was fractured while playing football. I understood how CT scans play a critical role in modern medical science. I also got to know how radiation is important in medical fields.

In this response, students' awareness regarding the precautions while playing football reveals how students engaged in learning by developing their behavioral engagement with the help of the storytelling method of teaching.

The data collected during the storytelling intervention reflect that storytelling pedagogy serves as a tool to shape students' behaviors, engaging them meaningfully

in their science class. Stories shared were found to be a strong bridge by reducing the obstacles between scientific contents and contexts of the students and making the science concepts more relatable and accessible. According to Trowler, Vicky et al. (2022), behavioral engagement of students can be fostered by creating "engagement interfaces" that include relatable and accessible content. When students find the contexts relatable to them, they feel more secure in the learning environment and are encouraged to ask questions and participate actively in class activities. All the stories shared in the class were based on Nepali contexts, although the names of some characters were chosen in different contexts to make the story interesting and relate to the contents. Various events and the responses of the characters from the stories provided a feeling of empathy, as discussed earlier (Storytelling for Emotional Engagement), and helped students to be just, ethical, and have a positive attitude. Stories help the students understand the related contents and the meaning of what they learn and internalize the values (Sanchez, 1998).

Students are engaged more behaviorally when their learning is associated with real-life applications (Darling-Hammond et al., 2020). In the stories shared during storytelling sessions, I created events and contexts associated with students' day-to-day lives. For instance, in the story of Race to the Peak of Hill on an inclined plane, I used the context of winding hilly roads which are part of every Nepali person as our country is regarded as a country of hills and mountains. These contexts helped students to relate the story to their own. Similarly, in the story of Electric (Cycle) Race, I took the context of traffic jams on the road to conceptualize electric resistance and electrons flow through conductors as traffic jams are part of daily life in Kathmandu.

Storytelling as an Inductive Approach to Teaching

The inductive approach to teaching is a student-centric method of teaching in which students are encouraged to discover specific rules, laws or patterns by themselves rather than directly being taught. In this approach, specific examples, cases, and contexts are presented to the students so that they can generalize the information and infer broader principles through these examples. Inductive teaching introduces subjects by giving particular observations, case studies, or issues. Theories are either taught or assisted by the students in discovering them only after their necessity has been demonstrated (Prince & Felder, 2007).

In my experience as a teacher, our traditional teaching approach-lecture method is deductive. The teacher introduces theories, mathematical formulae, principles, or laws first and presents examples for better understanding. The deductive approach is most common in science and mathematics teaching as these disciplines are more based on laws, principles, and mathematical theories. As a learner at the school and university levels, I encountered various laws and principles. I used to read and memorize the laws and recall them during the examinations; however, I used to struggle to connect these laws with real-world situations.

During my professional career as a teacher, before storytelling intervention, I focused on content delivery in the classroom. I used to state the science laws or define the content topic and repeat two to three times, asking students whether they understood. Generally, students used to say 'yes' or sometimes remained just silent. I assumed that they understood the science concept and I used to proceed for the next topic. Students' understanding seemed to be virtual because they couldn't connect the laws or contents with real-life situations when asked for assignments or during assessments.

During storytelling sessions, I narrated stories based on contents instead of beginning with a topic definition or statement of scientific laws and theories. Stories had different components through which learners were encouraged to conceptualize the contents. Characters and their actions, problems, challenges or conflicts, and resolutions of the conflicts in the stories helped to develop an understanding of the students. For instance, while beginning the topic, Newton's third law of motion, I used to state the law: 'Every action has equal but opposite reaction.' I used to restate it twice or three times and confirm whether they understood. Then, give one to two examples related to the law. I think this deductive technique just helped them to rote the law word for word and know a few real-life examples.

However, while implementing storytelling pedagogy, I narrated a story titled *Action & Reaction: Power of Balance* (Appendix-story 3). This was the story of two characters, *Balchhi* and *Majhi Dai*, fisherman and boatman. In this story, science law is presented through the daily tasks/activities of the characters, such as swimming and rowing a boat. A participant named Dolma wrote in the reflective writing,

> I recalled the day our school took us swimming last month while listening to a story about Balchhi and Majhi Dai in today's class. We learned that the push

of water backward with both hands while swimming was an action; consequently, we moved forward as a reaction.

The story helped learners to know how a swimmer moves forward while pushing the water back and how a boat glides forward while pulling the oars backward. They conceptualized pushing water backward and pulling oars as actions and moving swimmers and boats forward as reactions without stating the law through the inductive approach of teaching through story. In the discussion session, after narrating the story, I presented two different situations related to the law, ‘recoiling gun back when a bullet is fired from it ’ and ‘flying of rocket’. I observed that in a few seconds, students raised and presented the correct answers, showing how they were engaged cognitively in the classroom.

In another story titled "*The Electric (cycle) Race: Overcoming Resistance*," I discussed the subject matter of "Electric Resistance" and the factors that influence it. In this narrative, I established a race-based setting between the competitors, relating them to four elements influencing electric resistance: the conductor's length, area or thickness, temperature, and material used to make the conductor.

When establishing the relationship between electric resistance and wire length in lecture-based deductive classes, I used to start with the statement, "Electric resistance is directly proportional to the length of the conductor." This seemed to make it difficult for students to participate actively in class, comprehend the material, and relate it to real-world situations. But there was a specific moment in the story where a character named *Lakhan* talked about his experience and how the various road lengths he had to go and return to finish the race influenced his race. Without explicitly declaring the relationship between them, *Lakhan's* sharing serves as an inductive element to interest the learners and help them comprehend how resistance is impacted by wire length.

I concur with Prince and Felder (2007) that an inductive approach to education helps students become more motivated, increase their critical thinking and inquiry abilities, and develop their problem-solving abilities. Particular scenarios involving the characters in the stories, their conflicts, and their actions gave the learners context and made the situations seem real. They also encouraged critical thinking and probing questions, helped them comprehend the science in plain language in relatable contexts, and assisted them in making border-sense generalizations.

Chapter Reflection

In this chapter, I explored the scenario of my science classroom during storytelling intervention. This chapter analyzes the data collected and how these data support the role of storytelling pedagogy for students' meaningful engagement in science classrooms. I analyzed, discussed and analyzed how storytelling intervention promoted the emotional, cognitive, and behavioral engagement of learners in my science classroom. I transformed my class from a traditional lecture-based teacher-centered class to a constructivist student-centered inductive class.

During this chapter writing, I was confronted with multiple emotional feelings, sometimes happy sometimes sad, when I was in prolonged engagement with the data collected in the classroom. There were different moments in the class where students showed different reactions; these reactions again evoked my emotions while writing the chapter and working with the data. Despite sad and happy emotions, the outcomes of storytelling interventions only caused me to be happy as storytelling interventions improved the engagement of my learners in my class. I realized I had really come up with the solution to the problem which I had been encountering for many years.

CHAPTER VI
FINAL REFLECTION, CONCLUSION and IMPLICATIONS

This is the concluding chapter of this research study. In this chapter, I reflected upon my entire research study journey and learned insights throughout the journey of contributing to the knowledge construction process. I also looked back at my research questions and research methods in response to the learning outcomes and challenges I faced. Finally, I envisioned the implications of this research study and future directions.

Reflecting on Transformative Journey from Learner as a Passive Receiver to the Teacher as a Storyteller

I reflected in chapter one about my learning journey from elementary level to MSc, which did not unfold as typically expected for most students. As a learner, I was just a passive receiver of what the teachers delivered related to the contents. In the last year of my Bachelor's as a student, I began my new journey as a secondary-level science teacher. The teacher's role for almost decades was also a simulation of what I encountered as a learner in my science class.

My professional life as a secondary-level science teacher was smooth before the COVID-19 pandemic. I was satisfied with my role as a teacher because I was a qualified teacher with a Master's degree in one of the so-called difficult subjects, physics, and was a teacher of tough subjects with a good salary. Until the COVID-19 pandemic, I did not look back to examine my journey as a learner and teacher. Although I was working as a teacher, I never evaluated my role as a teacher. When schools were temporarily closed due to the COVID-19 pandemic in 2020, I was leisurely and confused regarding the further journey. That hard time of COVID-19 became a milestone for me and changed many things in my life. I decided to continue my learning as a M Phil student of education (STEAM education) at KUSOED. That was the first time I realized that I should learn education to develop my professional skills as a teacher.

Before my MPhil journey, the term research was an attempt to investigate something and explore new things with the help of experiments. My notion of seeing something was the absolutist point of view with a single reality. My ongoing educational journey helped me understand research in a wider frame, and I got a

chance to learn about various research methods and philosophical assumptions associated with the research methods. Reading various literature articles helped me to explore some major learning theories and teaching methods aligned. Through a series of assignments and classroom discussions, I got a chance to reflect critically on my learning journey and my role as a teacher. This critical self-reflection compelled me to examine my contemporary frame of reference to my view of learning and teaching and aroused questions in my mind: *Does my current teaching method engage my learners meaningfully? Is science a subject only a collection of abstract concepts based on scientific laws and principles?* Reflecting upon these questions led me to identify the disempowering forces causing the disengagement of the learners from my science classroom.

I recognized how authoritarian I was as a teacher and how my teaching pedagogy was the primary cause of disempowering my students. In my course STEAM education, the interdisciplinary approach focuses on the purposeful intertwining of disciplines of Science, Technology, Engineering, Arts, and Mathematics in educational contexts; being a science teacher, the major concern for me was a collaboration of science with one or many of the remaining STEAM disciplines for effective science teaching. While exploring various dimensions of STEAM education with the help of research articles and classroom discussions, I found Arts as the best fit to incorporate in science teaching. Through the course, I learned why art is the most significant educational tool for preparing creative, empathic, collaborative, and ethical learners with critical abilities who are needed to cope with global issues in the current period.

I realized that arts is an inevitable means to make STEM fields more socially responsible and to make science learning more lifelong and sustainable. Through self-reflection, I could pinpoint the barriers to meaningful, authentic, and inclusive learning in our environment, as well as potential solutions. With the help of additional practical sessions on design thinking and arts-based learning, I gained practical experience collaborating with my team to solve practical problems related to teaching and learning. I also developed problem-solving skills and empathy in innovative ways. It was my first time working on a real problem in a team with my friends. I felt that many problems I solved during my educational journey from primary school to university were just theoretical questions to which I provided answers using textbooks or memorized information from learning resources. After realizing and deciding on

the inclusion of art in my teaching method, I was in a dilemma for a few days regarding the form of Art to be chosen. There are various forms of art, such as dance, drama, songs, storytelling, etc. The objective of using a form of Art was to engage the learners in the classroom and provide a conceptual understanding of the science contents to the students. After brainstorming for a few days and exploring the Arts forms as pedagogical tools, I decided to use storytelling pedagogy intervention in my science classroom and conduct research study as action research.

This research journey was thrilling as well as challenging for me. As an MPhil learner in education and a teacher dedicated to putting some bricks in the construction of knowledge in science teaching and learning, I was very excited to begin this research journey. However, as a novice researcher, it was challenging to delve into the ocean of constructing knowledge. The first challenge for me was to make students realize that the contemporary teaching method used in the classroom was ineffective in engaging them meaningfully because they were used to the lecture method and used to think that it was the only method of teaching. I introduced some student-centric teaching methods before the storytelling pedagogy, such as Think, Pair and Share (TPS) Jigsaw. I tried to change students' frames of reference regarding their notion of learning methods. I assigned students to reflect upon classroom experiences comparing present classes with previous ones, which helped them to identify the hegemony of the lecture-based teaching method, which caused them to be disengaged from the learning.

In the first phase of planning, after choosing the topics for storytelling pedagogy and making a lesson plan, I encountered the most challenging task of my research: preparing stories based on the science topics and contents. I was not from a literature background; I was afraid of whether the story I prepared would work in class. Anyway, I prepared eight stories on various topics for the first cycle of my research. The day came in, and I was supposed to change the pedagogy with which I had been habituated for the last 30 years as a learner and a teacher. I narrated the first story with the title "*Sundarbasti,"* based on Inertia, a balanced and unbalanced force. I was a little bit nervous and excited as well. I began narrating the story; I observed students listening to the story curiously. I felt happy and thought my pedagogy worked as I expected. However, I suffered while collecting the data as it was difficult to observe each moment of the storytelling session while narrating the story in parallel.

Initially, when I took students' classroom experiences through their reflective writing and interviews, they expressed only what they learned about the contents rather than what they experienced in the class when storytelling pedagogy was utilized. Gradually, the transformation took place; students expressed their opinions concerning stories and contents during storytelling sessions and discussion sessions. Sometimes, some students express completely different thoughts and opinions than those in the contexts of the stories, which is evident in how storytelling develops learners' critical thinking. I found that when students were affected emotionally, they became more attentive and active in class. When the contexts of the stories used to be irrelevant to them, they used to be passive and less attentive. I remember while I was narrating the story "Newton and Cricket," the students who were cricket players, especially boys learners, were more active and attentive as the contexts were more relevant for them. After successfully completing the first cycle with eight stories, I reflected on the journey so far and realized that to address a higher level of cognition, I decided to introduce some pictures related to stories and ask students to imagine them before narrating the stories. I also included some questions about ethical dilemmas between the storytelling sessions. These sessions helped students develop their understanding of the contents and shape their behavior so that they engage in their classroom meaningfully.

In this journey of critical action research, my major achievement is that now I can engage my learners in the classroom without saying my usual maxim, "Keep quiet and listen carefully!" rather, I would say, "Share whatever you know!." This research study changed the notion of the nature of science not only for me but also for my students. We, students and I, both used to believe science was a difficult and abstract subject before the storytelling sessions; however, now we assume science is an interesting subject with contents that can be contextualized and humanized and can be understood if it is taught using appropriate teaching methods.

Before the MPhil study, the image of science curriculum for me was 'Curriculum as subject matter' as coined by Schubert (1986) because, as a learner, I was in the race to recall and remember the information delivered by a teacher. Similarly, my notion of teaching was the process of imparting the content knowledge and completing the syllabus as early as possible, with the intention of accomplishing my duty. I used to believe curriculum and textbook as synonyms of each other. However, my ongoing learning journey and this research study changed the image of

curriculum for me, namely, ‘Curriculum as agenda for social reconstruction’. While preparing stories, I spent time thinking, imagining and reflecting on various social issues while setting contexts, characters and events. During the storytelling session, the responses from students, such as empathy with the less-powered characters and sharing their opinions on social issues, led me to think about the importance of classroom culture, students’ experiences and their empowerment, which changed my curriculum image.

This research journey provided me with a great opportunity to observe and explore the emotional part of learning. I believe that I was guided by scientific ways of knowing, focusing on the cognitive aspect of learning and did not value the behavioral and emotional domains of learning. As a science teacher, I always focused on the materials to be taught. I overlooked the affective part of learning, which includes how learners feel during the learning process and their emotional condition. Through this research, I learned the importance of emotional engagement in developing cognitive and behavioral engagement. Previously, when I observed a student not attentive to the class, I used to punish him/her or complain parents. However, I will now try to explore the reason behind the disengagement and help students eliminate the obstacles. This research also strengthened the bond between students and me, breaking the formal barrier. During the storytelling sessions, there were many situations in which we laughed together loudly and became upset, too. This informal environment helped students to be confident. In contrast, discussions on social issues raised by stories helped empower themselves and raise the issue confidently in front of me, contrary to the past, when students hesitated to share or ask something due to formal teacher-student relations.

This research study journey helped me challenge my deep-rooted assumptions about teaching and learning. My 30 years of status-quo (my perception of teaching as a learner and a teacher) on the way of teaching and point of view of teaching as imparting content knowledge to students transformed teaching as scaffolding and creating opportunities for learners to participate actively in the classroom. Now, whenever I enter my classroom, I assume I am a co-learner rather than an authoritarian teacher. My research journey aligns with Mezirow (1997) as a researcher and facilitator; I was involved in critical self-reflection through reflective writing during the entire research journey, which changed my frame of reference to view teaching and learning. Critical self-reflection took me from the disorienting dilemma

(a situation that challenges a person's understanding of the world/things) regarding the role of arts in teaching and learning. This entire research journey was a metamorphosis for me, transforming me from a lecture-based teacher to a science storyteller with critical and autonomous thinking skills.

Reflecting on Research Design: Critical Action Research

My research problem was my problem in the classroom regarding the disengagement of the learners in my science classroom. Through this research study, I intended to solve such a problem by the intervention of storytelling in my science classroom for the secondary level. Critical action research was the best fit for the research design because action research helps solve problems through action (intervention) and a series of observations and reflections. My objective of this study was to explore the outcomes of utilizing storytelling pedagogy in my science classroom and act as a change agent to transform my pedagogy and enhance my students' learning, improving their meaningful classroom engagement. In this research study, I played dual roles, one as a teacher and another as a researcher.

The journey of using critical action research as research design was exciting and challenging for me. In the planning stage, I was very confident regarding the research, but in the very first step of developing stories, I faced a stumbling block at the very beginning. I wasn't from a literature background nor a professional copywriter and narrator. I started to imagine the story's plot, characters, and setting but faced challenges in including the science content that fit the story elements. I prepared multiple drafts of stories even to prepare a single story. One day, when I completed the first story titled "*Sundarbasti,"* based on scientific content, inertia, and balanced and unbalanced force, my confidence level developed.

The action phase of my research was much more challenging and thrilling. Just before the first class with storytelling pedagogy, I was quite nervous and afraid regarding how I narrate the story in the class. Although I could not observe the very first class as expected, I mostly concentrated on narrating the story; after the discussion session, I realized that storytelling could work. Narrating stories as a teacher and observing my class and student's behavior as a researcher simultaneously was difficult for me. Writing reflective notes after every story was a greater opportunity to modify and improve stories and observation techniques; however, obtaining students' reflections was difficult for the first few sessions of the

storytelling as students used just to describe the story narrated in the class rather than their personal classroom experiences.

The critical research design allowed me and my learners to reflect on our actions critically through reflective writing, which fostered students' critical thinking skills. The findings of this research motivated me to seek the problems associated with teaching and learning and attempt to solve the problems as I believe this action research solved my problem regarding students' disengagement in their science classroom. Despite some challenges, the journey of this action research study was a transformative journey filled with excitement and thrill, which played a crucial role in improving students' engagement and transforming me into a constructivist teacher from the teacher as a transmitter along with a change in my most used sentence 'Keep quiet! You don't know anything' to 'please share whatever you know.'

Reflecting on Research Questions

In this research study, I was exploring to answers of the main research question, "*How does the storytelling approach to teaching science engage students in the classroom?"* with two subsidiary questions: "*How does the storytelling approach motivate learners towards science education*?" and "*How does the storytelling approach help learners conceptualize scientific concepts?".* I have addressed these research questions in chapter V, which explores the scenario of my science classroom during storytelling intervention. Although I was a little bit confused regarding proper observation of students' engagement during the class time of the first session, as my major focus was to narrate the story and deliver content to the students, I tracked students' engagements through their reflective notes and the discussion sessions after narrating stories. I have responded to the research questions with the help of three themes exploring the students' emotional, behavioral, and cognitive engagement during storytelling sessions.

In this research, I explored storytelling as a pedagogical tool in a science classroom to engage learners meaningfully. During the storytelling sessions, I observed that students were emotionally affected by the elements of the stories narrated, which helped them connect emotionally with the story and the contents taught. The contexts used in stories of different events with various characters bound them to invest quality time in their classroom, fostering their emotional and behavioral engagement. The storytelling pedagogy created a supportive environment for open communication (Shofiyyah et al., 2024), which broke the passive and

unproductive silence in the class and fostered understanding of science contents with diverse perspectives. The narrative structure of the stories helped to simplify and humanize (Grenness, 2016) the abstract physical concepts of science, making them more accessible and contextual so that learners could internalize the concepts of science more easily. The intervention of storytelling pedagogy broke the pin-drop silence of the class and transformed students into active listeners from passive receivers.

Conclusion

This critical action research, which incorporates a form of Arts in Science classroom as an innovative pedagogy, leaves some emerging insights for me. This research was mainly intended to examine whether the storytelling pedagogy engages learners meaningfully or not during their science learning. The findings of this research study explore that storytelling pedagogy serves as student-centric pedagogy that can address the affective domain, the most overlooked part of learning domains. Various elements of stories, such as contexts, events, characters, and relations between characters, trigger students' emotions and engage them emotionally in the classroom, reducing classroom distractions and disconnection with the contents.

Although the traditional lecture-based pedagogy has some advantages, such as being time efficient, having clear control over the learning pace by the instructor, and the ability to share subject matter with many students, I found storytelling pedagogy more convincing and engaging than the traditional method of teaching. The storytelling pedagogy helps students remember and understand science concepts and fosters higher-order thinking skills such as critical thinking, evaluation, imagination and creativity. The social interactions of characters in the stories, students' sharing during discussion sessions, and their reflection on components of stories promote openness among students, which helps them to think critically and imagine what they envision, promoting higher-order thinking and competencies. Storytelling develops empathy among students, leading them to become a human with moral and ethical values and encouraging them to advocate for equality, equity and social justice. The narrative plots in stories and metaphorical representations help students to assume science as a human endeavor, relate science concepts with their contexts simplify science in accessible ways, and conceptualize them.

Here, the important thing to consider is not only the storytelling; certain factors may alter the outcomes of the research, such as elements of the stories, the

context chosen, the nature of science content and the way how science contents are blended with the story elements. As a novice researcher in this stage, I can proclaim that storytelling can be an important pedagogical tool for learners' meaningful engagement in science classrooms. However, the degree of engagement may differ depending on the teachers, stories, and nature of the science content. Another point to be noted is that storytelling alone may not be suitable for every science topic. Depending upon the topics, other teaching methods, such as project-based learning, lab experiments, and other methods, may be employed for learners' meaningful engagement. Time management is one of the greater challenges during storytelling sessions as it requires enough time to narrate stories, discussion sessions, and reflective writing. If a teacher feels hurried while narrating the stories, story elements may not touch students' feelings, which, in turn, is counterproductive.

In some cases, the language and the vocabulary chosen may also alter the learning outcomes as some students may not be good in a particular language or have difficulty understanding the meaning of vocabulary; therefore, such students may be far from the contexts of stories and disengaged emotionally and cognitively. I think teachers should be trained to prepare and narrate stories based on science content to effectively use storytelling pedagogy. Considering the time constraints, teachers can also use stories from the existing literary world. For example, "*The Science Book: Big Ideas Simply Explained"* by DK or "*The Man Who Went to the Far Side of the Moon* by Bea Uusma Scher.

Implications of the Study

In the future, this research study can be used as a reference in multiple ways. Especially teachers adopting traditional lecture-based pedagogy and want to use innovative pedagogy for their learners' meaningful engagement find this document more useful. Similarly, the researchers wishing to conduct their research on progressive pedagogy, for instance, arts-based pedagogy, those who wish to adopt an interdisciplinary approach, or those who utilize forms of arts as pedagogy, can find this as one of the useful resources. For Policymakers, book writers, and teacher trainers, this research study would also be one of the resources to consider. Not only the findings of this research study but the methodology also can be adopted in various ways by the researchers and teachers, such as conducting role-play pedagogy based on stories, reading stories by students rather than listening to teachers, adopting digital storytelling, and others.

Implications to the Teachers

With the development of science and technology, teaching and learning processes have also changed to large extents compared to the past few years. Teaching has become one of the most challenging jobs now. Teaching the present generation of students, which are called the z-generation and alpha generation, who are used to digital technology from the early years of life, is not easy. The major issue that most of the teachers face is with students 'meaningful engagement. This research study would help teachers explore students' emotional, cognitive, and behavioral engagements and plan accordingly to address their contexts. The science teachers, including others facing similar issues, would try storytelling pedagogy to make the class constructive and transform their pedagogy.

Implications to the Researchers

Besides the educators, education researchers would also benefit from using this document. Those researchers who are willing to explore student engagement use the form of arts as pedagogy and those who are willing to conduct action research studies would use this research as a reference.

Implications to the Policymakers

The findings of this research study would be helpful for the various stakeholders relating to teaching and learning. Policymakers such as curriculum designers, teacher's guide designers and textbook writers would use storytelling as a teaching approach and pedagogy for relevant topics.

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APPENDICES

Appendix A

Stories for Storytelling Pedagogy

1. Sundarbasti

Once upon a time, there was a village named "*Sundarbasti*" in a rural area in the hilly region. In the village, there were no facilities such as electricity and transportation. People in the village were supportive and cooperative. People used to grow varieties of fruits and crops. Although they used to produce enough fruits and grains, they were not happy as they had to throw their product as waste and give cattle due to the lack of a market in their village and lack of transportation facility to take the products to the market in the city. One day, they went delegation to the local government office and demanded for the construction of a road. After 3 months, the government started to construct the road passing the village. Although the road was rough and un-pitched, people were happy as they had a way to take their products to the market, earn money and travel in vehicles to save time.

Nearby the *Sundarbasti*, there was another village, '*Sunaulo Gaun'*. In that village, there used to be an Inter-village "Tug of war" game competition every year on the occasion of the *Maghe Sankranti* festival. That year also, the competition was announced by micing and radio. This time, the prize was Rs 50,000 with the trophy. Sunderbasti village also made their registration for the competition and started practicing. Finally, the day came, and villagers from different villages reached Sanaulo Gaun with the hope of winning.

Villagers from Sunderbasti were excited and happy as this year they were travelling by bus for the competition. The competition started, and through various rounds, many teams were eliminated. Finally, two renowned competitors, Sunderbasti and Sanaulo Gaun, reached the final. Both teams seemed to be strong and reached the final, defeating other teams. The final competition started, and with the whistle of the referee, both teams started to pull the tug towards their respective sides. However, the tug was at a constant position, and no team was able to pull it. For half an hour, both villages tried to pull the tug but couldn't change its position (balanced force). In the meantime, one of the members of Sanaulo Gaun felt strong urination and left the game. It was a golden opportunity for the *Sundarbasti*. Hence, they grabbed and

pulled the tug (Unbalanced force) violently and won the title of the competition with the trophy and the prize money.

The Sunderbasti team collected the prizes, took a bus and moved towards their home. On the bus, they were celebrating the victory with dancing and singing. Suddenly, the bus stopped, and they all jerked forward in the bus; they struck each other and fell down on the floor, and many of them got injured. The trophy got broken, and money was lost. Their happiness turned into sadness. Villagers got angry with the bus driver, scolded him and claimed compensation. The driver denied their blame and told he stopped the bus because a goat was crossing the road suddenly and the road was curved. People were not convinced with his answer, so they complained to the "Mukhiya" of the village. Mukhiya called a meeting, and the meeting formed the committee with the chairmanship of a teacher in the village. Later, the prize money was found in the bus below the seat. The committee investigated and concluded that the fault was not of the driver, but the cause of the accident was one of the properties of the science called inertia. Inertia is …….

2. Newton and Cricket

Once upon a time, Sir Isaac Newton went to play cricket games by bicycle. The cricket ground was about 15km far from his home. The game was supposed to be started at 8 o'clock in the morning. He left his home at 7 o'clock. He was pedaling his bicycle at a moderate pace, so it moved with constant velocity. After half an hour, he observed that he had traveled only 5 km distance, still 10 km was left to be traveled. He put more force on the pedals and increased the number of pedals so that the bicycle was accelerated (Acceleration is directly proportional to the force applied). He reached to the ground on time. The game started, and Newton was enjoying the game with the friends. At the instant, Newton was batting and the opponent player moved his hand forward to catch the ball hit by Newton. However, he dropped the ball and injured his hand. The captain of the team suggested him to hold his hands back while catching the ball (F inversely proportional to t). In the last ball of the 14^{th} over, Newton kicked, hit 6 runs and sent the ball out of the boundary line. Unfortunately, the ball was lost. They resumed the game with a tennis ball as there was only one cricket ball which had already been lost. The fielders felt that it is easier to catch a tennis ball more easily as compared to a cricket ball (F is inversely proportional to m). Both teams did the batting and fielding turn by turn. After the game was over, when Newton was ready to return back home, one of his friends told

him that he also wanted to go with Newton as he had to go to his uncle's house, which is nearby Newton's house. Newton agreed and told him to sit on his bicycle. He started pedaling his bicycle as much as possible, but it took about two hours to reach the destination. (F is inversely proportional to m)

3. Action & Reaction: Power of Balance

Once upon a time, in a "Shanti Gaun" near a riverbank, two friends lived, Balchii, a fisherman, and Majhi Dai, a boatman. Balchhi was famous for his skill of swimming and catching fish, and Majhi dai was famous for his skill of rowing a boat in a fast-flowing river.

One day, when they were in the river for their usual task but leisure, Balchhi proposed Majhi dai for a friendly competition to race and reach the other end of the river, Balchhi by swimming and Majhi dai by boating. Majhi dai easily accepted the challenge. They accepted a small boy from their village to observe their competition and decide the winner.

Two friends got ready at the river bank. Balchhi dove into the water, pushing into the water. At the same moment, Majhi dai stepped into his boat, placed his roars into the water and started rowing the boat, pulling the water behind.

Both friends gave their best effort. As the boy was very new to the technique of swimming and boating, he was surprised to see the unique incident inside the water. As Balchhi pushed water harder, the boy noticed that the more force he used to push water backward, the faster he moved forward. The boy thought to himself, "How is this happening?" Balchhi was pushing water backward, but he was moving forward.

Meanwhile, the boy noticed a similar case with Majhi dai. The harder he pulled the roars, the faster his boat glided forward.

The two friends reached another end at the same time. The boy announced both of them as winners and asked curiously the reason for his observation. Both friends looked at each other's faces but could not answer. Balchhi said, "I have been experiencing it since I started swimming but don't know the reason". Majhi dai added, "Me too".

When these three were thinking about the issue, a wanderer observing all the activities looked at them, smiled and unpacked the mystery. He talked about Newton's third law of motion. Action has an equal but opposite reaction. Everyone became happy and thanked the wanderer for teaching the important science lesson.

4. Race to the Peak of Hill

Once upon a time, there was a small village named “Maidan” in a valley. There used to be a competition to elect the bravest man of the village, “Pahalman,” every year on the occasion of New Year. Once at the end of Chaitra, all villagers gathered on a huge ground to organize the competition for electing Pahalman for the coming year. The Mukhiya (Chief of the village) announced the rules for the battle, in which each interested participant was supposed to run for one complete length of the ground, and the top three candidates would be selected for the final round battle. The top three candidates will be assigned to carry a sack of 50 kg of sand to the top of a hill on which the water tank was being built. The person who carries the sack first to the top of the hill would be the coming year’s Pahalman.

With the whistle of the referee, the race began, and finally, three participants, Bhim, Ram, and Arjun, completed the race, being among the top three, and clinched the spot for the final round.

For the final round, there were three different paths: the direct steep path, the spiral winding path and the forest trail path to reach the peak of the hill. The direct steep path was the shortest but more challenging, the spiral winding path was longer but less steep, and the forest trail was the longest and gentlest path. Path selection was done by giving the chance to select the first who completed the first round race as the first and so on. Bhim, who was the winner of the first round, chose a direct steep path, saying, "I will go through a direct steep path. My strength will carry me through”. The second finalist, Ram, chose the forest trail path, claiming it was the easiest path to reach the peak. Finally, for the last candidate, Arjun, there was no option for him, so he was supposed to take him on a spiral-winding path.

As the race began, Bhim lifted the heavy sack with ease and ran but struggled against the steep road, drained his energy quickly and gave up. Ram on the forest trail could not take a fast race due to many obstacles, and it took a very long time. Arjun, from a long winding road, walked at a steady pace. He tied the heavy sack on the wooden plank, pulled very comfortably and reached the peak first using the inclined plane, and he was awarded as Pahalman of the Year.

5. The Energia Kingdom

Once upon a time, there was a kingdom named "Energia" with 20 states. Among the 20 states, two were very popular and had unique identities. A state called Petroland was ruled by King Fossils. This state was the richest among all due to the

presence of fuels like petroleum, natural gas and coal in very high quantities. King Fossil was very egotistic, used to do whatever he wanted, and was careless about people's concerns. Another popular state was Greenland, ruled by Queen Renewa. The green land was not so rich, but people were very happy. The state was covered by green forests, and the environment was very clean. Once, a scientist named "Energy Conserver" proposed to design vehicles and machines based on hydroelectricity and solar energy for both states. King Fossil strongly denied this, whereas Queen Renewa accepted the proposal. King Fossil did not want to see Greenland to be a rich country. He announced the war against Green land, and the war continued for a very long period of time as the public people of Greenland also supported their government. Due to the long war, the energy sources from petroland were gradually exploited, whereas Greenland developed various machines and vehicles based on clean energies. They exported electricity to other neighboring states, and the states became rich. Finally, King Fossil surrendered in the war.

6. My Own Story: Hardship During Blockade

At the end of 2015, the Indian government announced an unannounced blockade in Nepal. Almost all sectors were affected by the blockade, which extended for about 5 months. But the most impacted sectors were transportation and industries. This is because these sectors were fully dependent on fossil fuels such as petrol, diesel, coal, etc., and our country was completely dependent on the Indian government. During that period, I was working as a secondary-level science teacher at one of the schools in Nawalparasi district. My school was about 13 km from my house one way, and I used to ride a petrol-operated motorbike. There was a huge scarcity of petrol so we were compelled to buy petrol in black which cost Rs. 500 per litre. We had LPG cylinders to cook food during the days when it was almost unavailable on the market because of the blockade. It was a day of Mangsir, and when I returned home from school around 6 O'clock in the evening, my mother came near to me and said, "Both of the cylinders at home just became empty. The gas supplier said that there was no chance to exchange the cylinders due to the blockade. Your wife is pregnant, and the delivery date is approaching. What to do?" I had no answer to her, so I remained silent. The next day morning, I contacted some of my relatives and friends regarding the issue of the LPG cylinder. I did not get a positive answer from anyone. However, some of my friends suggested that I go to the nearest market in India, Thutibari and exchange gas cylinders. I decided to go to India. I tied the

empty cylinder at the back seat of my motorbike with a rope and moved towards Thutibari. After about an hour, I reached Thutibari and crossed the border. I was afraid of being obstructed by border police or any authorities, but nobody interrupted me. I reached the market and asked to exchange the cylinder. However, most gas stations and suppliers told me that gas was not available, and some told me that they could manage if I paid Rs. 10,000 per cylinder. I did not have such a high amount. Still, I did not lose hope and asked the local people whether they could help. One of the local people suggested me to go to Nichlaul, another town in India which was about 40 km far from Thutibari. I felt the advice was genuine and moved towards the Nichlaul. After riding for one hour, I reached Nichlaul and asked for the gas station. Someone told me the location. There was a huge queue for the gas. I also stood in a queue. Unfortunately, after staying in line for about 3 hours, the person in the gas station told me the gas just finished, and the next tanker was supposed to come after two hours. I had no options. I waited, and finally, I got to fill up the gas cylinder at 7 pm evening. When I was returning to my home, I was blocked by border police at Thutibari and asked for Rs. 5,000 money for crossing the border. I told them that I did not have such a huge amount. They told me to give them how much I had. I gave them about Rs. 1,200 and got a chance to go to Nepal. Finally, about 9 pm, I reached my home. When I just reached home, I observed all the family members waiting for me eagerly. They were very sad since I was contactless from early morning as my phone was not reachable due to a network problem in India. I thought if I got into any kind of trouble, then I would stay in India.

That day was a memorable day for me, which compelled me to think of the importance of energy. That day, I realized why we should develop alternative sources of energy.

7. The Electric (cycle) Race: Overcoming resistance

Once upon a time, there was a village called 'Bijuli Gaun' in Nepal. There were two leaders in the village: Imansingh (Current lover) and Ratansingh (Resistance lover). They used to assume themselves as more powerful and superior than others and behaved like enemies to each other. One day, a cycle race was supposed to be between 'Bijuli Gaun' and the neighboring village *Sundarbasti*. Imansingh was in favor to chose participants for the race, but Ratnasing wasn't happy and he wished to lose their village against *Sundarbasti*. The captain of the team was in favor of Ratansingh. The Participants Amar (Area), Tika (Temperature), Lakhan (Length) and

Madan (Materials) were ready for the race. They participated in the race and shared their experiences as follows;

Amar: While going I chose the big and wide road so I could ride the bicycle fast as there were no disturbances on the road, but while returning, I came through a small street road, so I faced so many disturbances and couldn't come fast. (Resistance is inversely proportional to the area. As the area of the road is less, resistance increases: If there is less thickness or area of electric wire, there will be more resistance)

Lakhan: I chose a shortcut road while going and reached the destination very fast, but while returning, there was a construction process, and I returned through the highway, which took enough time for me to return here. (If the length of the wire is longer, it produces more resistance).

Tika: While going, I felt quite comfortable and rode very fast as the weather was good, but while returning, I couldn't pedal fast due to the excessively hot weather on a sunny day. (If the temperature is higher, there is more resistance in the wire)

Madan: While going, I went through a paved road and reached the destination fast, but while returning, I tried to escape traffic and used a unpaved graveled road. Unfortunately, the road was very rough, so I couldn't ride fast and it took more time. (Resistance also depends upon materials used: Metals are good conductors, whereas alloy such as nichrome is good resistor)

8. A Detective of our Body: CT Scan

There was a boy named Amar who was studying in grade 6 and living in Kathmandu. On his 12th birthday, his father bought him a new bicycle. On one rainy day, he was riding his bicycle near his home. A car at high speed was coming towards him. Amar pressed the brake of his bicycle, but it slipped due to the wet road. The car hit him, he fell down, and there were some scratches only on his body. But he was feeling extreme chest and head pain. His parents came out, an ambulance arrived, and he was taken to Bir Hospital. He was kept in bed. After some time, the doctor met him and said, “Hello, what is your name? How are you feeling?" Amar replied in a sad and low voice, “Amar! I am getting extreme headache and chest pain." The doctor said, “Don’t worry, Amar. We will diagnose what happened with you.”

He was wondering. He thought, how would the doctor know what has happened inside my body? He was frightened and asked his mother, “Will the doctor cut my body to see inside?” The doctor looked at him, smiled and told, “Oh, no

worries! We will not cut your body. To diagnose your problem, we have a magic detector which will reveal your problem."

"Magic detector? Where is that? How does it work?" Amar asked with curiosity. A nurse lifted him on her lap and took him towards a large machine that looked like a giant doughnut. The doctor told, "This is a magic detector of your body. This machine is called a CT Scan (Computed Tomography). This is a special X-ray which helps to see all parts inside your body." "How?" Amar asked.

Doctor elaborated, "Imagine that your body is like a big complicated building with many rooms and floors. If someone is hiding inside that building, we need a detailed map of that building. A normal X-ray machine just produces a flat picture of the building –that is, an outline of the house but not what is happening inside each room. On the other hand, a CT Scan produces a large number of pictures from different layers at different angles to create a 3d map of your body. This map lets us know whether there is any damage or not."

After knowing the reality, Amar agreed to follow the procedures. Nurses gently placed him on a sliding bed. The bed moved inside the CT Scan machine. Amar followed the doctor's instructions. After a certain time, the scan was completed, and he was taken out. The images appeared on a computer screen, and they contained pictures of bones, muscles, and the brain.

After examining all the images, the doctor declared that there was a small fracture in Amar's ribs and swelling in his head. The doctor gave him some medicine to heal the ribs and for the head injury. Amar thanked him and shared his aim to be a radiologist in his life and serve the lives of many people.

Appendix B

Sample of Questions for Reflective Note of Students

Name of student:…….. (optional)

Reflecting on today's class, what key concepts did you learn? How did this teaching method help (or doesn't help) to develop your understanding?

Sample of Questions for Reflective Note of Students

Name of student:…….. (optional)

Write reflective notes on new methods of teaching science, including your classroom experiences.

1. In what ways this method of teaching is better or (not good) as compared to the previous method?
2. If this method is better, how did this method of teaching help you understand and remember the science concepts?
3. Did this method make you feel more engaged or inspired to participate in the class activities? How?

Appendix C

Sample of Consent Letter

.....विद्यालयमा कक्षा ९ मा अध्ययनरत मेरो छोरा/छोरी .....को विज्ञान तथा प्रविधी विषयको कक्षामा अनुसन्धानात्मक कार्यका लागि कथाबाचन (Storytelling) को प्रयोगगरि हुने पठनपाठनलाई मेरो तर्फबाट विषय शिक्षक रमेश चापागाईंलाई अनुमती तथा मन्जुरी प्रदान गर्दछु ।

अभिभावकको नाम :

अभिभावकको हस्ताक्षर :