CONNECTING VEDIC AND ETHNO SCIENCE WITH SCHOOL SCIENCE CURRICULUM OF NEPAL

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Abstract

This dissertation aimed to find out the connections among Vedic saying, community doings, and school science teaching. I reviewed theories, plans, and practices along with national and international studies on Vedic scripture, Ethno knowledge and policies of the East and the West. The literature review provided contents, methods and evaluation criteria for the study.

This study was conducted following the (post) qualitative research approach. It was underpinned by decolonizing research paradigm. A transformative methodology was adopted for braiding Vedic, Ethno, and school sciences teaching and learning. This study was conducted in the Gorkha district. Participants from three schools and community members were selected through a purposeful sampling technique. The study included three teachers, nine students, one curriculum expert, one textbook writer, two purohit/pandit and nine community members. They were interviewed to document their perspectives on the connections between their spiritual and cultural practices and science teaching. Interviews, focus group interviews, observations and story sharing were taken as the methods for data collection.

The field data were coded and analyzed using Higgins' Rhizomatic approach. This approach helped connect the repeatable nodal points and take them as the central themes. After that the data were analyzed linking the Vedic texts and participants' views with scientific and logical justification.

The findings showed that spaces within the current science curriculum could be linked to Vedic practices and knowledge. For example, Vedic and Ethno practices of herbal medicine can be connected while teaching the chapter on Herbal plants. Ashuro, Khirro, Titepati and Cow dung can be introduced under the chapter herbal plants and organic manure. Spiritual practice of preserving sacred plants, rivers and

land can be taught while teaching environmental pollution. This interdisciplinary community knowledge demands a science, technology, engineering, arts, and mathematics (STEAM) approach to integrated science teaching. Besides, students can be encouraged to figure out science, non-science, science to be explored, and pseudoscience in their lives. They can also be encouraged to learn atomic, cognitive, quantum, and spiritual sciences together. The above findings are discussed by comparing with emerging theories rather than predetermined theories, though some theories are taken as the referent.

This study indicates that there is a need to include ideas, readings, and discussions in teacher education and teacher professional development programs encouraging preservice and in-service teachers to explore connections between current topics in school sciences, the Vedic ideas, and the Ethno sciences. A potential way to be inclusive of the Vedic and Ethno science ideas could be through a school science curriculum where distinct connections could be made between these three areas. However, science educators, teachers, and school curriculum developers and writers need to be cautious that not all scientific ideas and practices need to align with the Vedic and Ethno science ideas and practices. Therefore, the transfer of the Vedic and Ethno ideas and practices into the school science curriculum is not a straight path but a more judicious and selective path. This concludes that there are potential connections that could be made among the Vedic, Ethno and school sciences. Some of the connections are laboratory proved. Others are proven in human laboratories. Some others are yet to be established more scientifically.

In conclusion, the study shows that teaching the Vedic, Ethno, and school science together using culturally relevant content, method, material, and evaluation system would benefit students learning science. Additionally, a culturally relevant

science has the potential to make science more connected to local practices and knowledge that could then encourage students to find greater value in learning science. Similarly, teachers and local school districts could be more empowered to draw ideas and practices from local communities as exemplars to show the connections and reach of science directly in students' lives. Finally, since science is about learning how and why natural systems work, the Vedic and Ethno sciences could provide another layer of rethinking about nature and the natural systems that are more intimately connected to people's lives, culture, and centuries of practices. Thus, providing opportunities for our teachers to make science learning fun with a focus on critical thinking and new ways to explore and understand science and its value in the lives of people.

Declaration

I hereby declare that this dissertation has not been submitted for any other degree.

Kamal Prasad Koirala

Degree Candidate

January 2023

Recommendation Letter

We have read and recommended the dissertation titled "**Connecting Vedic and Ethno Science with School Science Curriculum of Nepal**" submitted by Mr **Kamal Prasad Koirala** for the degree of Doctor of Philosophy in Education (Science Education), to the Faculty of Education, Tribhuvan University for its final acceptance.

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Approval Letter

The dissertation titled "**Connecting Vedic and Ethno Science with School Science Curriculum of Nepal**" submitted by Mr **Kamal Prasad Koirala** for the degree of Doctor of Philosophy in Education (Science Education) has been examined and approved on 27 January 2023.

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Kamal Prasad Koirala
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AD	=	Anno Domini
ASC	=	Altered State of Consciousness
AV	=	Atharva Veda
BC	=	Before Christ
BCE	=	Before the Common Era
B.Ed	=	Bachelors' of Education
BG	=	Bhagavata Geeta
BS	=	Bikram Sambat
C	=	Content
CDC	=	Curriculum Development Centre
CE	=	Common Era
CERID	=	Research Centre for Educational Innovation and Development
DRP	=	Decolonial Research Paradigm
E	=	Evaluation
EA	=	Ethno Agriculture
ECG	=	Electroencephalograph
EE	=	Ethno Ecology
E-EAM	=	Ethno Ecology, Ethno Agriculture and Ethno Medicine
EK	=	Ethno Knowledge
EM	=	Ethno Medicine
ERO	=	Educational Review Office
ES	=	Ethno Science

HESCO	=	Himalayan Environmental Studies and Conservation Organization
ICT	=	Information Communication and Technology
INGO	=	International Governmental Organization
IST	=	Information Science and Technology
KUSOED	=	Kathmandu University School of Education
M	=	Methods
M.Ed	=	Masters' of Education
MoEST	=	Ministry of Education Science and Technology
NAST	=	Nepal Academy of Science and Technology
NCFSE	=	National Curriculum Framework of School Education
NEB	=	National Examinations Board
NEP	=	National Education Policy
NGO	=	National Governmental Organization
NSTIP	=	National Science Technology and Innovation Policy
OBT	=	Occupation, Business and Technology
PD	=	Professional Development
QSR	=	Quantum Speed Reading
RECAST	=	Research Centre for Applied Science and Technology
RV	=	Rig Veda
SE	=	Science and Environment
SS	=	School Science
STEAM	=	Science Technology Engineering Arts and Mathematics
STEM	=	Science Technology Engineering and Mathematics
STS	=	Science Technology and Society

TC	=	Transcendental Consciousness
TEK	=	Technological and Ecological Knowledge
TM	=	Transcendental Meditation
USA	=	United States of America
VS	=	Vedic Science
WHO	=	World Health Organization
WMS	=	Western Modern Science
WSK	=	Western Science Knowledge
YV	=	Yajur Veda

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Chapter I

Introduction

This is a study on the connection of Vedic and ethno science with the school science curriculum of Nepal. It aimed to see the relationship between Vedic saying, community doing and school science teaching. This introduction section includes Ethno science with non-literates and the connection of non-literates' science with Vedic and school science. Then I follow by the statement of the problem, research questions, significance of the study, delimitations, and the operational definitions of key terms.

Ethno Science with Non-literates

Thirty-five years ago, I studied at the primary level at Shree Himalaya Secondary School in the Gorkha district. During that time, I did not have access to the radio and watch to check the time to go to school. My non-literate (can not read and write the printed text) mother used to remind me that I was getting late for school. She used to urge me to take lunch and get ready for school as quickly as possible. I would follow my mother, grab lunch and go to school. After finishing the class, sometimes I used to play volleyball and often reach home late in the afternoon. My mother used to question why I was late that day. Most of the time I studied at night. Then my mother used to tell me to sleep. I found that she used to estimate time by looking at *Tintare* (the belt of the constellation Orion). She used to wake me up by looking at the *Dhrubatara* (Pole star) and *Sukratara* (Venus – in Nepal people call the planet venus Sukratar - venus star) in the morning.

My mother's time calculation method made me curious: how she knew it was time to wake up, go to school, and sleep at night. In response, my mother told me that she calculated time by seeing the shadow of houses and the distance covered by the

sun in the *Akash (S*ky) during the day. In the evening, she looked *tintare* (Orion's belt) and calculated the distance by using her *kuret* (distance between the Thumb finger and Index finger). In the same way, she calculated the length of *Sukratara* and *Dhrubatara*. In the rainy season, she used to look at Gande *(Goat weed/Azeratum conyzoides L.*) *Jhar*'s leaf and *Junkiri* (small lighting insect) make noise as an alternative to the sun's distance. Now I realize how my non-literate mother possessed knowledge of astrology and time calculation. This made me curious to know how my non-literate mother understood every day science.

One day, I cut the branches of Peepal (*Ficus religiosa*) tree, planted in *Chautara* for animal fodder. When my parents saw this, they were angry and asked me to stop it, saying this tree is a form of God Bishnu. They felt that cutting Peepal was a sinful deed because it gave cold air to the travellers resting under it in the Chautara (Koirala, 2022). Their knowledge indicated that they were botanists and humanists because they knew that the Peepal tree generates oxygen and relieves the travelers.

When I had abdomen pain, my mother assumed that my stomach was infested with *Juka* (roundworm) or had the problem of Ganao (gastritis). She used to prepare kharanipani (a mixture of water and ash i.e. source of base) and asked me to drink it. After sometimes, I got relief from the pain. For my diarrhoea, she used to give me the solutions of Guava/ Psidium Guajava (leaves and bark), Ghordtapre (*Centella asiatica*), Bel Patra (*Aegle marmelos*) and Rani Sinka (*Cheilanthes dalhousidae*) (Rai & Singh, 2015). This indicated that my mother knew medicinal plants as that of a pharmacist.

My mother used to preserve seeds by mixing Kharani (Ash*)* and Timur *(Zanthoxylum aramatum)*. She used to keep seeds in an air-tight container to store

them for a long. This shows that she knows pest control methods. My father used Titepati (*Artemisia indica*), Asuro (*Adhatoda vasica*) and Khirro (*Wrightia arvorrea*) to get organic fertilizer for good food production (Rai & Singh, 2015). This means that he is a disguised agricultural scientist.

My father arranged the bed with position of the head toward the east. Sometimes, I used to change the directions. Then he used to yell at me by saying, "Aren't you *padheko manchhe?"*(educated person). He suggested that we should never sleep heading in the north direction. If we did so, it would disturb our minds and hamper concentration power. This shows that my father was teaching me about the effect of the terrestrial magnet containing north to south.

My neighbour used to make wooden ploughs in different sizes based on the size of oxen, the soil's hardness, and the terrain's (Koirala, 2022). This shows that my neighbour knew many aspects of making a plough. This means he was an engineer, a mathematician, a soil scientist, and an agriculturist. This kind of transdisciplinary and multidisciplinary knowledge and skills that I am curious about knowing how my neighbors, without formal schooling, understood skills and knowledge; and how I could then find links between local knowledge and the knowledge taught in schools.

My next neighbour was a blacksmith. He used to make iron and copper pots, pans, and utensils. In doing so, he knew the required temperature the metal had to be heated to get it into the required size and shape of the utensils (Koirala, 2022). He would use coal as a source of energy. He used a mixture of different chemicals to weld the other parts of metals together to give a fixed shape or to sharpen his tools (Koirala, 2022). This shows that my blacksmith neighbour was a mechanical engineer and chemist. My observation of his work further raised my curiosity about the ways of connecting his indigenous knowledge with the school curriculum.

I present these examples of Ethnoscience practised by the non-literates to show how knowledge has been used and how it has been produced. There are many science-like practices in the community. I categorized their sciences into three broad areas: Ethno agriculture, Ethno medicine, and Ethno ecology to delimit my study area (Pieroni et al., 2005). I reviewed Vedic literature to find out the perennial sources of the non-literate sciences. Then I examined the connection of the three areas of Ethnosciences with the school science curriculum in content, method and evaluation.

Connection of Non-literates' Ethno Science with Vedic and School Science

To explore the perennial source of non-literates science, I studied the Nepali translation of four Vedas, Upanishad, BhagvatGeeta, Brahma Sutra, and Shrimad Bhagavat Maha Puran. After reviewing these literatures, I felt that our seers envisioned the knowledge much earlier than the current modern science. It was transferred to the new generation through Sruti (hearsay) and later appeared in written form. Below I present some of the key examples from various Vedic texts to show knowledge and wisdom that sustained a balanced environment between humans and posthumanists.

a. Vedic seers in agriculture:

   Vedic seers suggested different agricultural tools, agricultural ingredients, agricultural land, irrigation methods, values of cow dung, cultivation system, and their nutrient value. Example of agricultural knowledge of the Vedas:

   - Wheat, til (sesame seeds), kush, jwano, bayar, katusha, ghee, honey and paddy were used as nutritional foods (AV.21.30)
   - Sun evaporates the water consistent in the ocean and irrigates the earth's surface (AV, 13.3.9)

- Praying farmers to Asvinkumar against petty destroyers of crops (AV, VI. 50)
- Indra himself was considered the designer of the agricultural field with sufficient water to provide nutrients (AV, 3.17.4), and plough share is regarded as the leading agricultural tool (AV,3.17.3)
- People in the Vedic period used: a. Divyah (Rain water) b. Khanitrimah (Water of wells) c. Svayamjah (Spring water) d. Samudrarthah (The water of the rivers falling into the sea) for agricultural purposes (Kaur, 2014, p. 361; RV, 7.49.2).
- They used grafting between Khair and Peepal (AV. 3.6.1) and Sami and Peepal (AV. 6.11.1)
- Sharp agricultural tools were recommended for the cultivation and harvesting of foods (AV, 3. 17.2)
- Fertilizers help to increase the food product of land (RV, 3. 8.7) and focus on the selection of appropriate seeds in a proper season as well as focus on control of over rain and drought for crop production (AV, 7.18.1-2)

b. Brahmanic (authors of Brahman) seers in agriculture:

   In *Satapatha Brahmana* the farming process has been described in four words *Karsana* (cultivating the field), *Vapana* (sowing seeds), *Lavana* (reaping the harvest), *Maida* (threshing) (Kaur, 2014) indicates that the agricultural practice of Vedic period was not less scientific than the modern practice.

c. Connection of Ethno medical science with Vedic literature: Vedic seers suggested different medicines. These medicines have now appeared in the

form of Ayurveda, Naturopathy, Mudra chikitsa, and shamanism. Below is the list of selected examples of each medicinal knowledge from the Veda:

- Sunlight is used to cure heart attack (RV.1.50.11) an example of Naturopathy
- Aswinikumar jointed artificial iron leg to Vispala, who lost it in a war (RV 1.116.12) is an example of surgical technology like modern science
- Pure water is considered a nutrient like a mother's milk (YV. 36.16; Samaveda, 2.4.4).
- Peepal and Palas have not only spiritual values, but they were used as life energy providing medicinal plants in the Vedic period and used to cure disease (YV, 12.79-80)
- Milk, ghee, honey, and soma are used for their nutritional as well as medicinal value (YV, 21.33)
- Soma is described as the king of the world, has the power to prolong the life of humans, and is called the king of heaven and earth, of humans and gods (RV. 8.48.4, 9.96.10; 9.97.24)

d. Connection of Ethno ecology with Vedic literature: Vedic seers suggested different ecological ways to maintain the earth's balance. This environmental knowledge was transformed in other sociocultural groups as a spiritual practice. Below is the list of the selected examples of ecological understanding of the Vedic period:

- The whole universe is considered a sacrifice (Yajna), and natural cycles such as the carbon cycle, water cycle, nitrogen cycle, Saurya cycle, Moon cycle and Ritu cycle help to protect the environment

and save from pollution (Dvivedi, 2004; RV, 10.90.6 & YV, 31.14).

- Peepal is worshipped as a form of Bishnu (BG, 10.26; 15.1) and protected for its ritual values since the Indus Valley civilization; however, it ultimately helped to control air pollution by absorbing the pollutants (Carbon-dioxide) from the atmosphere, providing a massive amount of oxygen and used as Ayurvedic plants (AV, 5.4.3; Kumar, 2008)
- The water cycle is described as Maruta carrying water from the ocean, reaching the sky, and returning to earth. That water helps to grow the rice, wheat, barley and other medicinal plants on the earth (AV. 4, 27.2)
- Excretion, urine, blood, animals meat, and poisonous substances should not be thrown in the water (Manusmriti, 4.56)
- RV mentioned the protective layer of an atmosphere protects us from the unwanted radiation (ultraviolet rays) of sunlight which is now called the ozone layer (AV, 4.2.8).
- Yajna is considered a way to protect against water pollution through smelting Vayu (RV, 1.23.18)
- The *mantra* takes about concord with the universe-peace of the sky, peace of mid-region, peace of earth, peace of the water, peace of plants, peace of trees, peace of all-gods, peace of Brahman, peace of universe, peace of peace (AV, 19.9.14 & YV, 36.16). This mantra also helps to protect the environment.

The above-discussed evidence indicates that Vedic knowledge transformed into a different cultural society. My non-literate mother, literate father, and my non-literate neighbour learned it as spiritual and cultural values. The present generation neglects such knowledge's importance in society and the curriculum development sectors. Upadhyay (2022) said there had been much-needed research in science education by embedding Vedic and cultural experiences in science teaching. Therefore, this study attempted to link this Vedic and Ethno knowledge with the current science curriculum to explore the cultural practices of local people.

Moreover, it supports the documentation of culturally practised knowledge that is still not explicit in school science education. As I mentioned earlier in this chapter, I focused my study on three broad areas of science, viz., Ethno ecology, Ethno agriculture and Ethno medicine. In doing so, I brought the content, method, and evaluation of the Vedic, Ethno, and school sciences for their potential connections.

Rootless Me

Nepal imported Lord Macaulay's English Model Education via India (Timilsena, 2016). It was further nourished by Huge B. Wood, ignoring the Vedic Sanskrit/Local knowledge system (Parajuli, 2013). In this context, my curiosity increased to know about Vedic knowledge and scientificness of that knowledge in the modern time. On the other hand I was familiar with the ideas expressed by many social reformers concerning the Vedic and religious practices that are not scientific. The social reformers in my neighbourhood taught me the same way. Therefore, I missed the cultural narratives of the communities and their relations with science. I did not get opportunities to read Vedas and Vedic literature in school. This literature was composed of about 3000 BCE (Osborn & O'Hara, 2010). Besides, I had never attempted to see the philosophical and scientific importance and implications of Vedic literature in my context.

Because of my unfamiliarity with the Eastern source of scientific knowledge, I felt that only experimentally verified knowledge is science; what Westerners did and marketed globally is science, and what my ancestors received/accepted as knowledge is dogmatic/spiritual and nonscientific. I had an opportunity to study eastern philosophy during my M. Phil study. I got insights into various aspects of eastern philosophy. What are the scientific practices of our ancestors? When did our ancestors use Vedic science? These questions gave me clues that my parents and neighbours have been using what the west calls science in another form.

Statement of the Problem

I learned Ethno knowledge in the community. I heard Vedic knowledge from the pundits and by studying Vedic scriptures. I learned science at school and university, and now I teach science at a university. However, I did not connect these two Vedic and Ethno knowledge with science in my science teaching for a while. I observed that other science teachers also did not apply these practices in their classroom instructions. So there is a lack of connections between Vedic and Ethno knowledge while teaching school science. I noticed this gap as a problem.

British Colonial rule attacked Hinduism in India through education (Timilsena, 2016). It aimed to make educated people as "Indian in blood and colour, but English in the test, in opinion, in moral and in intellectual" (Osborn & O'Hara, 2010, P. 17). As an education advisor of the National Education Planning Commission in 2010 BS, B. H Wood introduced a similar type of education in Nepal (Parajuli, 2013). This hegemonic impact of the western education system replaced local knowledge, skill, and understanding (Osborn & O'Hara, 2010). I realized that teaching western science without connecting indigenous and Vedic wisdom is also a problem of the study.

Our ancestors' knowledge was labelled as unscientific, useless, and dogmatic. The knowledge practised by Vedic seers and our non- literate people by their intuition, experiences and observation were not taken as authentic knowledge and devalued to implement in the science curriculum. This made me curious to assess knowledge from different sources; hence, I stated this as a problem.

As a teacher, I never realized the community-focused curriculum also unfolds an opportunity for engagement in practice. I taught from the textbooks as directive pedagogy but ignored the situated and peripheral learning of the students (Leve & Wenger, 1991). To bridge this learning, I stated this as a problem to link bookish knowledge with the knowledge of the people around them.

I knew Vedas had provided many scientific thoughts (Osborn & O'Hara, 2010). However, I did not find it mentioned in our school science curriculum. This gap needs bridging at some points. With this realization, I made it a problem of the study.

Research Questions

Research questions must be answerable within the confinement of a research project, derived from contexts that will determine the research's shape, direction and progress (Andrews, 2005). Andrews further added that there is an apparent reason for asking the questions, and its answer will contribute to public debate and add to the existing knowledge. I present my general research questions as well as specific research questions of my study as follows:

Navigating question:

- What can be the appropriate curricular connection for teaching Vedic, Ethno and school sciences together?

Specific question

- What are the scientific notions contained in Vedic scriptures and Ethno practices?
- How can they be displayed in a curricular frame like content, methods and evaluation?
- What could school science curriculum co-exist among Vedic, Ethno, and school sciences in the field of Ethno agriculture, Ethno ecology and Ethno medicine?

Significance of the Study

This study is significant to those who want to examine the connection of Ethno and Vedic knowledge with school science teaching. It is also essential to the students who live in the Ethno world, who study Vedic rituals, and who study modern science to investigate scientific practices everywhere in their personal and social contexts. It is also significant to teachers who get questions from students and parents about science and technology. This study is important to the Gurus and the disciples of the Gurukul, who do not study modern science, assuming that there is no science per se in their Vedic courses. This study is valuable to the pedagogical and policy-level reforms in the central and local education systems to integrate indigenous practices. This study is important to the Ministry of Science Technology and Education, Curriculum Development Centre, Research Centre for Educational Innovation and Development, Educational Review Office, and Higher Examinations Board to prepare national policies for implementing the Vedic and Ethno knowledge at the school level. This significant study could be useful for students who want to critique and explore the Vedic and Ethno practices that could be embedded in science.

Finally, this study is significant to teacher trainers and educators who want to do curricular and pedagogical reforms at the national and local levels.

Delimitations of the Study

Vedic texts, Ethno knowledge, and modern science teaching have several areas that need research. However, I have delimited this study by (a) reviewing the Vedic literature through materialistic scientific views; (b) rereading the national and international research on Ethnoscience; (c) connecting related findings of these sciences obtained from different texts; (d) exploring the knowledge of Ethnoscience with nine Ethno practitioners; and (e) applying hermeneutic approach to understand the Vedic and historical literature.

In this research, I thoroughly analyzed the topics on "the science and environment"; and "occupation, business and technology" in class eight, which relates to ecology, agriculture, and medicine. I intended to explore their connections with Vedic and Ethno sciences. In this process, I used Comte's three stages theory for scientific argumentation on spirituality/theology and philosophy. I also used critical theory and research for critiquing and challenging colonial knowledge. The collateral theory was used for braiding Vedic science, community and Ethnoscience, and school science in the context of school classroom teaching.

Operational Definitions

Vedic Science: Vedic Science (VS) for this study covers Vedic astronomy, cosmology, Ayurveda, architecture and technology, ecology, energy preservation and conservation and spiritual consciousness (Frawley, 2009).

Ethno Science: Ethno Science (ES) is considered socio-culturally practised, preserved and transformed cultural knowledge. It includes Ethno botany, Ethno

pharmacology, Ethno medicine, Ethno cosmology, and Ethno astronomy, Ethno ecology, Ethno spiritual knowledge, Ethno technology and architecture, and Ethno agriculture.

Community Science: Community science (CS) is that science practised by community people since the Vedic period and transformed into day-to-day experiences and field experiments of community people that has helped in the wellbeing of the social lives of people.

School Science: School Science (SS) is the organized body of knowledge obtained through observation by testing facts about the physical world, natural law and society. The scientific inquiry applied includes the evidence-based study of the natural world (Bybee, 2006). It is known as the Eurocentric knowledge system, Western science, or modern Western science. It was started in 17th century for social transformation in Europe as the renaissance movement.

Workplace: A workplace is a location where someone works for his employer. It may be home, farm, factory and office. For this study, work place refers to where the Ethno practitioners, teachers, Vedic purohits/specialists, and curricular designers and textbook writers practice their skills.

Ethno-ecology: Ethno-ecology is considered as ecosystem management, conservation of resources, sustainable development, preserving sacred groves, and preserving spiritual-related plants, animals and places. It mainly focuses on the relationship between living beings and their physical environment, resulting from the people's close relationship with their natural habitat and life experience.

Ethno-medicine: The knowledge of Indigenous or traditional medicine has been passed on from one generation to the other for the treatment and prevention of diseases (Nimoh, 2014). Traditional healers, Medicinal herbs, Medicinal plants,

Shamanic practice, Ayurveda, Naturopathy and Mudra chikitsa collectively play essential roles in serving our social health care from ancient times to the present with Ethno medicine (Nimoh, 2014).

Ethno agriculture: Ethno agriculture (EA) is local agricultural practices of food cultivation, food harvesting, use of local manure, use of local insecticides and pesticides, seed selection and preservation, use of farm tools for good crop yielding and irrigation, and land use system for growing more food.

Panchagavya: A mixture of cow dung, urine, ghee, milk and yoghurt is called Panchagavya. It is mainly used in Nepal, including India, as the sacred substance at the time of Yajna and all other rituals from birth to death.

Decolonization: Decolonization is the process of rediscovery and recovery, mourning, dreaming, commitment and action (Chilisa, 2012). It is also a way of valuing locally practised knowledge from ancestral texts and cultural practices.

Chapter II

Research Methodology

"The process of decolonizing methodologies has brought Western and Indigenous methodologies closer together" (Held, 2019, p. 7)

Decolonizing research methodologies emerged from dominant research methodology to advance indigenous people (Gerlach, 2018)

Introduction

In this chapter, I discuss methodological groundwork to investigate connection of Vedic and Ethno science with school science curriculum. For this, I begin with philosophical considerations such as ontological, epistemological, axiological and methodological assumptions under the decolonizing research paradigm to guide my research ideas in the research process. Then I discuss the post-qualitative and braiding design, which helps me determine the study. Then I use the hermeneutic approach to understanding the Vedic and Ethno science from Vedic scripture and Ethno practices. In the empirical study's methodological mapping, I use transformative participatory methodologies to decolonise and indigenize the research process. Hermeneutic approach aids in understanding the Vedic, eastern philosophies, and cultural scriptures to see them with a scientific eye view. For that, the literature that is seen as appropriate was selected through a systematic review process. I then discuss the participant selection, information collection, and data analysis procedures. Then, I discuss quality standards and ethical considerations followed during the data collection and analysis process. Finally, I discuss the referent theory that I chose and the conceptual framework to reframe my whole study.

Research Paradigm

A research paradigm is a basic set of beliefs or worldviews about 'relational reality' that provides the researchers with a broad worldview and ways for the research (Creswell, 2013, 2007; Denzin & Lincoln, 2013, 2018; Lincoln & Guba, 2013; Yin, 2016). This belief or worldview is itself a paradigm (Lincoln & Guba, 1013) and it is never fixed but always evolving. However, transformative and indigenous research paradigms usually share many of their philosophical underpinnings, decolonizing aspiration and social justice issues (Held, 2019). In this multi-paradigmatic space, I used decolonizing research paradigm, which carries many common characteristics of both the western transformative paradigm and the eastern indigenous paradigm as a holistic and localized worldview. So decolonizing research paradigm supported in critical research for the socially and historically shaped realities based on relativist, relational, multiple, socially constructed realities, and mutual reality based on the multitude of relationships (Held, 2019).

A decolonizing research paradigm [DRP] was developed collaboratively i.e both eastern and western researchers came up with a new framework as the two-eyed view (Held, 2019). With one eye, they explored the indigenous way of doing research. From the second eye, they criticized/ challenged the dominant research methodologies. Here, the DPR emerged as a way to link the dominant knowledge system with the local knowledge system. This epistemic practice of generating cultural knowledge and connecting it with Eurocentric and Whiteness (Shizha, 2012) modern knowledge comes under the rubric of decolonizing research. Higgins (2014) said it is active negotiation and navigation between Indigenous and Western epistemologies and ontologies. As Belczewski (2009) stated, if we use traditional

medicine, ecological practice and Ethno agricutural practice with the current science curriculum, it can be named decolonizing science teaching.

It is an anticolonial research approach that provides a place for indigenous voices and epistemologies in the research process (Datta, 2017). It is an “ongoing process of becoming, unlearning, and relearning who we are as a researcher and educator, and taking responsibility for participants" (Datta, 2017, p. 2). Each research paradigm consists of four basic premises/philosophies – ontology, epistemology, axiology (ethics) and methodology (Creswell, 2007; Denzin & Lincoln, 2018, p. 195). This decolonizing research paradigm also has ontology, epistemology, axiology and methodology as the co-relational ways for indigenizing the present context of Nepal.

In my study, I used the DRM to link the Vedic and Ethno practices of the local people with school science curriculum considering the relational reality. It supports the connection between qualitative (Cram & Mertens, 2016) and post-qualitative (Denzin, 2019) research and tries to link both western and eastern knowledge systems as a two-eye view (Hatcher et al., 2009). This approach supports of braiding (McGregor et al., 2018) the practised cultural knowledge with the modern school science curriculum to reduce cognitive imperialism (Basiste, 1986) among the local people. Moreover, it includes “indigenous ways of knowing in academia, that is, to teach them, to use them in research, to value them as equal to western approaches to knowing and to creating knowledge” (Held, 2019, p. 2). As mentioned earlier, I used the DRP because of many commonalities between the two sets of philosophical assumptions: reciprocity, the multi-faceted nature of reality, the relationality of knowledge, and giving voice to the oppressed community (Held, 2019).

The DRP consists of axiology followed by ontology, epistemology and methodology as philosophical assumptions. According to Grange (2018),

post/qualitative research resonates with many of the ethico-onto-epistemologies of indigenous people and there is no separation among epistemology, ontology and axiology. Details of the philosophical considerations of the present study are below.

Ontological Assumption

Ontology is the "science or study of being, concerned with 'what is' with the nature of existence, with the structure of reality as such" (Crotty, 1998, p. 10). Ontology raises basic questions about the nature of reality and the nature of the human being in the world (Denzin & Lincoln, 2018). Ontology is concerned with the approach of social inquiry mixed with the nature of socio-cultural reality (Bryman, 2012; Creswell, 2007; Lincoln & Guba, 2013; Lincoln et al., 1018; Merriam & Tisdell, 2016) to understand the constructed world (Sousa, 2010). It functions along with epistemology, informing theoretical perspectives on world view on the nature of reality (Crotty, 1998).

Blaikie focuses on positivist ontology of an ordered universe made of atomistic, discrete, observable events, critical rationalists and essential uniformities (Crotty, 1998). But this scientific paradigm has shifted from the natural world to the social world (Scotland, 2012). My ontology is relativism because it values multiple, socially as well as historically shaped realities (Held, 2019; Lincoln et al., 2018). It enables researchers to develop negotiating meaning for action and situations in relational ways (Cohen et al., 2007; Kovach, 2018).

There are many constructed realities as a product of the interaction between languages, consciousness, shared meanings, practices, documents, tools, artefacts and individuals (Cohen et al., 2007; Scotland, 2012). In other words, I believe the real nature of the Vedic and humans locally and sociologically construct Ethno science

through their different actions and interactions in reciprocal ways between humans and the natural world (Kovach, 2018).

The Vedic ontology can also be named as situated and relational. It is also well knitted. Aapah (water) is an example of it which consists of agni (fire), aaditya (sun) and baidyuta (thunder) (Mahesh, 2013). This shows that Vedic ontology is always relational to each other and situational to the lived context.

Burrell and Morgan analyzed ontological, epistemological, human and methodological assumptions underlying two ways of conceiving social reality (Cohen et al., 2007), but my focus is on the relational and reciprocal connection to study the social reality (Kovach, 2018; Wilson, 2008). Extrinsically multiple truths (dualism) in society but intrinsically, they are connected (non dualism) in a unified form (Packer & Goicoechea, 2000).

Thus, the ontology of the multiparadigmatic DRP is based on the multiple socially constructed realities (Held, 2019). It applies the relativist, participatory relationship with nature, culture and historical reality, socially constructed realities, mutual reality based on the multitude of relationships, and socially and historically shaped reality (Held, 2019; Kovach, 2018). Wilson (2008) argued that it is the relationship between great-grandparents and great-grandchild. Datta (2017) said that we could not discover knowledge; we can learn from our ancestors, land and culture, developing reciprocal relationships. In my research study, I emphasize cultural/ community knowledge so that my ontology is based on the relational reality with experience, culture, land, cosmos, living and non-living events, and local knowledge holders for the transfer of knowledge into the new generation of people and transforming myself as a researcher and my participants as co-researchers as far as possible.

Epistemology

Epistemology refers to the theoretical ground for knowledge generation (Creswell, 2007; Merriam & Tisdell, 2016) and the relationship between the research participant and the researcher (Creswell, 2013; Lincoln & Guba, 2013). Epistemology asks, “How do I know the world?” “What is the relationship between the knower and the knowable?” (Denzin & Lincoln, 2018, p. 195). Moreover, it refers to the “theory of knowledge embedded in the theoretical perspectives and thereby the methodology” (Crotty, 1998, P. 3). The epistemology considers what can be known and how what is assumed to exist can be known (Blaikie, 2000; Crotty, 1998) and how the world and society can be known or how human beings acquire/develop the knowledge of the world and its phenomenon (Sousa, 2010). Regarding the knowledge construction of decolonizing epistemology, Kovach (2018) pointed out that “knowledge is holistic and implies empirical, experiential, sensory, and metaphysical possibilities; knowledge arises from interconnectivity and interdependency; knowledge is animate and fluid; knowledge arises from a multiplicity of sources, including nonhuman sources” (pp. 389-390). He further describes the worth of indigenous epistemology as:

> The outline of the stone is round, having no end and no beginning; as the stone's power, it is endless. The stone is perfect of its kind and is the work of nature, with no artificial means in shaping it. Outwardly, it is not beautiful, but its structure is solid, like a solid house in which one may safely dwell. It is not composed of many substances but is of one substance, which is genuine and not an imitation of anything. (pp. 388-389)

Scotland (2012) supported the argument that knowledge is human construction as he argued that “meaning is not discovered, but it is constructed through interaction between human consciousness and the natural world” (P. 11). Decolonizing

epistemologies share characteristics in understanding that knowledge is constructed through trusting relationships that are respectful of cultural norms and values (Cram & Mertens, 2016). With this meaning, decolonizing epistemology helps to connect the sacred and mundane and provides holistic and common knowledge connecting with the empirical and metaphysical world of modern and Vedic science (Kovach, 2018). The Vedic epistemology is based on acquiring higher knowledge or wisdom (Pragya). It can be obtained aagam and nigam ways of knowing. Aagam ways requires Guru. It also values verbal testimony and seeing and analyzing the situation through perception, logical inference, and analogy (Radhakrishnan, 1956I). Nigam follows the path of Neti and Neti to negate the knowings and finally reach the final knowing as Brahma (cosmic energy/super conscience).

In this study, I examined the connection of Vedic and Ethno science with the school science curriculum in the given social context in a relational way. I constructed the meaning of my field findings that emerged through the creation of knowledge and the two-way relationship with the local priest, science teachers, students, Ethno practitioners, curriculum developers and textbook writers.

So what I learned from the cultural practitioners, local students, local pandit/purohit, and science teachers are my knowledge sources. I developed a two-way relationship and reciprocity with my informants as a co-researcher for understanding the cultural reality of my informants about their knowledge development and transformation praxis. Sharing life experience; talking with knowledge holders; observing the social phenomenon, artefacts, and cultural practices; discussing the practices of Vedic and community/cultural knowledge in school science teaching as well as cultural events, and involving the community knowledge holders is the method of generating knowledge in my study.

Axiology

Axiology is a branch of philosophy that studies the nature of value. It is a branch of philosophy that deals with ethics, aesthetics, and religion (Lincoln et al., 2018). It refers to the value system of personal and social reality (Creswell, 2007; Lincoln & Guba, 2013). It is an "answer to all the knowledge available to me, which is the most valuable, which is the most truthful, which is the most beautiful, which is the most life-enhancing"? (Lincoln & Guba, 2013, p. 37). It is expected that social scientists should be value-free and objective in their research and avoid preconceptions about research to treat social facts (Bryman, 2012). However, Christians (2018) and Held (2019) argued that socio-cultural sciences could be purposeful, relational, reciprocal and rational; and should serve value relevance.

Similarly, Held (2019) and Wilson (2008) argue that axiology promotes respectful representation and reciprocity through relational accountability considering social emancipation. Vedic scriptures mainly focus on four purushartha (actions) called dharma, artha, kaam and ultimately moksya. Dharma is a natural and honest act; artha is honest earning; kaam is enjoyment; and moksya is the attainment of the supreme consciousness or cosmic energy. In this sense the Vedic axiology can also be called relational and reciprocal.

This study incorporates the study of Vedic literature and other different types of eastern philosophy and Ethno practices in Nepal and globally. I cannot be completely value-free (Bryman, 2012) and unbiased like the positivist and post-positivist researchers to see the Vedic literature only as a materialistic view but not possible to be value free. While collecting data, I equally valued the information obtained from my research participants. In this process, I reviewed the literature on eastern philosophy written by east and west valuing equality. I considered my

participants' arguments in my writing process as Verbatim in the analysis process and searched the Vedic and scientific proof of what they said. With this approach, I was able to build two-way relational and reciprocal rapport with participants being accountable.

Methodology

The methodology concerns a broad theoretical and procedural strategy for acquiring knowledge about the phenomena under investigation (Creswell, 2007). It is the science of studying how research is scientifically done (Kothari, 2004). Brewer (2001) argued that "it is broader theoretical and philosophical ideas about the nature of knowledge, explanation, and science that the research community gives them authority to endow knowledge as reliable and objective" (p. 2). A methodology focuses on the best means to gain world knowledge (Denzin & Lincoln, 2018). It arouses the methodological question: "How does one go about acquiring knowledge? The answer one can give to this question is constrained by the answers previously given to the ontological and epistemological questions" (Lincoln & Guba, 2013, p. 37). It includes research methods and techniques to employ in the world's inquiry (Sousa, 2010).

Brewer (2001) clarifies the distinction between method and methodology. He defined methods as the procedural rules; methodology is the "broad theoretical and philosophical frameworks into which these procedural rules fit" (p. 2). In my study, methodologies refer to both theory and practice, which I utilized to conduct research activities to accomplish the objectives of the research question. Under the DRP, I employed the transformative research methodology because DRP support for critical voices of my participants for indigenizing school science teaching in the present context. The hermeneutic methodology is used to study Vedic literature and other eastern philosophies critically. The detail of each is given separately below.

Transformative Methodology

DRP is based on the multi-paradigmatic assumption, which consists of transformative research methodology because it supports indigenizing the knowledge system by weaving cultural practices (Held, 2019). This knowledge system follows transformative procedures while learning.

Transformative is in the sense that people in the village share their knowings no matter which content they hold. I consider an experience as a transformative experience for its inherent power to alter something valuable to the person. Paul (2014) gives three ways in which an experience or engagement could be transformative for a person.

First, "An experience is epistemically transformative if the only way to know what it is like to have it is to have it yourself" (p.1). Example: Being able to ride a bicycle for the first time or eat food for the first time. Second, "An experience is personally transformative if it changes your point of view, including your core preferences" (p. 2). Example: Learning about the contribution of Nepali soldiers in WWI and WWII in Europe. Third, "An experience is transformative if it is both epistemically and personally transformative" (p. 2). Example: Becoming a father or mother for the first time, going to college.

Drawing from Paul's definitions of transformative experiences and what is transformative, there are many transformative experiences that Nepali students go through in a good science classroom. In the case of many Nepali schools, students hardly get a chance to utilize their village knowledge in science classrooms as helpful and legitimate knowledge. Yet, when they can do that in a class that gives students a transformative experience learning science. Transformative experiences do not have to be something huge; they can be simple but still valuable to students. For example, a student studying the factors that support plant survival can bring the knowledge from

their village that plants like rice need lots of water, but plants like wheat or mustard need much less water. This gives students a transformative experience of participating in science class because it connects scientific knowledge about the relationship between plants and the amount of water required for the plants to grow well. As viewed by Mashoko et al. (2016), if teachers teach school science in a cultural context, they automatically tend to be transformative while teaching and learning. In other words, it supports the learners' dialogue, engagement, and reflective interaction with the science ideas in the book, teachers, and peers. In this sense, I consider these experiences in science classrooms as transformative.

The transformative approach is based on Ethno methodological procedure. Kovach (2018), states that transformative learning seeks the relationship as an action, which is how we enable community practice to empower both researchers and participants. It develops reciprocity to produce mutual relationships between researchers and participants producing empowering capacity within the community people/participants so that it acts as the decolonizing process (Thambinathan & Kinsella, 2021). The transformative methodology focuses on the emancipation of community people, not just hearing the voices of Western people. It is about liberation from generations of silence, and seeing the world as one valuing modern and cultural knowledge (Held, 2019). It supports the emancipation and empowerment of culture and community people and school science teaching/learning appreciating the community knowledge (Freire, 2000; Held, 2019).

The present school science curriculum (grades 6-8) has found focus on transformative learning pedagogy through project-based work and experimental work as formative assessments. However, there is a lack of connection between school science teaching and community knowledge. Teachers are seen as motivated only by school knowledge, and students cannot develop critical thinking skills based on what

their teachers taught them. Students lack abilities to make arguments and counter-arguments during science learning. So the cultural knowledge that students develop by interacting and living with different indigenous people of Nepal does not dominate school science and is not considered at par with the Modern science; yet school science is socially and culturally constructed (Mashoko, 2022). One way to mitigate the loss of local knowledge in science is to bring community knowledge holders into the formal science classroom to share their indigenous knowledge and connecting that knowledge with school science (Opoku & James, 2021). For example, the chapter on "sustainable development of environment" in grade eight can be co-taught with local people. For example, the local people can share how they are involved in saving the local forest by being active members of the community forest preservation program.

Furthermore, transformative experience for students relied on transformative pedagogy which supports the development of problem-solving capacity, discussion abilities, project-based work, experimental work and engagement of the students in humanistic learning rather than the mere act of teaching how to read and write (Santos, 2009). Upadhyay et al. (2021) also viewed that applying cultural knowledge with in-school science teaching supports transformative learning and decolonizing present science teaching. However, as Banks and Banks (2016) said, the implication of a transformative curriculum and pedagogy in classroom teaching is lacking due to the detachment of the school curriculum from the community's and students' cultural connection during curriculum designing strategies and the teaching-learning actions. A nearly identical view is presented by Mensah et al. (2018), who said that moving toward transformative and social action (practice) teaching in elementary and secondary science classrooms is challenging due to the lack of proper pre-service and in-service professional knowledge and experiences connecting cultural knowledge with school science teaching.

As the researcher, my reflectivity presented in the last chapter also indicates how this study transformed me, as said by Mazirow (Hoggan & Kluobert, 2020). There are four types of the integration process of cultural knowledge within school science teaching: parallel, divergent, convergent, and substitutive. However, I believe that the parallel form of integration, valuing equally cultural and school science, (Mashoko, 2022) supports Vedic and Ethnoscience teaching in the school science curriculum and potentially provides transformative learning and bridging between the classroom and student experience gap (Archer-Kuhn et al., 2020). As Liu (2020) stated, the involvement of teachers, students, educators, and community people should be empowered to implement community knowledge for such types of transformative learning.

Hermeneutics Interpretation

The word hermeneutics is related to the Greek deity, Hermes, the messenger that brought the gods' divine messages to humans. Hermes not only god divine messenger verbatim but also acts as an interpreter to render the word's meaning (Lacity & Janson, 1994). Hermeneutics began as a science of interpretation of religious, sacred, or ancient texts (Wernet, 2013); its practical application is a critical interpretation of a text, especially scripture. Lacity and Janson (1994) further add that the goal of hermeneutics is to "exactly translate the text and discover the intention contained in the text by identifying the intention of the author and placing his or her meaning within its historical and cultural context" (p. 149-150), these rule, however, reflect the background of an interpreter, although they are presumed to capture author's intention. In the initial phase, it was used as a theory of interpretation of the Biblical (Crotty, 1998; Mallery et al., 1987) scripture and then gradually extended to interpret the other text (Smith, 2007).

Historically it was associated with the interpretation of ancient philosophical and historical documents, careful analysis of words, grammar, sentence structure and knowledge of the time and culture in which they were produced, yielding a progressively more profound understanding of the text (Crotty, 1998; Lacity & Janson, 1994). Hermeneutic is one of the methods of interpretive paradigm (Mallery et al., 1987) that grounds the meaning of texts in the intentions and histories of their authors in their relevance to readers. It regards texts as transmitting experience, beliefs, and judgments from one subject or community to others (Mallery et al., 1987). But, Wernet (2013) critiques that "hermeneutics no longer only deals with then arrow topic of textual understanding but widens to the question of understanding as a fundamental principle of human action and everyday life encounters" (p. 234).

Furthermore, I understood that hermeneutic is a science of interpretation and is situated under the interpretive paradigm (Crotty, 1998). Theologians had originally used this method to investigate the inner meaning of sacred texts (Crotty, 1998). It was appropriate for me to adopt the hermeneutical approach because I was going to create materialistic meanings from Vedas, Upanishad, Bhagvat Geeta, and other scriptural and philosophical literature. Most scholars use hermeneuticss to study Vedic literature and cultural system (Frazier, 2010). Frazier further added that the eastern philosophy entails mainly "Sanskrit philosophical reflection in the Upanishad, Bhagvat Geeta, and Brahmasutra"(p. 6). Following his suggestion, I choose hermeneutics as an effective method of study for data generation of Vedic literature with materialist viewpoints.

Most western scholars have also provided the hermeneutic framework for the analysis of different types of texts. Lacity and Janson (1994) provided the text analysis approaches by positivists, linguists, and interpretive interpreters. They further

critiqued that hermeneutic and intentional analysis exemplifies interpretive assumption, and here, “when the researcher cannot directly interact with originators of the text, as in the case of an ancient manuscript, the researcher tries to understand how the author, as well as his or her culture and experiences, influence text interpretation”(p. 140). Interpretivist approaches are also concerned with the contextual circumstances that influence authors and the contextual events that affect researchers' interpretations. They believe that a researcher must learn more about the author, their culture, and the period to understand the text (Lacity & Janson, 1994).

Thompson (1997) applies the hermeneutic grounded interpretive framework for deriving marketing insight from the analysis of qualitative textual data. I also realize that this framework can be used to generate three levels of interpretation: (1) discerning the key pattern of meaning expressed by a given text, (2) identifying the key pattern of meaning that emerges across the reading text, and (3) deriving broader conceptual and managerial implication from the analysis of produced narrative from the text.

The task of this study was to generate meaning by analyzing the Vedas and other eastern philosophies written by easterners and westerners, thereby expressing it in a meaningful materialistic way. For this, I went beyond the literal meaning of Vedic literature, searching for significance between the verses, and making the materialist meaning of the text as my understanding unfolded. I attempted to interpret the in-depth meaning and explore the materialistic implications of Vedic literature.

I began my study by reviewing the literature that explains the world's products from the 18th century to now . Some texts were written around 1500-1000 BCE (Osborn & O’Hara, 2010). Veda is considered the oldest written scriptural text in the world that was compiled, reclassified, renamed, and reinterpretation in India by Veda-

Vyasa. However, I found it's re-re-written and re-re-interpretation (Lacity & Janson, 1994) of the literature in a different language, not the language of Vedic stamp (original scripture).

Like other religious and philosophical texts, recent pasts than Veda were not the original text. These Indian continental religio-philosophical texts are the "development of interpretative formulae in the Indian continent and western as well which was advanced through interpretation and reinterpretation" (Lacity & Janson, p. 150). The six orthodox schools of philosophy, including other Vedic literature such as Upanishad, Bhagavat Geeta, Brahma sutra, and different types of Puran, are products of the hermeneutic of Veda. As Alfred North Whitehead said, “Western” philosophy is footnotes to Plato; the “Eastern” philosophy looks like footnotes to Veda (Ghimire, 2014).

I reviewed original Nepali, Hindi, and English texts based on the above discussion. I reviewed their interpretations by different scholars as far as possible. I considered the historicity and contextualization of these texts while reviewing them (Kinsella, 2006). As a hermeneutical interpreter, I just interpreted other people’s meanings, which can be better or worse. Interpretation can never be final because it is intrinsically incomplete. Every interpretation of a text is not a complete and final interpretation. The interpretation itself is subject to reconsideration with the change in time (Webb & Pollard, 2006).

In conclusion, it can be said that understanding the true meaning of the text of scripture with accuracy has always been a challenging and complex problem in all world religions. However, hermeneutics, the science of interpretation, has helped us establish specific rules, philosophies, and methodologies for interpreting scriptures (Webb & Pollard, 2006). It is not merely a theoretical discipline of the rules or methods of interpretation but a theoretical-cum-philosophical discipline (Webb & Pollard, 2006; Wernet, 2013). It is primarily a search for meaning through these

methods and principles which bring out the textual meaning relevant to the present context.

Webb and Pollard (2006) explained that hermeneutic interpreters should understand the language and words of the text. Although I do not have in-depth knowledge of the Sanskrit language, I attempted to interpret the meaning by studying Hindi, English, or Nepali translation of the text and to understand the authors ' intention of interpretation in a scientific way. I disagree with Dilthey's argument of hermeneutics to advocate the acceptance of text at face value without any critical considerations or review (Webb & Pollard, 2006). As a researcher, I always proceed with a hermeneutical circle or spiral (Webb & Pollard, 2006) and try to be critical in the meaning-making process.

Research Design

A research design is a strategic plan that sets out the broad conceptual structure of research work focusing on research questions and the study's purpose (Brewer, 2000; Creswell, 2007, 2013; Denzin & Lincoln, 2018; Kothari, 2004). It "situates researchers in the empirical world and connects them to specific sites, people, groups, institutions, and bodies of relevant interpretive material, including documents and archives" (Denzin & Lincoln, 2018, p. 58). It is a blueprint that guided me to decide who or what would be studied and the procedures for collecting and analyzing the thought of the participants, as well as its focus on data analysis and report writing procedures. The design is, therefore, a logical map that provides the researcher with a systematic guideline to collect sufficient evidence to address the research questions and reach a conclusion. Yin (2009, p. 26) deals with a research design as the "logical sequence that connects the empirical data to a study's initial research questions and, ultimately to its conclusions about these questions". Following the literature above on research design, I present my design in the following ways:

Figure 1 *The Research Process*

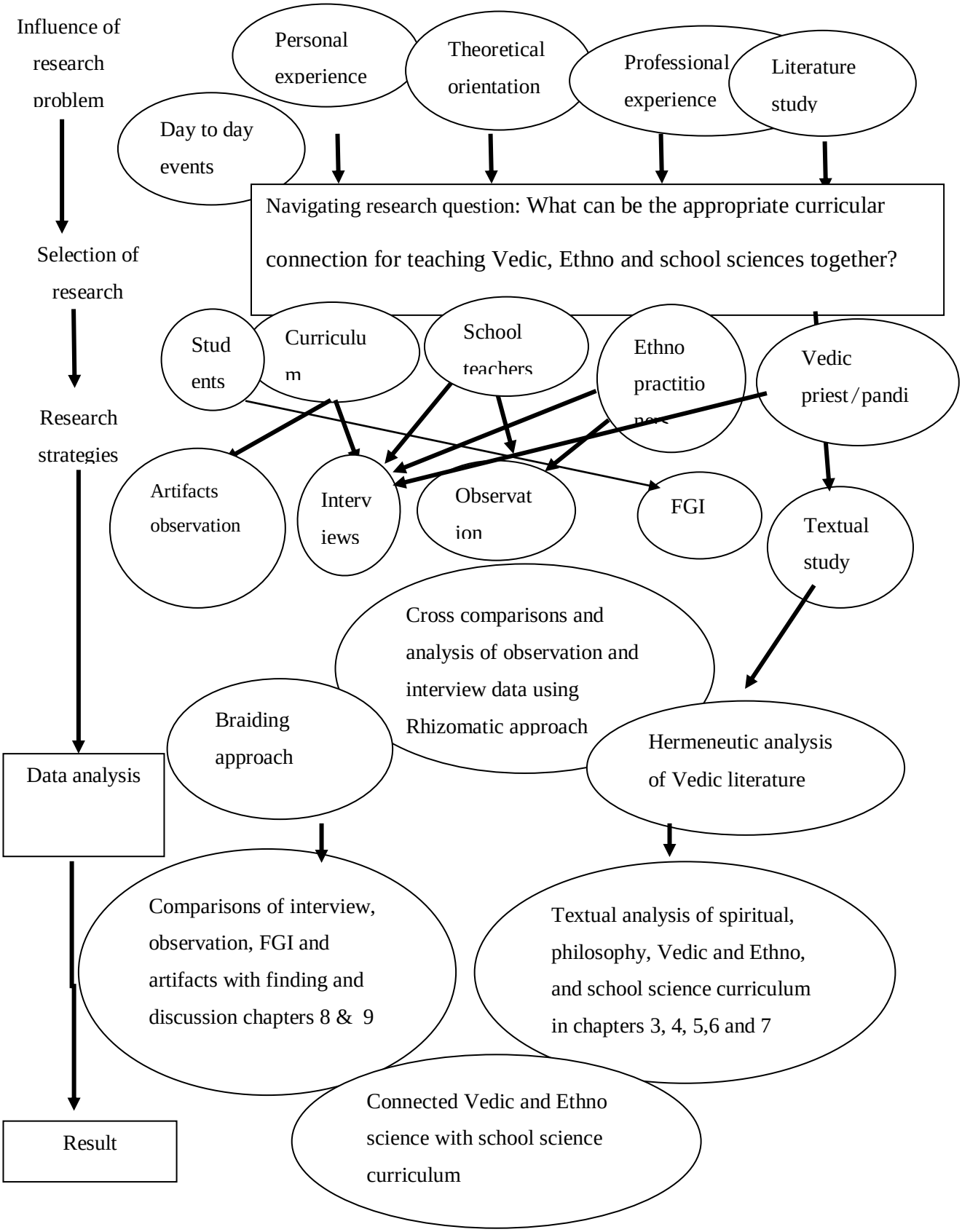


Figure 1 outlines my blueprint or logical map, guiding me from the preliminary stages to question formation about and setting up a conclusion and the research questions. I am aware that in scholarly research practice, researchers use alternative research designs: qualitative and quantitative. Quantitative research focuses only on the physical world, searching for a single reality and not connecting the social phenomenon (Erickson, 2018). Due to failing the traditional deductive/ quantitative (Denzin & Lincoln, 2018) approach, the research has been increasingly forced towards qualitative research since the mid 19th century (Crotty, 1998). However, researchers are now moving toward post-qualitative research after 1990 (Denzin, 2019). Both qualitative and post-qualitative research/inquiry is not a single methodological practice over others. Post-qualitative research is based on the artistic reality of the decolonizing approach (Qsterm et al., 2021). It is an interdisciplinary, trans-disciplinary, and counter disciplinary (Denzin & Lincoln, 2018) field that includes:

> American pragmatic, naturalistic, critical reality, multi-paradigmatic, and interpretive tradition of sociology, anthropology, communication and education, phenomenological, hermeneutic, semiotic, Marxist, post-structural perspectives, feminist, critical theory; and studies of indigenous and aboriginal cultures. (Denzin & Lincoln, 2018, p. 49)

As the data interpreter and meaning creator of Vedic and philosophical literature (Ghimire, 2017), I chose the qualitative research/inquiry design because it is a set of complex interpretive practices which supported my holistic inquiry process. According to Creswell (2013), qualitative research/inquiry design situates the researcher in the empirical world and connects research questions to data. The design is, therefore, a logical map that provides the researcher with a systematic guideline to

collect sufficient evidence to address the research questions and help in conclusions (Denzin & Lincoln, 2018). Moreover, qualitative research involves collecting various empirical materials; case studies, personal experiences, introspections, life stories, interviews, artifacts, Focus Group Interview (FGI), cultural text and productions, observational, historical interaction, and visual text (Denzin & Lincoln, 2018).

For the post- qualitative data collection, in-depth interviews, participatory observation, FGI, sharing circle, artifacts and document analysis methods were mainly employed. Still, the literature analysis is based on the analysis and interpretation of Vedic literature written in Sanskrit and translated into Hindi, English, and Nepali by hermeneutic meaning-making as a materialistic understanding (Coffey, 2014). The rhizomatic approach of Higgins (2014) was used to organize, analyze, interpret and make sense of the textual data.

An iterative rendition study approach (Ghimire, 2017) was used to refine, validate and reach the "theoretical saturation" (Bhattacherjee, 2012, p. 106) of both textual and empirical data (Dey, 1993), whereby any additional iteration did not yield any more insight into the literature - empirical data (Bhattacherjee, 2012).

Generally, social science has five types of qualitative inquiry approaches (ethnography, narrative, phenomenology, grounded theory, and case study) (Creswell, 2007, 2013; Denzin & Lincoln, 2018). Similarly, Merriam and Tisdell (2016) indicated six types of qualitative inquiry strategies (ethnography, narrative studies, phenomenology, grounded theory, case study, and critical qualitative research). These qualitative strategies are appropriate for an in-depth study of the natural phenomena of the socio-cultural dimension. Among the various type of qualitative research paradigms, I prefer post-qualitative research as a decolonizing research because it uses participatory and transformative research/inquiry (Bhattacherjee, 2012; Creswell,

2007; Held, 2019; Merriam & Tisdell, 2016; Stake, 2010). I utilized decolonizing paradigm for the inquiry of Ethno knowledge, its ways of transformation from generation to generation, and empirical data collection connecting with the present school science curriculum.

Likewise, empirical data collected from the interviews, FGI, observation, sharing circle, and artifacts were analyzed, seeking the implication of it in the current science curriculum. Further, the findings from the above analyses that coincide with Vedic and Ethnosciences related to Ethno ecology, Ethno agriculture, and Ethno medicine.

The hermeneutic approach of meaning-making (Moustakas, 1994) helped to analyze the Vedic test with an eye on the scientific notion (Crotty, 1998) and find out how this knowledge was generated and transformed in our culture from one generation to another as community science.

Methods

There are no hard and fast methods for decolonising research like other qualitative approaches (Datta, 2017). Decolonizing process is based on the activities of researchers and community participants. Appreciating the indigenous activities with the involvement of colonized persons and considering their socio-cultural practices could be the primary method (Thambinathan & Kinsella, 2021). Methods include how to conceive, process, and generate the data and analyze, interpret and structure the data of fieldwork or historical/ philosophical documentary study (Kothari, 2004). It has included “observation, narrative, inquiry, arts-based inquiry, the interview, visual research, autoethnography, online ethnography, analyzing talk and text, focus groups, thinking with theory and collaborative inquiry”(Denzin & Lincoln, 2018, p. 59). This argument encouraged me to search the multiple methods

of producing, analyzing, interpreting, and presenting the Vedic literature, and empirical data from the Ethno practitioners, understanding and interpreting this knowledge in a more objective way. Moreover, it helped me find out the practices of Vedic knowledge in societies as Ethno knowledge and search for the connections of its practices in modern science teaching.

Methods are generally used to answer the research problems or accomplish the research objectives. It is a systematic process to deal with different aspects of a research problem. But to understand Ethno knowledge, stories can be told through visuals, performative and textual ways (Kovach, 2018), through which a harmonious relationship develops between the researcher and indigenous practitioners/co-researcher (Moustakas, 1994). This study intended to interpret meaning generated from the text and empirical data sources. So, I used different methods for empirical data collection, described later under the heading information generation tools and procedures.

Participants and Study Contexts

As I already have stated, the empirical part of this study consists of the interviews of local level Ethno practitioners, local and national level selected priests, basic level science teachers, basic level students (class 8), and curriculum and textbook writers from the Curriculum Development Center. The background information of the participants is given in appendix 9. At the national level, I selected a school-level science curriculum designer to find out the bases of philosophical consideration of curriculum, the procedure of science curriculum design and knowledge generation policy as implemented in schools. Similarly, I selected a textbook writer to document his life experiences, perceptions, and practices regarding textbook writing experiences. I purposefully selected three public schools and three

science teachers of the basic level grade from three different backgrounds within the Gorkha district.

I selected three students from Grade 8 to explore their cultural knowledge and its connections with the current school science curriculum. In selecting students, I considered the multicultural context of the classroom.

To understand and explore the practices of Vedic knowledge, and its connection with agroecology, I selected my father as the priest/pandit of my study purposively and convincingly (Patton, 2015). Another participant was taken from a Vedic specialist in Nepal, who could explain the meaning of the texts and had a deeper understanding of the Vedic philosophy. One had the minimum knowledge to translate the meaning of Veda, Bhagvat Geeta, and Puran in Nepali, and another participant had Vedic knowledge as *karmakanda*. Both helped me explore so much of the Vedic knowledge that they were performing a co-research level task and also building a relational connection with me. From this, I developed both the Vedic and the community knowledge, which supported me in developing the decolonizing idea.

To understand the Ethno practices and knowledge transformation system of different cultural groups, three Ethno practitioner groups (Englander, 2012) were participants. One of the three groups was Ethno ecologists, who used to provide knowledge to save the local environment and earth by preserving and transforming the knowledge from generation to generation. So considering this, I selected participants who knew the eco-friendly environment.

The second group of participants were local agriculturalists, who had been harvesting, preserving, and cultivating different types of crops for a long time. They prepare and use various agricultural tools for farming, using local fertilizers and help transfer knowledge from generation to generation.

The third groups of my participants were Ethno medicinal experts/ local healers practicing Ethno knowledge to treat the disease by using local medicine and helping preserve local medicinal knowledge by transferring it to the new generations. To collect the information from the selected participants, I took open-ended interviews, observed some artifacts and discussed the knowledge generation and transformation process and connecting process with school science teaching.

This study was an exploratory study. The context of the study was not bounded within a fixed geographical region. However, my Ethno practitioners were mainly within study areas of Barpak Sulikot Rural Municipality and its periphery. I selected the schools considering three geographical areas: (S1) a school in a rural area in a multicultural socio-cultural context. In this school, the students belonged to the local community whereas the teachers belonged to different communities as outsiders. The school (S2) is located in the district headquarter, where most students and teachers are outsiders. Most of the students in Grade eight were from Gurung community who came from the different geographical areas (mainly remote areas) of Gorkha district. Third school (S3) was located on the outskirt of Gorkha Municipality, where most of the students were from the marginalized Kumal community. In this school, most of the students were Kumal, but the teachers belonged to various cultural groups. These three geographical contexts (see appendix 8) and school contexts supported me in understanding students' and teachers' diverse views, ideas, and knowledge about their social-cultural context and understanding how to braid their knowledge with the current school science curriculum.

Entry in the Field and My Reflection

As an exploratory research, I did not bind the fixed area's participants for my study. My motto was to explore the Vedic and Ethno knowledge that they learned and that

had been transferred to the new generation. My focus was on how my participants understood and what types of knowledge they gained through the socio-cultural context. So field engagement, like the ethnographic study, was not my motto. So, I selected the field as the broader context. However, I selected the schools considering the socio-cultural context for exploring knowledge differently.

The socio-cultural context of the study area was familiar to me because I had visited the study area before I started my research. Most of the participants were familiar with me except the students. When I got permission to collect data from the university, I visited the selected schools. I was familiar with all the staff members and headteachers of those schools. Being familiar with the headteachers of these schools, I did not have difficulty sharing my research goals. The headteachers and science teachers welcomed me into their school and allowed for classroom observations. I felt that they had an enthusiasm for my study. Science teachers and head teachers assisted me in selecting the participants from the students. Science teachers were happy to share their experiences with me. The selected students were curious to explore their knowledge and experiences about the cultural practices and their experiences with me. A harmonious environment was created with the selected students when I was in the field. However, I did not meet them frequently due to COVID- 19 Pandemic situation. After the three initial focus group interviews at school, further investigations of their knowledge were carried out by using telephone interviews to prevent the spread of the disease for the saturation of my study data.

Being familiar with the sociocultural context of my study areas, I did not feel any hesitation or difficulty collecting the information I needed. I met all the participants in their homes and workplaces. I started to discuss them informally. I did not take any type of formal consent with them because my purpose was only to

explore the knowledge, ideas, perspectives and practices so that it could assist in reforming the current school science curriculum. Most of the Ethno participants were familiar with me. They were curious to share their experiences with me. I had planned to do a focus group interview with Ethno practitioners. It was not possible during the field visits. So, I conducted personal interviews and asked my informants to share their personal experiences (Chilisa, 2012) about their cultural practices. In this process, I visited them three times in one-week intervals at their home and workplace for information collection. All the participants freely expressed their experiences, ideas, understanding and skills they had developed in their life without hesitation. I felt they provided sufficient information in the data analysis process. I did not need to meet them frequently for the interviews and story-sharing.

For the data collection with curriculum specialist, textbook writer and the Vedic specialist/ pandit, I conducted telephone interviews due to COVID-19 pandemic. In this way, I collected the information required for this study. In this context, I conducted five informal sharing circles (Chilisa, 2012) with teachers, students, the chairperson of the school management committee, and headteachers. I did informal telephone interviews with more than five purohit/pandit.

Data/ Information Generation Tools and Procedures

Data collection is known as the information and knowledge collection procedure, which is collected from experience, observation, and experiment (Yin, 2016). To accomplish the research goals, appropriate data collection procedures are essential. Merriam (2009) critiques that qualitative data is used to collect quotations from people about their "experiences, opinions, feeling and knowledge"(p. 85). In qualitative research, data serve as the foundation of a research study, and relevant data may come from four data collection methods: interviewing, observing, collecting and

examining (materials), and feeling (Creswell, 2007; Yin, 2016). But, Mavhandu-Mudzus (2018) included "individual interviews, focus group interviews, documentary reviews, and observation in data collection method of qualitative research" (p. 2), whereas Patton (2015) added interviews, observations and field notes, and documents as a data collection tools.

In qualitative research, the researcher is the leading research instrument, and the researcher makes the meaning of collected data giving the reality about the phenomenon. Moreover, according to Creswell (2007), qualitative researchers also collect data from email messages and online gatherings. In the present chapter, as an exploratory researcher, I used qualitative and post-qualitative data collection approaches to decolonise the study.

This chapter presents the data collection tools and methods (called procedure). It describes how and what types of interviews were accomplished, what, when, where and how observations were conducted. Similarly, it describes where and how materials and artifacts were collected during fieldwork and how the participants' feelings were recorded. It presents how I built relationships and maintained accountability with the participants (Held, 2019; Kovach, 2018; Yin, 2016) to explore the phenomenon related to my issues.

Interview/ Story Sharing

Interviews/ story sharing provide researchers with rich and detailed qualitative data for understanding participants' experiences, how they describe those experiences and the meaning they make of those experiences (Rubin & Rubin, 2012, cited in Castillo-Montoy, 2016). Interviews/ story sharing are used when the researcher wants to document information that are hard to observe (Chilisa, 2012; Merriam & Tisdell, 2016). An interview yields direct quotations from people about their experiences,

feeling, opinions, and knowledge, and the purpose of interviewing is “to access the perspective of the person being interviewed” (Patton, 2015, p. 55). Interviews/ story sharing are one of the most essential sources of information in decolonizing study because a researcher and a participant engage in a relational conversation, increase reciprocity, and focus on questions related to a research study (Held, 2019; Merrium, 2009). It is a primary source of information that comes from the person’s life experience of the natural phenomenon through the informal, relational, reciprocal and interactive process as the story form (Chilisa, 2012; Moustakas, 1994; Patton, 2015).

Standardized open-ended, informal conversational (called ethnographic interviews), and semi-structured interviews are commonly practised in qualitative research. I used many types of open-ended approaches in this exploratory research (Held, 2019; Merrium, 2009; Patton, 2015).

For the open-ended approach or open dialogue, Chilisa (2012) called the learning circles, which give room for collaborative flexibility in exploring the natural phenomenon. Using this form of inquiry allows the interviewer to ask participants for the facts or opinions/experiences about the phenomenon. In some situations, the interviewers may even ask the respondents to offer their insights/stories into certain occurrences and may use such propositions as the basis for further inquiry (Yin, 2016). Both qualitative and post-qualitative decolonizing interviews/story sharing are based on reciprocal and relational accountability (Wilson, 2008).

In my exploratory decolonizing study, each Ethno practitioner and teacher was asked to respond to the open-ended interviews/ dialogues. I prepared an interview guideline (Castillo - Montoya, 2016; Patton, 2015) that was developed based on theory and literature, which guided the open-ended interviews/storytelling for proving the reliability and fixed boundaries of the study’s research questions (Castillo - Montoya, 2016).

Before conducting post- qualitative interviews/ story sharing, the researcher considered building the rapport between interviewer and interviewee (Creswell, 2007) utilizing warm, caring, and empowering dialogue in the interviews. This helps two-way trust between the interviewer and the interviewee for gathering required information (Creswell & Poth, 2018) and helps to stop the domination of the interviewer in the interaction. The interview dialogue flowed naturally and I gathered information about what the Ethno practitioners' experiences and practices were about their cultural knowledge; how they gained knowledge from their elders; how they transferred their expertise or knowledge to the new generation, and how they linked their learning in school science curriculum and how they linked this knowledge with day-to-day life experiences. The open and telephone interviews/sharing were conducted with science teachers about the implications of cultural knowledge in the school science curriculum, mainly focusing on the E-EAM, including social practices. Moreover, they found it challenging to teach spiritually and culturally embedded knowledge that is transferred from generation to generation. As the experience and understanding of the Vedic practitioners towards the use of the Vedic knowledge, its preservation, and practice system, the selected Vedic practitioners' views, experiences, and stories were collected using open-ended face-to-face or telephone interviews.

The curriculum designer and textbook writer participated in telephone interviews only to understand the experience of curriculum and textbook preparation practice. I interviewed them to learn the policy-level understanding and implementation process of science curriculum development and to explore their views about reforming the current science curriculum and textbooks. Open-ended telephone interviews/ dialogue was recorded on mobile phone recorder, and the recorded data

were transcribed in Nepali (Creswell, 2007) at first and then translated into English (Stirling, 2001) for the purpose of themes generation and analysis.

Focus Group Interviews/ Sharing Circle

The group interviewing/ sharing with participants involve interviewing several participants at the same time, the emphasis being on questions and responses between the researcher and participants. Patton (2015) explained that "as a method of qualitative research data collection, a focus group is an interview on a topic with a group of people who know about the topic"(p. 93); Ethnocultural students have knowledge of Ethnoscience and to explore their knowledge and understanding and their knowledge transformation process, I carried out focus group interviews (FGI) with them because I am well aware of the fact that Nepali students being the culturally and economically marginalized, they are shy to interact with outside people. Further, they are reluctant in a one-to-one interview/ sharing setting to explore their understanding of the use of Ethnoscience and their connection to the current school science curriculum (Merriam & Tisdell, 2016). The importance of FGI is justified by Merriam (2009), clarifying the following version

> Unlike a series of one-on-one interviews, in a focus group, participants hear each other's responses and make additional comments beyond their original responses as they listen to what other people have to say or share. However, participants need not agree with each other or reach any kind of consensus. Nor is it necessary for people to disagree. The object is to get high-quality data in a social context where people can consider their views in the context of the opinions of others. (p. 94)

There is an assumption that a one-on-one situation can make rural economically and culturally marginalized students anxious and inhibit can do discussion, while

'safety in numbers' diffuses this anxiety. Another assumption is that the interaction of group participants stimulates talking and makes it easier for them to open up. Therefore, group interviews were conducted for students to reduce anxiety and stimulate talk and self-disclosure. FGI elicits interaction, brings out differences, and engages in a cooperative and creative endeavour for sharing experiences (Creswell & Poth, 2018). This process fits well into the constructivist/interpretive and decolonizing research paradigm (Chilisa, 2012; Merriam & Tisdell, 2016). With these considerations, an open-ended interview guideline was designed to conduct FGI/ sharing circles with students. The focus of these interviews/sharing circles (Chilisa, 2012) was to gain insight into how the students experienced Ethno knowledge, how they were involved in learning activities, how they obtained the knowledge, and how the knowledge was transferred in their community. Similarly, it was used to understand why their knowledge was essential in day-to-day practice, how they could preserve their knowledge and how this knowledge could be braided with the present school science curriculum. It also sought their suggestions on ways of improving the existing practice of the school science curriculum.

Merriam (2009) argued that there are no hard and fast rules about how many participants to include in an FGI/ sharing circle, although most writers suggest somehow between six to ten participants are preferable. Yin (2016) indicates that two to three participants are sufficient for small group discussions/ sharing circles. But Chilisa (2012) proposed two to twelve participants for taking sharing circle. So, I followed their suggestion and included three participants in each FGI/ sharing circle, and it was conducted three times in each school.

Observation/Watching

Detailed descriptions of people's activities, behaviours, and actions, are recorded in observations (Merriam, 2009). In a decolonizing inquiry, there are no hard

and fast prescribed tools for data collection; however, in-depth interviews and participatory observation seem important to understand the interviewee's experience about the phenomenon and knowledge generation practice (Chilisa, 2012; Patton, 2015). Direct observation in a decolonizing study occurs when the investigator has the opportunity to gather data through observation and participation to become a part of the experience and the phenomenon for a better understanding of it (Chilisa, 2012; Creswell, 2007; Patton, 2015). The value of direct observation is justified by Patton (2015) as a scientific method as follows:

> Astronomers observe the cosmos, biologists' nature, and social scientists' people. Our ancestors observed fire and figured out how to control it. Copernicus observed the movement of the planets and placed the sun at the centre of the solar system. Newton observed falling objects and figured out gravity. Darwin observed species variation and theorized about evolution. All scientific knowledge is rooted in observation. (p. 495)

Patton (2015) has given many phrases such as "field-based observation, including participant observation, fieldwork, qualitative observation, direct observation, or field research to understand and capture the context in a holistic perspective for qualitative analysis" (p. 499-450). My participant observation was related to Ethno practitioners to understand their everyday practices, knowledge transfer process and teacher’s classroom teaching science about the cultural connection in their teaching. So my participatory observation supported building a reciprocal relationship (Held, 2019) between the participants and me.

Merriam and Tisdell (2016) stated that participant observation is done 1) observations take place naturally where the phenomenon of interest naturally occurs instead of a location designed to interview, and 2) observational data represent a first-

hand encounter with the phenomenon of interest rather than a second-hand account. In this type of participant observation, I used my knowledge and experience to interpret what is observed in the field, recording the behaviour and understanding what participants may not feel free to discuss or not want to discuss. Observation is based on the research purpose and research question. I watched "physical setting, participants activities, interaction, conversation practice, and their behaviours during the observation by using the senses; including sight, sound, smell, touch, and taste"(Creswell & Poth, 2018, p. 232).

Moreover, the purpose of participatory observations in my research is to observe the use of culturally relevant Ethno knowledge practice and find out their knowledge-generating process from sociocultural understanding to link with school science teaching. For this purpose, first of all, I took interviews/ dialogue before the observations (Merriam & Tisdell, 2016) of their activities regarding the knowledge generation and transfer process. I then observed the trustworthiness as they mentioned it.

For this study, I did participatory classroom teaching observations of the teachers teaching science in public schools. I recorded observation data as follows:1) descriptive notes and expanded fieldnotes, and 2) a diary and journal- written reactions and concerns throughout my fieldwork. During the data collection process, I attempted to write my field notes as reflections as soon as possible (Creswell, 2007). My role as a researcher was as a participatory observer and developed a two-way relationship and accountability (Held, 2019) with participants in the decolonizing study to know the detailed behaviour of participants regarding cultural practices in classroom teaching. I collected the information being a participant maintaining reciprocal connections (Chilisa, 2012) with my participants for the optimum saturation of required data.

Observations represent a first-hand encounter with the phenomenon of interest of the researcher. I carefully observed/ watched, systematically experienced, and consciously analyzed observations for meaning-making and reduced the evidence of personal bias (Glesne, 2006). Figure 2 shows my way of observation.

Figure 2 *Procedures for Preparing and Conducting Observations*

Source: Creswell & Poth (2018)

Document/ Artifacts Analysis/Viewing

Document analysis/ viewing is another important qualitative data collection procedure. Documents are objective, unobtrusive and non-reactive measures in social science, which include physical traces, official records, private documents, and simple

observations (Merriam, 2009, Yin, 2016). Documents are a term used broadly to refer to "printed and other materials relevant to a study, including public records, personal documents, popular culture, visual documents, and physical artefacts" (Merriam, 2009, p. 86). He further suggested that various types of documents included excerpts, quotations, or entire passages extracted from multiple types of documents. Moreover, Patton (2015) critiqued the document analysis:

> Written materials and documents from organizational, clinical, or program records; social media postings of all kinds; memoranda and correspondence; official publications and reports; personal diaries, letters, artistic works, photographs, and memorabilia; and written responses to open-ended surveys are collected. Data consist of excerpts from documents captured in a way that records and preserves the context. (p. 56)

Documents are generally a ready-made source of data easily accessible to the imaginative and resourceful investigator, including a wide range of written, visual, digital, and physical materials relevant to the study (Merriam, 2009). Moreover, following materials are parts of the documents: official records, letters, newspaper accounts, poems, songs, corporate records, government documents, historical accounts, diaries, autobiographies, photographs, films, and videos (Merriam, 2009; Yin, 2016).

I purposively selected documents that were relevant to my investigation. In this study, I selected, downloaded, and analyzed two significant documents: policy papers, including designed old and presently revised school science curriculum and Vedic literature with artefacts (Merriam, 2009). Regarding the policy papers, I analyzed the policy of curriculum designing, including the educational acts, educational commissioners' reports, science curriculum, agency reports, and foreign

policy guidelines of different times, which assisted me in understanding the situation of both modern and Vedic science practices and identify the link with Ethno knowledge. In the selection process, I applied the Google archive, Library Genesis, and Google scholar.

As suggested by Glaser and Strauss (1967cited in Merriam, 2009), in the Vedic aspect, I consulted the library, bought books, studied magazines, reports, archives, Internet sites, and Journal articles (Yin, 2016); the Vedic literature like Vedas, Upanishad, Bhagvhat Geeta, Manusmriti, Brahamsutra and westerners' translated Sanskrit books as well to understand the Vedic reality, their verification process and westerners' interest towards it. In the ways of Vedic literature analysis, I tried to observe my focus was on the materialist viewpoint and analyzed by applying the hermeneutics approach described earlier in this chapter.

Participants Selection Strategies

Sampling is an essential procedure in the research procedure. Sampling is generally used in quantitative research. However, the qualitative inquiry frameworks are based on paradigmatic, philosophical, and theoretical orientation, guiding inquiry towards core questions to do the sampling (Patton, 2015). Qualitative researchers routinely work closely with relatively small numbers of people, interactions, situations, cosmos, or spaces; it is central that these are chosen for good analytics (Chilisa, 2012; Rapley, 2013). In the qualitative inquiry process, the sampling and analysis process is iterative. Through the sampling, appropriate participants who can be helpful in fulfilling the objectives can be selected. According to Patton (2015), sampling decisions focus on specific people, situations or sites because they offer a specific - 'biased' or 'information-rich'- perspective. Participants are always considered to have prior knowledge about the land, cosmos, and nature.

The logic and power of purposive sampling lie in selecting information-rich cases for in-depth study. One may learn much more by focusing in-depth on understanding the needs, interests, and intensive of a small number of carefully selected participants (Patton, 1990). I selected the sampling strategy to fit the study's purpose, the resources available, the questions being asked, and the constraints being faced.

In some cases, purposive sampling may not be complete to accomplish the desired objectives; that is, the sample selected, by my understanding, wouldn't have sufficient experience with the phenomenon. I purposively selected the sample for convenience (Patton, 1990) because both my birthplace and working area are Gorkha district and it is socio-culturally and geographically diverse. I realized that I could get the sufficient information that I need for my study. In the first meeting with my sampling participants, I explained in detail my purpose of data collection and the cause of sampling them.

Size of the Participants

In qualitative inquiry, there are not well-accepted rules for selecting the sample participants. The number of participants to be chosen for the quality inquiry depends on “what one wants to know, the purpose of inquiry, what’s at stake, what will be useful, what will have credibility, and what can be done in available time and resources” (Patton, 1990, p. 174; 2015, p. 470). In-depth information, if the cases are information-rich, a small number of participants can be valuable. But in the diversity of understanding variables, a more significant number of people can help explore phenomena (Patton, 2015). In a decolonizing study, if per participant have a large amount of information, in such a case, fewer participant may be sufficient for the study.

Following the suggestions by Patton (1990) and Mavhandu-Mudzusi (2018), my participants' size also depends upon my study's purpose. Based on my decolonizing study purpose, I selected (Mavhandu-Mudzusi stated that if two participants are involved, it is called couple/dyadic or joint interviews) three interviewees in each focus group interview. I conducted three focus group interviews according to my research questions to get students' in-depth understanding and experiences (Mavhandu-Mudzusi, 2018). Mavhandu-Mudzusi called it triple hermeneutic because there was a "third interpretation where the researcher tried to make sense of how each partner makes sense or interpret the interpretation of the other partners to understand the couple's experience of the relationship"(p. 3).

My number of participants depends on the saturation of decolonizing inquiry (I did not feel more investigation is needed for saturation, so I did not increase the participants' size or increase the number of interviews or observations) (Patton, 2015). However, the qualitative inquiry does not need more sample size to accomplish the research. I also applied a small number of participants in my FGI/ sharing circle. The matrix below shows my study location, sampling, participants, methods, tools, number and procedures.

Table 1*Matrix of Different Methodological Aspects*

Participants	Study location and sampling	Methods	Tools of data generation	Number of participants	Data collection procedure
Curricular designers/ Textbook writer	Kathmandu Purposive	Interview/ sharing and documents study	Interview/sharing guidelines, diary	Two	Audio recording and field note
Students	Gorkha: HSS Saurpani, Bal mandir S.S. Gorkha, Mahendra S. S Kundur, purposive	FGI/ sharing circle	FGI/sharing guideline	Three students from each school in class eight	Audio recording
Teachers	Gorkha: HSS Saurpani, Bal mandir S.S, Mahendra S.S	Class observation/ watching interviews/	Interview/ sharing guidelines, Observation	One science teacher from each basic school	Audio recording and field note

	Kundur, purposive	sharing	guideline		
Ethnopractitioners	Gorkha/ Suarpani, purposive	Interview/ sharing observation/ watching	Interview/ sharing guidelines, Observation guidelines, Videography with consent	Three Ethno groups consisting of three members in each group	Audio recording with consent, field notes
Vedic pandit/specialist	Gorkha/ Kathmandu, purposive	Interview/ sharing	Interview guideline	Two Vedic Pandit/specialist	Audio recording with consent, field note

Data Analysis Procedures

Data analysis is an essential function in qualitative inquiry. It is the summarization of large quantities of data into understandable information from which well-supported and well-argued conclusions can be drawn (Creswell, 2007). It is a process of reviewing, cross-checking, summarizing, looking for patterns and themes and making sense of the data connecting with relevant literature (Creswell, 2007). Data analysis is the circular process of describing, classifying and connecting data (Dey, 1993). Moreover, Anderson and Arsenault (1998) add that analyzing qualitative data is a "systematic process that organizes data into manageable units, combines and synthesizes ideas, develops constructs, themes patterns or theories and illuminates the important discoveries of your research"(p. 138). Roulston (2013) critiques that data analysis is data reduction, data reorganization, and data representation.

But there is seen some variation in qualitative data analysis. Miles et al. (2014) stated that data analysis as including "phases of data reduction or condensation, data display and conclusion drawing, and verification and emphasis on the importance of using the visual display to interpret and present data" (p. 32). However, it extended to the interpretation of the meaning to understand the phenomenon. So it is called hermeneutic influence analysis (Roulston, 2013).

Hermeneutics influences qualitative inquiry in three ways: how participants' experiences and the interpretive process are "mediated by language; the conceptualization of the research process as holistic; and the re-conceptualization of research as cross-cultural dialogue" (Freeman, 2008, p. 388). This indicates that the data analysis process is iterative, and it is seen as appropriate for my empirical and Vedic textual data analysis, through which it helps examine context and multiple-level of interpretations of varying cultural understanding (Roulston, 2013). Cohen et al. (2018) mentioned that the researcher uses different theoretical lenses to examine the report on the phenomenon and emerging situation. In looking at phenomena through the chosen theoretical lenses, the researcher must be aware that this may be selective, excluding, and even distorting data. This means participants may have different theoretical perspectives, and the researcher may feel it's important to report it in the data organization and analysis process.

The empirical analysis of the data is influenced mainly by the 'general inductive approach' (Creswell, 2007; Thomas, 2006; Dey, 1993), constant comparative method' (Charmaz, 2006; Glaser & Struss, 1967; Strauss & Corbin, 1998) and 'decolonizing approach' (Chilisa, 2012; Held, 2019). Here, my focus is the decolonizing of data analysis using the braiding design,

All of these approaches are seen as appropriate for qualitative data analysis. For decolonizing data analysis, researchers reduce data by eliminating repetitive statements and data irrelevant to the phenomenon being examined (Roulston, 2013). For this decolonizing analysis, considering the research questions, the first set of interview data was transcribed using a transcript sheet. All data were collected in Nepali and transcribed and then translated into English before analysis. The analysis

helped make meanings, constituting knowledge, scientific notions, structure, and coherence in selecting relevant terms from the data. This is being a decolonizing research; the chosen analysis method was exploratory, and the Rhizomatic process was used for the filtration of data to determine the main themes from the most nodal point.

The Rhizomatic analysis process supported picking out the subtheme and global theme (Leander & Rowe, 2006) without using the traditional coding system because "Rhizomatic analysis works against the reductionism of conventional coding methods through productively putting to work a network of connectivity and relationships between theories, practices, data, ethics, and other bodies of knowledge and being that are always already becoming"(Higgins, 2014, p. 6). I applied this analysis approach in my data analysis to see the relational connectivity (as stated in the indigenous research paradigm) of different ideas expressed by the different participants. I linked it as the form of a Rhizome but not like the root of a tree in a single-centred form. For that visual understanding of environments/situations, a mind-mapping program that consists of nodes and links, I sew an intricate web of inter and intra relationships between chunks of interviews, observation data, field reflection, concepts, and theories for decolonizing/indigenizing science education (Higgins, 2014).

To describe the essence of the experience of the Ethno-practitioners, the Vedic pandit/ the Vedic experts, students, school science teachers, curriculum designers and textbook writers, I applied the Rhizomatic approach from where the main themes and subtheme emerged as intersected knots of relational knowledge were determined (Higgins, 2014). Chapter VIII presents the analysis and interpretation of these themes and subthemes with justification.

Moreover, my analysis is not limited only to empirical analysis. It is extended to historical textual analysis also. For the textual/historical document analysis, Anderson and Arsenault (1998) prescribed that it is applied to the analysis of data in documents and refers to the systematic description of the contents of documents. It indicates that content analysis focuses on the relevancy of the topic, evaluates bias and prejudice in print materials, and assesses the text's difficulty level and conceptual reality. Considering these ideas, I applied content analysis to my Vedic and philosophical documents. In doing so, my focus was viewing both spiritualist thought and materialistic stand using Comte's three-stage theory (described in detail later). Before doing content analysis, I applied the hermeneutic method for historical text analysis.

Ensuring Rigours/Trustworthiness/Standard Establishment of the Study

For the standard establishment and trustworthiness of quantitative research, such as the positivist research paradigm, use the terms reliability, internal validity, external validity, and objectivity. But this post/qualitative study is naturalistic and relational, philosophical perspective inherent in my study; I used rigour rather than ‘trustworthiness’ or ‘standard establishment’ (Cohen et al., 2018) in my heading because it represents the “researcher’s creativity, sensitivity, flexibility and skills in using the verification strategies that determine the reliability and validity of the evolving study” (Cypress, 2017, p. 260). Similarly, Smith and McGannon (2018) also used rigour instead of trustworthiness and recommended three criteria for the judgment of qualitative research are: the methods of member checking, the methods of inter-rater reliability, and the notion of universal criteria. Here, interpretive researchers extended the meaning and used the positivist worldview connecting interpretive worlds such as "objectivity/conformability of the work,

reliability/dependability/audibility, internal validity/credibility/authenticity, external validity/transformability/fittingness, and utilization/application/action orientation" (Miles et al., 2014, p. 271).

Thomas (2006) simply indicated four general types of trustworthiness in qualitative research: "credibility, transferability, dependability, and confirmability" (p. 243). But in qualitative decolonizing research, there are still not hard and fast standard established criteria. It is mostly focused on establishing the two-way relationship between the researcher and participants as co-researchers. However, the trust established in decolonizing and indigenizing research is based on reciprocity, relational accountability, reflectivity, and transformative knowledge sharing (Held, 2019).

The qualitative validation is used by LeComte and Goetz (1982) as "internal validity, external validity, reliability, and objectivity, and operationalized these new terms and techniques such as prolonged engagement in the field, and the triangulation of data source methods and investigation to establish credibility" (Creswell, 2007, p. 202-204). This study is based on the notion of the existence of ‘contextual’ and ‘multiple’ constructed truth; instead of positivist words, the research literature is replete with the discussion of standards for assessing the quality and rigour of the research (Cypress, 2017; Denzin & Lincoln, 2018; Freeman et al., 2007; Patton, 2015).

Regarding the qualitative study, Lincoln and Guba (1985) and Creswell (2007) restate the reliability and validity criteria as ‘trustworthiness’ and ‘authenticity’ measures, namely credibility, transferability, dependability and confirmability. Creswell (2007) recommends eight primary validation strategies to attain trustworthiness: prolonged engagement and persistent observation, peer debriefing,

external audits, member checks, thick description, triangulation, clarifying researcher bias from the outset, and negative case analysis.

However, Creswell and Miller (2000) identified nine verification criteria for ensuring 'trustworthiness' or 'rigour' in the qualitative study. Out of these procedures of validation strategies, I chose triangulation, thick description, and member checking (Beuving & Vries, 2015; Creswell, 2007, 2013) as crucial procedures in qualitative inquiry, but Creswell and Miller (2000) emphasized on triangulation of methods, prolonged observations in the field, member checking, and use of the thick and rich descriptions for the rigour of research process.

For explorative/ decolonizing study, Cypress (2017) supported ideas of Creswell and Miller (2000) and Creswell (2007), emphasising all types of rigours or trustworthiness in naturalist decolonizing inquiry. Despite these suggestions, he advocated and reflected on a contemporary reconceptualization of the debate and dialogue that have been ensured in the literature. And presented "primary validity criteria as credibility, authenticity, critically and integrity, and secondary validity as explicitness, vividness, creativity, thoroughness, congruence, and sensitivity" (Crypress, 2017, p. 260) for the evaluation process.

Recently Morse (2015) presented new strategies for ensuring the reliability and validity of qualitative inquiry "prolonged engagement, persistent observation, thick and rich description, negative case analysis, peer review or debriefing, clarifying researcher's bias, member checking, external audits, and triangulation" (p. 9). This indicates that there are no hard and fast rules and limitations to using the validation strategies in qualitative inquiry, and it is an emerging process. It depends upon the used philosophes and theories, the researcher's perception of the validity, nature of participants, methodologies used to collect data, and availability of participants to

provide the required information. It is a contextual type of ensuring the validity of qualitative research. In my qualitative type investigation of being a central phenomenon of connecting Vedic and Ethnoscience with the school science curriculum and exploring the experience of all types of participants in a natural way, I have tried all types of rigours within the whole inquiry period as far as possible.

My decolonizing approach to the qualitative study also could be operationalized using the criteria of "credibility, transferability, dependability, and conformability" (Cypress, 2017, p. 257). Since my study aimed to understand the perceptions about Vedic and Ethno knowledge of Ethno practitioners, Vedic pandits/ Vedic specialists, school science teachers, students, textbook writers and curricular experts in their working area, I used open-ended questions. I tried to establish the relational reciprocity based on four validation process as Cypress stated.

In a qualitative study “credibility, the accurate and truthful depiction of a participant’s lived experience, was achieved in this study through prolonged engagement and persistent observation to learn the context of the phenomenon in which it is embedded and to minimize distortions that might creep into the data”(Cypress, 2017, p. 257). For this, I tried to live a long time and built rapport easily with them, met them frequently and did telephone dialogue with the participants for the saturation of my study. At an informal level, I frequently visited the field so that mutual understanding between the participants and me developed quickly. Peer debriefing was conducted through meetings and discussions with the expert researcher to allow for questions and critiques of field journals and research activities (Cypress, 2017).

Another mainly used strategy of credibility is triangulation. Merriam (2009) proposes four types of triangulation: “the use of multiple methods, multiple sources of

data, multiple investigators, and multiple theories to conform to emerging findings" (p. 215). In my decolonizing study, I used interviews (open interviews, sharing circles with focus group interviews), participant observation and document study. I have tried to cross-check the method to collect the data from different participants based on the central phenomenon of three types of science. Triangulation was achieved using multimethods of data collection from various participants. (Anfara et al., 2002; Merriam, 2009). As Merriam mentioned, I tried to collect data from different sources to get the saturation of data in my study.

Another commonly used strategy of ensuring internal rigour or credibility is member checking, called respondent validation (Merriam, 2009). It is the decolonizing research, I established the two-way relationship, reciprocity and felt accountability with my participants (Datta, 2018), as mentioned by Creswell (2007) and Thomas and Magilvy (2011), who are involved in data collection; after data transcript, data analyses, interpretations, and conclusion, back to the participants so that they can judge the accuracy of the data provided by them as co-researchers. In this process, more interviews and observation processes were re-conducted to solicit feedback on my emerging findings from some participants I interviewed before. Other informants were also taken for saturation and in-depth data (Merriam, 2009). I kept in touch with them during my study, shared knowledge, and collected the required information.

The ability to transfer research findings or methods from one group to another, or how one determines the extent to which the findings of a particular inquiry have applicability in other contexts or with other subjects/participants, is called transferability in the qualitative language (Thomas & Magilvy, 2011). I immersed myself in the phenomenon to know, describe, and understand it comprehensively and

thoroughly focusing on collecting, identifying, and analysing data (Cypress, 2017). For better comprehension of the data, I transcribed the audio records of the interviews by myself and made the themes and final report writing as true and as accurate as possible.

Dependability is another strategy of qualitative validation of study which is closely related to the notion of quantitative word reliability. It can be achieved through external transcribing and thematizing. In my decolonizing study, it was determined the quality of all research processes, including tools construction, data collection, coding, transcription, thematizing, and interpretation and analysis (Thomas et al., 2011), was ensured by self-assessment and peer-review from the supervisors to get consistent results with the collected data (Merriam, 2009).

Conformability is the final strategy of qualitative validation of the study and is related to the objectivity of quantitative word objectivity. It is confirmed by triangulation which was prescribed earlier. Another important way of validating strategies of qualitative inquiry is reflectivity. One potential threat to validity that I need to consider is my bias, frequently an issue because qualitative research is open and without structure and relational, so it is called exploratory (Cypress, 2017). Researcher bias is seen in instrument construction, data collection, transcription, thematizing and data analysis to interpretation (Merriam, 2009). So I, as a researcher, became aware of their perception, preconception, and opinion to conclude. The strategy to understand the researcher bias is called reflectivity, which means "how researcher engages in critical reflection and predispositions, that they bring to reflectivity which helps to control the biases in qualitative research" (Cypress, 2017, p. 259). I have been reflective, showing my observation of reality in data collection and analysis (detail is given in the reflection section of the last chapter).

Another necessary rigour of qualitative inquiry is to determine the study's trustworthiness. For this, I focused on the credibility of Vedic literature collected for analysis . For the credibility of the literature, I studied both original and translated books several times and dug out the materialistic meaning contained in the Vedic literature and eastern philosophy. I compared interpretive texts and original texts as far as possible. In doing so, I took other scholars' references on their interpretations. I used both the Vedic literature and philosophical resources interpreted through both "Oriental)"eastern knowledge practitioners and "Occidental)"westerners who have both eastern and western knowledge but cultivated in western countries (scholars to reduce their civilizational prejudice made from the unspiritual attachment and to observe through multiple perspectives). I rigorously accessed texts to use as sources . While interpreting the texts, I considered that 'understanding is always provisional' and 'conclusion is always tentative'(Dascal, 1989).

Being a decolonizing researcher, I attempted to expose the reflectivity by starting the introductory part from my non-literate parents' knowledge of Ethno practice, my neighbour's technological knowledge, my own experience of Ethno and the Vedic knowledge, my oriental cultural knowledge of my practice of modern science as a science student and science teacher in the initial period of study. Why am I motivated to study three types of science? Why did I select a qualitative inquiry approach? Why do I choose decolonizing approach? Why and how did I selected the tools and collect the data? How I transcribe, thematize, analyze and interpret the data? How do I draw the finding, and discuss them by connecting different emerging decolonizing theories and conclusions from the collected data? My reporting the answers to these questions indicates my reflectivity on this study. It helped to minimize my bias in the whole inquiry process.

As Cypress (2017) stated, being a decolonizing researcher, I can recognize that my interpretation is correct because the reflection process awakens my inner moral impulse. I can do my best to guard off my biases, preconceptions, and assumptions which help me to bring to this study. Some previous conceptions which help to hold the past belief about the phenomenon under the study are expressed in reflection more clearly.

In Addressing Ethical Issues

Ethics has been defined as "a matter of principled sensitivity to the right of others" (Cavan, 1977, cited in Cohen et al., 2018, p. 112). When we are going to discuss the qualitative inquiry, the researcher faces so many ethical issues in doing qualitative research can be described as occurring before conducting the study, at the beginning of the study, selection of problems, during information collection in the field, in conducting data analysis, dissemination and reporting the data, and in publishing a study (Cohen et al., 2018, p. 112; Creswell & Poth, 2018, p. 95; Patton, 2015, p. 724). Creswell and Poth (2018) and Denzin and Lincoln (2018) applied a new term that the researcher always considered the ethical issues mainly related to three principles: respect to the person (respecting the participants and ensuring the consent process withdrawal right of participants from the study), concern for welfare (ensuring do not place participants at risk) and justice (treat people equally in recruitment, sampling, site selection and criteria guiding side choice). Regarding the ethical consideration, the researcher's role is identified by Creswell (2013) and Wilson (2008) as informing participants, being respectful of the research site, reciprocity, using ethical interview practice, maintaining confidentiality, collaborating with participants and becoming accountable between human being and nature.

Ethical consideration is the “protection of subject from harm, the right to privacy, the notion of informed consent and issues of depiction all need to be considered to head of time” (Merriam, 2009, p. 230). According to Hamersley and Traianou (2012, cited in Cohen et al., 2018), British Educational Research Association [BERA] (2011) set out five ethical principles: minimizing harm, respecting autonomy, protecting privacy, offering reciprocity, and treating people equally (p. 117). Regarding the ethical issues faced by the qualitative researcher, Creswell's (2007) group sat into “informed consent procedures, deception, confidentiality towards participants, sponsors, and colleagues; benefits of research to participants over risks; and participants requests that go beyond social norms” (p. 141). But, Patton (2015) offered twelve checklists to explain the different version of assuring ways of ethical consideration in interviewing process are as: “informed consent and confidentiality, confidentiality versus people owning their own stories, how much of an interview must be approved in advanced, reciprocity, how hard to push for sensitive information and being careful in the face of danger in the field” (p. 725). But in educational research, Anderson and Arsenault (1998) divided ethical consideration into ethical standards and professional standards and explained in detail the common problem that confronts researchers.

Being qualitative decolonizing research, for exploring the Ethno experience knowledge, I did not take the written and formal informed consent with my participants. However, I took oral consent with them. I used either pseudonyms or real names for confidentiality on the verbal consent of my participants due to being an explorative type of research. I have tried to follow the BERA (2011) derived ethical considerations as far as possible in the whole research process.

In Addressing Dilemmas

In qualitative research, an ethical dilemma is another emerging issue. It is likely to emerge with regard to the collection of data and the dissemination of findings (Merriam, 2009). An ethical dilemma can be minimized by collaborative and participatory research process with informed consent, confidentiality, risk assessment, clear policy on data access and ownership, following legal conduct, protection of privacy, and extending the reciprocity in the research and following the procedure of validity (Patton, 2015). It indicates that I have followed the trustworthiness and credibility in research to address the ethical issue.

In my qualitative research, I followed standard ethical principles (Creswell & Poth, 2018) as my guideline because it provides details on how to consider ethical issues before conducting a study to publish a study. I visited the field and participants at least three times in this study. For the first time, I visited all my participants and tried to build rapport with the interviewee and the whole gatekeeper. I introduced my personal information, study purposes and subject matter as well. On the second visit, I took verbal consent by explaining the purpose of the research in front of respondents and getting oral permission before doing research. I gained their confidence and trust in my research and developed the relationality, accountability and reciprocity to protect the harm in the research process (Cohen et al., 2018; Kovach, 2018; Wilson, 2008).

All participants' privacy, confidentiality, and anonymity were assured that their identities would be kept private and confidential during and after the research process. However, due to knowledge explorative research, some participants' names were included by taking their oral consent. I dedicated myself to either disclosing their name or using pseudonyms in the research report to save the privacy of my

participants. I never used deceptive (Creswell, 2007) fraud to take data and misbehave in the analysis and interpretation of data. But, I became a critical reflective researcher (Denzin & Lincoln, 2018) as far as possible in the case of Vedic literature and philosophy to see the materialistic view in my interpretation.

In qualitative research, an ethical dilemma may arise when doing an in-depth interview and participant observation. Merriam (2009) critiques that "when the observer may witness behaviour that creates its ethical dilemma, especially behaviour involved in abuse and criminal activity" (p. 232). As Merriam stated, I did not feel any ethical dilemma in any sector in the information collection process. If my informants were policymakers, they would be affected by prepared documents about the policymaking process in Nepal at a different time, and they may not show me actual documents which guide the education system of Nepal. However, I did not include them in my study. Mostly I searched the policy-related documents only on the internet so that I did not feel any type of ethical dilemma during my research.

Another dilemma I faced in data collection was that data may have filtered through certain theoretical positions and biases. Deciding what is essential and which one is attended and which one is excluded in the data collection and analysis is contradictory to the researcher's view, and they may not decide what is right and what is wrong, but I did not feel so in my research process. I strongly followed the ethical consideration standards suggested by Creswell and Poth (2018). These guidelines helped me minimize the ethical dilemma in my investigation.

In Protecting the Participants

To protect my participants from harm, I respected the culture of the participants when collecting the data related to Ethno practice and Vedic knowledge.

In my study, I did not attempt to show the power and position of the researcher at a higher level and participants at a lower level .It means I followed collaborative action, reciprocity and relational accountability with participants (Held, 2019). It helped me to remain honest, respectful and sympathetic towards all the institutions and participants (Ghimire, 2014).

In Presenting the Report

I fully followed the American Psychological Association [APA] (2020) seventh version as a standard ethical guideline. I followed the BERA (2011) and American Educational Research Association [AERA] (2011) ethical guidelines (Cohen et al., 2018) for my study throughout the entire research process from planning to final dissertation writing.

Review of Literature

A review of literature is a written summary of journal articles, books and other documents that describe the past and current stages of information on the topic of the research study (Creswell, 2013) and analysis and interpretation of the theoretical, conceptual and empirical research literature related to a topic or theme (Anderson & Arsenault, 1998). Bryman (2012) stated the literature on the following issue should be identified: "What is known about this area? What concepts and theories are relevant to this area? What research method and research strategies have been employed? Are there any significant controversies? And, are there any inconsistencies in findings relating to this area?"(p. 98). Literature review means reviewing studies, theories and philosophies, and relevant propositions in the related area of the study so that the researcher has ideas on previous studies, their conclusions, and deficiencies and takes an informed decision for further research (Creswell, 2013; Roberts, 2010). The literature review “helps shape the study, enrich

the data collection and analysis, and strengthen understanding of the findings" (Anderson & Arsenault, 1998, p. 84). I applied the thematic review approach. I selected certain kinds of literature by applying meta-analysis procedures to review the literature that helped me answer research questions. In doing so, themes were generated through analysis and synthesis (Creswell & Poth, 2018) and the study gaps in existing literature were declared.

In this process, I did not use conventional techniques to write a review of the literature as a separate chapter. Instead, I analyzed spiritual scriptures, Vedic understanding with a materialistic viewpoint and eastern philosophies into different themes and organized them into separate chapters.

These chapters which were arranged of reviewed kinds of literature that provided historical accounts of spirituality and its scientific connection; Vedic and Upanishadic philosophy and its scientific verification; six systems of Hindu philosophy and its materialistic understanding; Charvak, Jain, Taoism and Buddhist Philosophy, and its materialistic viewpoint; socio-cultural practices of Ethno science and its linkage with school science curriculum and Vedic science and the transformational pedagogies involved within them were reviewed separately. Different theoretical and empirical literature reviews related to the above themes to justify my problems were reviewed and presented in the thematic form separately.

Theory as a Referent

A theoretical framework is the "blueprint" of the entire dissertation inquiry (Grant & Osanloo, 2014). It serves as the guide on which to build and support the study and provides the structure to define how we philosophically, epistemologically, methodologically and analytically design the dissertation as a whole (Grant & Osanloo, 2014). It means the selection of an appropriate theory to accomplish the plan

of study of the topic and the concept of the study to make clear. According to Ghimire (2014) and Creswell (2007), there are three ways of thinking about the role of theory in research: theory as a lens through which information is observed, theory as a paradigm to understand the phenomenon under study, and theory is new knowledge it emerges from the study.

In qualitative studies, such as decolonizing studies, inquirers attempt to build the relational experience from participants with no explicit theoretical orientation (Creswell, 2007). Although my study is qualitative and decolonising, I applied the transformative methodology; I used Comte's three-stages theory as an umbrella term to shape my study, in the beginning, to understand it as a spiritual, philosophical, and scientific view.

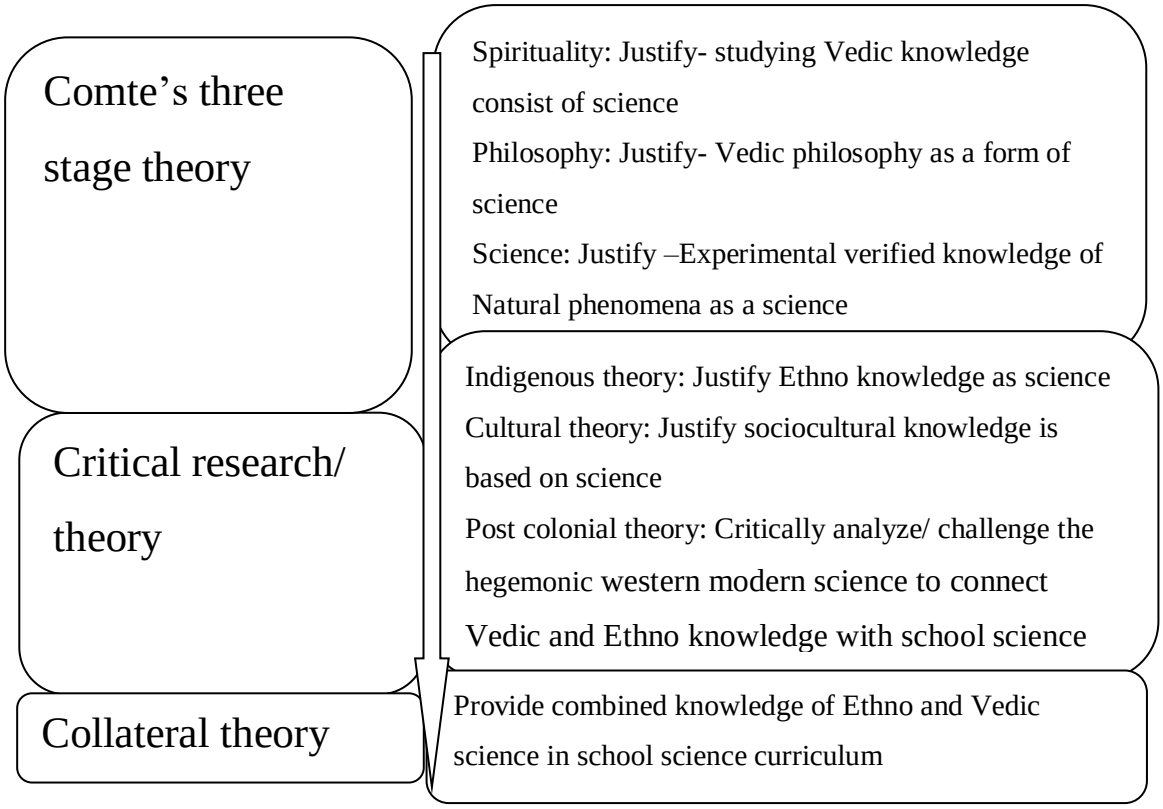
Comte's three-stages theory was used successively in three theoretical stages; spiritual, philosophical and scientific. It was used as 'theory as the lens 'at the beginning of the research for a guideline or to provide the shape/ directions of the spiritual and philosophical study with materialistic views.

Critical research is used in social science, humanities, and art studies; called Meta- theory within which cultural, indigenous, and postcolonial theories are included (Bilgili, 2018). It helps to value sociocultural knowledge and helps to shape and strengthen our knowledge practised like as scientific knowledge.

I used critical theory in the final form to further challenge Western science and see the community knowledge with scientific justification in interpreting different data to connect with the school science curriculum. I used a collateral theory (Jegede, 1995) that supported me to braid the Vedic and Ethno science with the school science curriculum. In selecting the theory as a lens, I considered the theory as new knowledge that emerged from the study. I discussed and attempted to link the several

theories and literature which supported this study. Thus, these theories were only used as the referent theories for my study to guide the whole research process. Critical research is also Meta-theory; within it, many theories are included (Tuner, 1990). Social theory, postcolonialism, cultural studies, deconstruction, postmodernism, poststructuralism, feminist theory, Marxist theory, indigenous studies, psychoanalytic theory, and structuralism is generally treated as critical theory-based theories, paradigms or approaches (Bilgili, 2018; Merriam & Tisdell, 2016). These all oppose the scientific positivist objectivity and support cultural voices for their emancipation, and social justice through critical argumentation (Bilgili, 2018). However, all the theories are not possible to include in this study. As a critical researcher, I appreciated the voice of the Ethno practitioners and the Vedic knowledge holders and tried to relate them to the school science curriculum. So cultural, indigenous, and post-colonial theories are found appropriate for challenging Western science valuing cultural knowledge. Finally, collateral theory helped me to sew/ braid different schools of thought of science in a form of a garland providing the existence of each science equally.

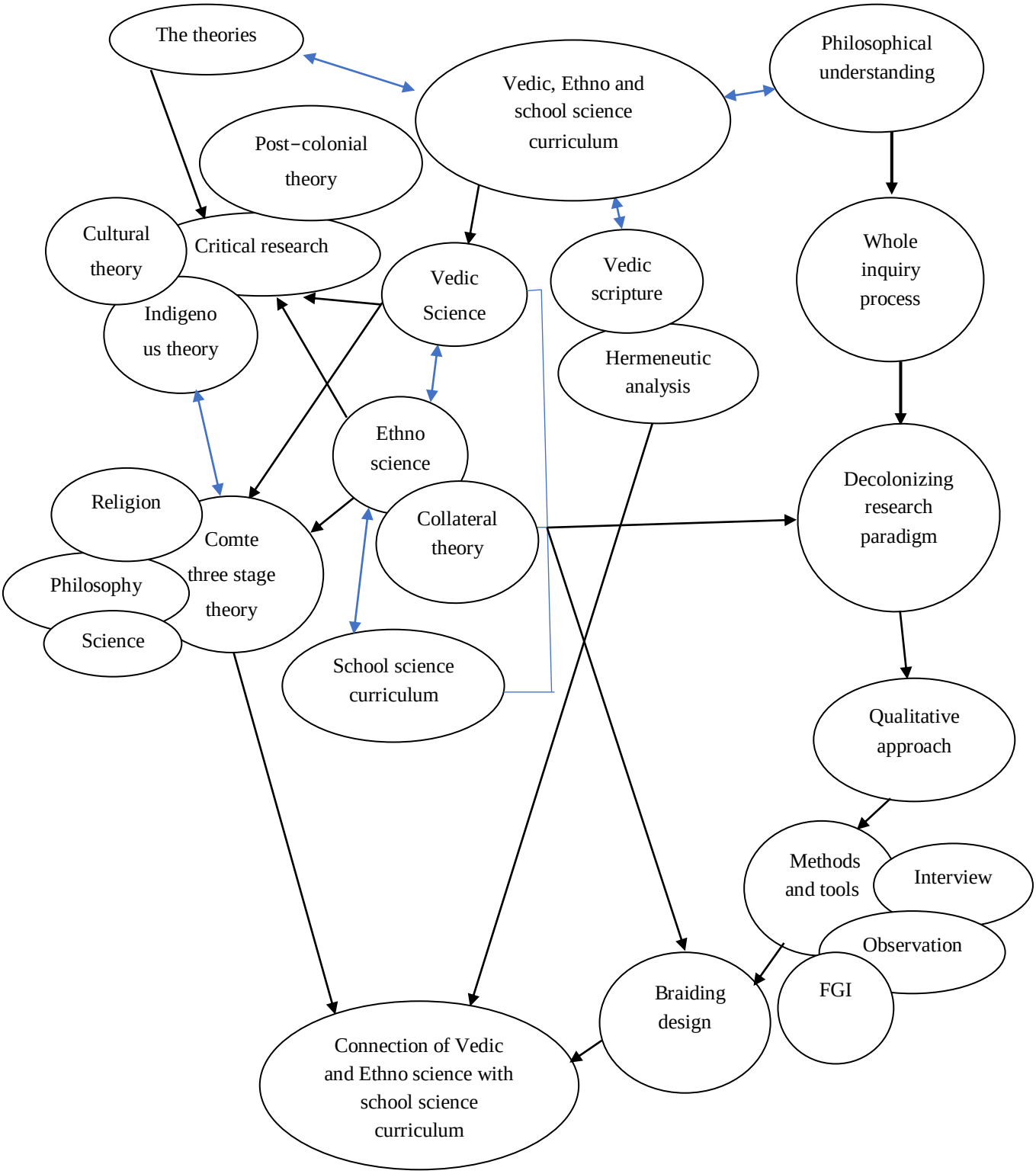
Figure 3 *My Illustration: Theoretical Linkage*



Conceptual Framework

The conceptual framework offers a "logical structure of connected concepts that help provide a picture or visual display of how ideas in a study relate to one another within the theoretical framework" (Grant & Osanloo, 2014, p 17). It is not simply a string of concepts but a way to identify and construct epistemological and ontological worldviews and approaches of study for the reader. The conceptual framework also allows for specifying and defining concepts within the problem (Luse et al., 2012). Once the conceptual framework for a dissertation has been established, researchers can begin to determine how to write their dissertation (Grant & Osanloo, 2014). Figure 4 presents a blueprint of theoretical, philosophical, and methodological linkage with how Ethno and Vedic science can be synchronized with the school science curriculum in the context of Nepal.

Figure 4 *Conceptual Framework of Research Process*



The above conceptual framework shows how study issues arise, what are the philosophical bases of my study, how the research paradigm supports me in shaping the research process, what theories help me for this study, what methods and techniques can use for the data collection, how can analyze the textual and other empirical data, and how can braid this holistic knowledge with the school science curriculum systematically is given in detail.

Chapter III

Curricular Ingredients of Science in Spirituality

Introduction

In this chapter, I discussed the origin and development of spirituality and its linkage with philosophy and science. Then, I tried to see the science-like spiritual and cultural practices. Finally, I tried to see the cosmological and psychophysiological practice of Shamanism and their healing practice. I attempted to find the science like curricular contents, methods, and evaluation in this process.

Relation of Spirituality, Philosophy and Science

My reflection on the religious literature showed that philosophy, spirituality, and science emerge horizontally. Philosophy stays in the centre. It is supported by spirituality to set the destination of human beings and science to solve social problems. They also exist vertically to deal with socio-cultural development in a given historical context.

Several scholars have argued the interlink among philosophy, spirituality, and science. The world-famous philosopher Russell (1995) argued that philosophy and science were not considered separate entities. They were born together in the sixth century, at least in the west, whereas spirituality was already established as a distinct discipline. However, another philosopher Varma (1973), viewed that philosophical and spiritual concepts and propositions should be studied from the Vedic period. Philosophy emerged as a separate discipline afterwards. Spirituality came under theological discipline. Russell (1995) further explained that spirituality and science are two aspects of social life. Russell's understanding shows that there are three curricular areas: philosophy, spirituality, and science. The first is the destination seeker; the second is the way of living, and the third is the people's social life.

Western philosopher Bloomfield (1908) focused on the Brahmanical system of religious philosophy, especially Vedanta and Sankhya. He said these two theosophical systems probed twin riddles of the universe and human life.

Eastern philosophers have argued that philosophy and spirituality are separate from each other. Krishnanandan (1994) argued that spirituality makes a person a broad-minded, loving, charitable and divine. Philosophy, for him, is the rational justification behind spirituality.

Muller (1882) argued that the oldest religious scripture, the Veda is the highest authority of the Hindu spiritual beliefs. He said that the Vedas are also a source of the Christian religion in the sense that the theory of Christ is the theory of the Vedic Agni or fire. Fire for the Veda symbolises movement, life, and thought. He further argued that the Vedic trinity of sun, fire, wind, and God family is a cosmic unity.

Rao (2002) argued that philosophy in the Indian Sub-continent began with the Veda, with considerable philosophical progress, while Greece was beginning. However, Bloomfield (1908) forwarded the somehow different views that spirituality began in the Vedic period, but philosophy began with the great epic Upanishads as a part of Veda and developed with the combination of the Vedic religions.

Lysenko (2018) explained that the origin of the spiritual philosophy is a sign of human consciousness to find out the reality of self. He argued that "Indian continental philosophy focused on *vyavaharika* and *paramarthika*. *Vyavaharika* is related to worldly experience, whereas *paramartika*is related to *samsara*. *Parama-artha,* literally means the "supreme goal" or the "supreme truth" or "genuine reality" is beyond *samsara"* (p. 217). Buddhist philosophy, on the other hand, focuses on

samsara. In Buddhist terminology "it is *nirvana*; in Brahmanism, it is absolute monism; in Advaita Vedanta and Para-Advaita it is *purusa, atman* and *jiva"* (p. 217).

Tisdell (2006) pointed out differences between spirituality and religion, although he argued that these are rooted in a deeper interest in the sacred. Learner (2000 cited in Tisdell, 2006) focused on

> Emancipatory spirituality; highlights a sense of wonder; cultivation of mindfulness, and love and care for the universe; and it is manifested in actively working for environmental sustainability; a focus on the transformation of a world and exploring the world from multiple perspectives. (p. 21)

Voland (2009) claimed that spiritual practices are scientific and he added that "neurochemical processes which coincide with these mental states are associated with consequences for health and well-being; they reduce the perception of pain, regulate temperature, support the immune functions, reduce the loss of blood pressure and activate the bonding system" (p. 13). This indicates shamanism and question whether it is the history of medicine or the history of religions.

Tisdell's arguments of spirituality and Voland's neuropsychological process show that spirituality and its connection with science can be the curricular content. It also indicates that students should explore age-old cultural practices from a scientific point of view.

Comte (2009) stated that there were different theoretical stages of the theological or fictitious stage: the metaphysical or abstract, humanistic: and the scientific or positive stage. His three stages theories attempted to find out the relation between life, the world, and the cosmos. But his approach reflects different stages of social development.

Comte's three states theory gives the curricular contents like the relation between theology and science; fictitious metaphysical science with the hard science; the relation between the cosmological changes and the human body.

The discussion above shows that Eastern philosophy began with the association of Dharma i.e. natural science. Later it became a part of religion. Religion guides the transaction of knowledge, focusing on in-depth metaphysical consciousness, and spirituality is the basis of scientific development. The above overlapping justification also indicates that philosophy is in between science and spirituality, they are interlinked disciplines.

Science in Spiritual Practice

Hindus prepare rectangular *chautar*a to plant trees (i.e. *peepal, bar, somi,* etc) for *Dharma* or *Punya*. Near the *chautara,* they dig the water pond also. Hindu culture does these functions for religious purposes, but their work has hidden science. The trees in chautara provide oxygen in huge amounts and protect the direct sun rays on a hot day. Water is considered the life energy for the traveler.

In the Hindu culture, *Tulasi* is planted in front of the house and worshipped as a God *Bishnu*, providing a huge amount of Oxygen. So, in the earlier period, Hindus took seriously ill patients in front of the *Tulasi* plant to give a huge amount of oxygen for respiration even at the time of death. Hindus put *kush* (Darbha grass) in front of the door for sacrifice but now scientists found that it absorbs the electric light and saves from lightning (Shastri, 2076 BS). Similarly, Hindu women make a mixture of cow dung and red mud to sweep their house everyday morning. They say that "if we did not sweep the house every day god Laxmi would not enter into our house". They also go fasting and worship different gods in different festivals, which is justified by modern science that fasting is better to control the extra weight and blood pressure.

Hindus have a cultural belief that cutting a tree is sin or evil (pap). They believe that excretion near the water resource is sin (pap) because there is being Snake (nag-devata) that will be angry. Hindus take it as a sin to throw dirt waste materials into the river and pond. This knowledge helps protect the environment and make water resources clean and less polluted. Hindus worship earth, sun, and moon as God.

The selected Hindu religious practices show that each and every practice of the people can be the content of the science curriculum. Some of them are proved and other are to be proven. The teaching method would be project work to the students; lab work for test and claim of patient right as "innovation of the ancestors".

There is an extensive justification of the use of fire as a sacrifice, in a whole Rig Veda hymn in where the first mandala of the first mytre of the first sukta stated the Agnimide (Rig Veda, 1.1.1). It indicates that the religious use of fire is justified by science for the use of the whole purpose of the universe and source of energy. Supporting the above statement, Muller (1882) added that "Hindus worship different God as different form e.g. Indra, the god of blue sky; sometimes Agni, the god of fire; sometimes Varuna, the ancient god of the firmament" (p. 81). He further described in earlier times religion as a divine influence was underlined and supporting every relation of life and every social institution.

In the Vedic religion, Aditi is defined as earth, a narrowing of her scope, somehow as we of the modern languages make synonymous the term world and earth (Bloomfield, 1908). Voland & Schiefenhovel (2009) explained in a study report that “depletion of dopamine in delimited regions of the brain, which is typical for persons who have Parkinson’s disease, is responsible for their less developed spirituality” (p. 5).

What we call nature now are the Vedic Devata (gods). Every Devata thus can be curricular content for science students. For example, Agni and Barun are connected to Devata. It symbolizes that there is water in fire and fire in water. This means content like a comparative understanding between school science and spiritual practices can be taught in the school curriculum.

Creationism vs Evolutionism

Creationism and evolutionism are the two areas of discourse about the origin of the earth, of humanity, and other species. Creationism talks about divine origin and evolutionism deals with evolution by natural selection. 'Evolutionism' questions to 'creationism' with the different concerns of religion. According to Becker (1985) creationism is related to religion and evolutionist is related to science, as regarded to equivalent, logically comparable and so mutually exclusive theory. Dobzhansky (1973 cited in Clement, 2015, p. 280) stated "*I am a creationist and evolutionist. Evolutionist is God's or nature's, methods of creations*". He further clarified that in Muslim countries, several scientists accepted the Darwinian evolution, however, thinking that God governs it. But Clement (2015) argued that there are compatibilities between religious faith and acceptance of evolution.

On the other hand, Voland and Schiefenhovel (2009) attempted to justify the natural implications of religion as follows:

> A different study of the religious matter expanded from the discipline of theology to other disciplines too, since sociologists, psychologists, and philosophers have all sought to analyze and understand "homo religious", searching reasons why religion can help in our daily lives, has so far led to a consistent as the naturalistic explanation for how religious behavior first developed and established. (p. 1)

Darwin (1859) concluded in his book ‘on the origin of species’ that each species had not been independently created, but had descended, like varieties, from other species. However, Prapanacharya (2050 B. S.) stated that Taitariya Upanishad justified about human creation and critiqued the evolutionary theory of Darwinism. He argued that if men were created from microorganisms and developed by the monkey, all microorganisms and monkeys may have changed into humans after a long time. In line with Prapanacharya’s critique on evolutionary theory, Delisle (2019) said that Darwin is focused on “facts and assumptions, probabilities and speculations…in most illogical confusion….and of using his imagination to supply the lack of factual observation” (p. 47). Krishnananda (1994) also explained that "from the two halves of the body of Brahman, Mahu and Satarupa were created as a king and queen, Pryavrata and Uttanapada as their sons, and Akuti, Devahuti and Prasuti as their daughter" (p. 16). On the other way Brahma or Hiranyagarbha projects out of his mind the original individuals,-Sanaka, Sanandana, Sanatana, Sanatkumara, and Sanatsujata, from the cosmic body of Brahma, of the first progenitors of beings,-Marichi, Atri, Angiras, Pulastya, Pulaha, Kratu, Bhrigu, Vasishtha, Daksha and Narada (Manu-Smriti, 1.35).

Vass (2009) claimed that an evolutionary explanation of religiousness is possible, however, sufficient data to confirm an adaptive hypothesis was not found yet. According to Freese (2000), in the mid-19th century, Europe and America attempted to debunk the Darwinian theory of evolutionism governed by a Divine will. Freese (2000) claimed that “historians, sociologists, and many in the humanities are cognitive creationists who believe that the mind, including intelligence, emotions, beliefs, and attitude, is immune to the law of nature, be they biological or

environment" (p. 9). This argument is supported by Clement (2015) who found that most of the Muslim, catholic and protestant are most creationist and then evolutionist.

Social Darwinism and Cultural Development

Comte (2009) developed the three-stages theory to explain social development and the positivist approach to study social phenomena, but Darwin developed a theory to see every human (social) phenomenon with evolutionary perspectives. Here, Darwin's theory destroyed the creationist approach to study social phenomena (Varma, 1973). Comte (2009) defined modernism based on epistemological criteria as being a social phenomenon of knowledge-making through scientific or positive approach. Focusing on Comte and Darwin's theory, Morgan (1877) formed the uni-linear evolutionary theory and proposed three stages of society- savagery, barbarism, and civilization. Spencer was the sociological theorist and focuses on social phenomena whereas Darwin was an evolutionist of natural selection and focused on the origin of species. "Social Darwinism" was coined from the fusion of these two words (Kassebaum, 2000, p. 14).

The Social Darwinism theory has been popular among anthropologists and sociologists for the religious research for a long time. In mid -19th century, social-cultural evolution theory emerged from the work of Marx, Morgan, and Tylor. Indigenous group obtained the opportunities to be called civilized and cultural progress was established. Mesoudi (2011) attempted to justify the use of socio-cultural evolution theory is that

> Sociocultural evolutionary theory can make a novel, significant contributions to problems at the forefront of the social sciences, such as the emergence of cooperation, the role of agency in human affairs, the relative influence of history and function in explaining social phenomena, and issues of subjectivity and social construct. (p. 158)

Kerr (2019) connected that "Darwinian social evolutionary theory can improve ourunderstanding of why particular symbols, myths, and memories are preserved, but also selected - in the Darwinian sense – as a result of their being adaptable to particular environmental contexts at particular times" (p. 171). Kerr further justified that Darwinian evolutionary theory is useful to understand social and cultural change and the development of nations and nationalism.

Misaudi's social-evolution theory and Darwinian evolutionary theory are the foundation for studying social and cultural change, which can be the content of teaching science. It can be justified through involvement in social interaction and counter-argument to the view of sociologists for the betterment of society.

Social Scientist and Cultural Practice

Social scientists include anthropologists, sociologists, psychologists, geographers and historians who study past events and the achievements of human behaviour. The mid-nineteenth century was the period of social scientists. There was no disagreement among social scientists in the view that religion is a human creation; however, they have little deviation on how this religion was created and sustained. Here are some theories on religion's social origin and development, proposed from both positivist and materialistic viewpoints. Ashley (2020) listed different social scientists such as Comte (1942), Marx (1843), Tylor (1871), Spencer (1875), Muller (1888), Durkheim (1915) attempted to explain the world around them providing reasons and rationality for social change, which was divinely inspired to unfold (Thompson, n d).

Social scientists view cultural evolution as a part of the grand plan of nature, which may be the curricular content. The teaching method could be to search for the justification of divine power in society.

After the discussion of social scientists' views on religion, some theories on the origin of religion are presented in the next section of this chapter.

Ghost Theory in Cultural Practice

In 1876 Spencer proposed his theory of "monism" or ancestor worship, arguing that religion's origin is belief in ghosts rather than soul (Battini & Alexey, 2011, p. 87). In contrast, Tylor's theory focuses on the idea of the soul rather than that of ghosts (Oyeshile, 2008). Ghost theory and soul theory were two versions of a dream theory of the origin of religion (Oyeshile, 2008). For Spencer, the gods were derived from early savage experiences of ghosts who were thought to be the heroic ancestors of a particular tribe or group and worship of ancestors appearing in the form of ghosts was the most primitive form of religion (Ghimire, 2014). A newly dead kinsman or a killed enemy may become a source of heightened danger. So, ancient humans feared their dead ancestors and started social organisations to protect themselves (Nazaretyan, 2005).

The scientific reason for appearing ghost is based on the law of conservation of the dead body's energy. In this sense, the relation of the ghost as the form of energy can be the curricular content. The pedagogy could be the narrative collections with elders and participation in local worship programs.

Moreover, Spencer discussed references to the conception of things as visible and invisible: primitive human beings saw natural phenomena as sun and moon, stars and clouds, come and go (Oyeshile, 2008). Tylor criticized Spencer's idea to develop the theory of the origin of religion. Spencer defended that he refuses the argument of Tylor that ancient human being has an innate tendency to conceive things animate around them (Carneiro, 1981). Spencer critiqued the Tylor's ancient culture and

argued that there was a time when the man (human being) did not grasp the differences between the animate and inanimate (Durkheim, 1995).

Both Animism and Manism (ancestor worship/ghost theory) are rooted in dreams since they are regarded as two versions of the dream theory of the origin of religions (Battini & Alexey, 2011). Scholars attempted to assimilate them because Tylor's work depended on intensive firsthand information in vestige culture. Carneiro (1981) suggested that Tylor's theory was just an empirical verification of Spencer's hypothesis. For Carneiro (1981), Spencer's claims are based on the supernatural belief of the "ghost theory", whereas Tylor's primary claim is animism, an attribution of spirits to animals, plants, and inanimate objects. Thus, Tylor was a master of fact and Spencer a master of theory. They can be differentiated as Tylor's explanation of human nature is inanimate objects and Spencer's explanation is fear of ghosts. But the term animism, derived from the Latin word anima, meaning breath or soul, is equally applicable to both theses.

The vestige of ghost theory in terms of duality can be observed even in modern society, e.g. to awaken a sleeping person abruptly is prohibited, as it was feared that in such a state, his soul might not be able to return quickly enough to the body. Therefore, Spencer (1875) referred to ghosts rather than the soul as a source of origin of religion. He added a different view that a ghost is a permanently independent entity; for ancients, god is found as the ghost of a remote ancestor and superior person. This helped people feel that ghosts are divinities reflected in ancestor worship. They are the origin of every religion.

Animism and Cultural Belief

Tylor developed animism in 1871 in his book primitive culture. He defined it as 'a belief in souls or spirits and is used as a synonym for 'religion (Harvey, 2010).

He argues that animism has associations with the ‘souls’ and ‘spirits’ that Tylor saw as central, definitive matters of spiritual belief in all religions (Harvey, 2010). Scholars have debated between naturalism and spirituality. However, the religion of the spirit is called animism and it is near to naturalism. Both of them explain the origin of religious thought rationally (Durkheim, 1995). He further argued that it is the science of religion. Historical analysis of the idea of the soul is fundamentally religious.

From Tyler and Durkheim's idea, animism is used as naturalism. Is the connection with spiritual power can be the content knowledge? The methods of teaching such as spiritual practice with natural objects and discourse among the science teachers and experienced elders can be the ways of teaching.

Tylor (1871) described direct transfusion of the soul by a medicine- man in northwest America. The medicine man put his hand on the breast of the dying or dead. Then he holds them over the head of a relative and blows through them. The next child burns to receive the departed soul is animated by it. It takes the rank and name of the deceased. He further argued that in Greenland, the father believed that the soul of a dead child of his had passed into the living child of hers (Tylor, 1871). Marenko (2014) opines the boundaries between the social world (human) and the material world (nonhuman), as well as the animate and the inanimate, are questionable. He added a new category as a Neo-animism and critiqued that Neo-animism prompts us to rethink our relationships with the world and where the frontier between human and nonhuman, living and non-living, might be located (Marenko, 2014). However, Harvey (2010) argued that some English speakers "do talk about their ships, cars, and computers as if they were animate being rather than inanimate objects, giving them names blessing or cursing them, and applying the personal

pronoun rather than the impersonal it" (p. 19). So, Jensen and Blok's (2013) animism was adapted to academic disciplines such as ethnology and psychology and is popular in everyday language.

The inanimate object that covers the animate soul with spiritual power can be the curricular content.

Moreover, animism is found near naturalism; it focuses on conceptualising a continuity between human and nonhuman, which can be produced metaphorically, ritually and literately (Jensen & Blok, 2013). It focuses on contemporary ecological understanding and indigenous eco-cosmology. According to Tylor, primitives suffered from primordial stupidity. They nevertheless exercised their limited intellectual powers to develop explanations of the world in which they lived. Therefore, religion began with the belief in spiritual beings (Martin, 2005). Tylor explained "three forms of primitive culture and summarized as the first rites for the animists were funeral rites; the first sacrifices were food offerings destined to satisfy the needs of the departed and the first altars were tombs" (Durkheim, 1995, p. 49).

However, Tylor argues Animism was the earliest form of religious belief, and that religious thought progressed over time to more civilized forms of organized religion and pattern of cultural development in the Darwinian line in three stages, from “savage” to “barbarism” to “civilized” (Molendijk. 2004, p. 325).

Totemism in Culture

Totem appeared in the ethnographic literature at the end of the eighteenth century, which includes humans, particular plants and animals (Durkheim 1995; Harvey, 2010). Frazer (1887) argued that a totem is an object that generally includes species of animals or plants, more rarely a class of inanimate natural objects and very rarely a class of artificial objects. Frazer (1887) classified totems into three types as:

> 1) Clan totem: common to a clan and passing by inheritance from generation to generation, 2) the sex totem: common to all males or all the females of tribes, to the exclusion in either case of the other sex, and 3) the individual totems: belonging to a single individuals and not passing to his descendants. (p. 2)

Rose uses the term ‘totemism’ to refer to "these relationships and commitments that cross species boundaries, involving high degrees of mutual care between particular animals, plants and human or human-animal relationships" (Harvey, 2010, p. 22). He further establishes the responsibility of local, multi-species communities for the well-being of all co-inhabitants, an obligation that is commonly identified as ‘the Law’ among Aboriginal people but also (re-) translated as ‘Dreaming’ (Harvey, 2010). Totemism is a religion that originated in ancient society. It is a source of social norms, and social harmony in modern society.

Harvey's identification of the primitive relationship of humans, plants and animals can be taken as the subject matter of school science. The discourse among cultural elders and religious leaders about the religious function and their preservation can be the way of teaching.

Frazer (1887) argued that totemism is both a religious and a social system. Durkheim proposed "totemism as a theory of the social origin of religion and MecLennan was the first to try to connect totemism with general human history" (Durkheim, 1995, p. 85). This theory focuses on taking care of relationships of well-being among all the inhabitants of an area or country (Harvey, 2010). Whereas totemic organization posits a dichotomous relationship in which ‘‘nonhumans’’ provide a repertory of labels for social classification (Jensen & Blok, 2013).

According to Durkheim (1995), there are more than five hundred totemic names listed by Howitt from among the tribes of the Australian Southwest. Forty

names are not neither name of plants and animals. They are "clouds, rain hails, frost, moon, sun, wind, autumn, summer, winter, certain stars, thunder, fire smoke, water, and sea, etc." (p. 102).

Durkheim believes that totem represents the natural object such as clouds, rain hails, frost, moon, sun, wind, autumn, summer, winter, certain stars, thunder, fire smoke, water, and sea. These natural objects can be the subject matter of the curriculum. It can be taught through observation and involving students in generating knowledge from natural objects.

Durkheim observed the defects in Tylor's theory of animism and Muller's theory of naturism a) religion as superstition and b) individualistic. Durkheim (1995) explained that religion originated in primitive society, a source of social norms and social harmony in modern society. Jevons (1899) viewed that "all sorts of societies use the sacrificial feast as a means of binding themselves to their divinity-voluntary associations as well as blood-relations, members of a nation or a tribe as well members of a totem-clan" (p. 372). He further claimed that the totem clan is the earliest social organization known in the evolution of society which worships the deity as a form of a religious organization.

Disagreeing with Tylor's spirituality, Jevons and Durkheim's argued that totem helps for the preservation of natural objects as well as shows the social evolutionary practice with social harmonization. It means arguments and counter-arguments over totem can be the content of school science. Conversation, dialogue, and storytelling among religious elders can be the teaching method to get knowledge on the Nepalese totems and their kinship relation with spiritual being as protectors.

Moreover, Frazer (1887) claimed that pure totemism is democratic and it is a religion of equality and fraternity. One individual of the totem species is as good as

another, advanced the religious society. It is a belief that a totem animal is one that is with you for a lifetime, both in the physical and spiritual world as a guardian spirit.

Naturism in Culture

Naturalism is the modern western theory, which depicts human being as part of nature. It is a scientific method which provides a privileged point for understanding (Jensen et al., 2013). Muller (1901) suggested that as soon as we know anything of the thoughts and feelings of man (human), we find them in possession of religion. According to Tylor, ancient records of religious thought preserved are the songs in the Veda. He further said that the Veda's explanation of the phenomena of ancient religion must be considered authentic, written and language proof (Martin, 2005).

According to Muller (1892), Buddhism would be a natural religion in the eye of Brahmans and Brahmanism would be a natural religion in the eye of Mohammedans. He further stated that he found both philosophy and religion in the Vedas: an effort of cosmological interpretation of the Vedic seers is philosophical, and the interpretation and response to them are religious.

Mullar's arguments of Hinduism and Buddhism as a natural philosophy can be the curricular content. Discourse among teachers and religious leaders can be a way of learning the natural value of Hinduism and Buddhism. It can be evaluated through the spiritual understanding of the students.

The early (Vedic) Aryans interpreted cosmological (natural) forces such as rain, storm, day, night, thunder, etc., as gods. They composed songs to approve the gods to manipulate their power for human benefit. Muller argued that religion originated from natural forces. Hence he proposed the theory of religion as Naturism. According to Schmidt and Rose (1935), Muller (1892) delivered a Gifford lecture focusing on "positivism, and distinguished three kinds of cult- objects, namely 1)

things which could be grasped, such as stones and shells, 2) partly grasped, like trees, rivers and mountains, and 3) not at all, as the sky, the sun and stars" (p. 40). He called them physical religion and social relations with humankind. Muller (1892) further argued that "natural religion is formed by physical, anthropological and psychological religion because psychological environment presupposes both physical and anthropological religion" (p. 91). He further argued God had to be conceived as soul-like and the soul of humans as God-like because only similar entities can be united (Muller, 1892).

Muller and Schmidt's argument shows that religion and naturism focus on the same natural god. This can be the curricular content of science teaching. Discourse among students, teachers and spiritual leaders can be the method of teaching. Besides, students can be asked for project work on about Vedic natural gods

Schmidt and Rose (1935) further clarified the Vedic god and roles as Aditya. They function as the guardians of the sacred order of the universe and native Aryans. Aditya works as a supreme being as the chief gods of seven planets. Like that the Rig Veda mentioned the Surya, the eternal charming daughter of the sun, who is desired in marriage and is considered a female solar deity. Ushas is also viewed as the sun, while Mitra Varuna is regarded as the sun's eyes (Schmidt & Rose, 1935).

Those natural gods having eternal power and spiritual value can be taken as the subject matter of the school curriculum. The way of teaching may be project work to collect the narratives of the community elders.

The Rig Veda's first hymn of the first Mandala mentioned the Indian continent's principal deities-fire is a natural phenomenon. Primitive Latin meaning *ignis* is closely related to Agni, which was the first phase of the religion of nature (Durkheim, 1995). About the use of fire Durkheim expresses the following view,

> No matter how it first appeared- whether it came from lightning, whether it was obtained by rubbing tree branches against one another, or whether it sprang forth as sparks from rocks – it was something that moved, that progressed, from which one had to protect oneself, that carried destruction with it; but at the same time, it was something that made life possible in winter, gave protection at night, and served as both an offensive and a defensive weapon. Thank fire, man ceased to be a devourer of raw meat and became an eater of cooked foods. Later, it was also using fire that metals were worked and tools and weapons made; it thus became an indispensable factor in all technical and artistic progress. Where would we be, even now, without fire? (pp. 71-72)

Schmidt and Rose (1935) further classified religion as physical, anthropological, and psychological, where natural religion is formed by the combination of these three religious aspects. Moreover, Aditya, the guardian of the universe and humankind, is considered a supreme being representing seven planets. Parjanya, the god of thunder and rain-storm, Varuna and Dyauspitar are called our lord and father (Schmidt & Rose, 1935). The sacrificial fire, Agni, is the messenger who brings humans into relation with the deity. S/he is likewise themselves the sacrificing priest.

The counter-argument of Schmidt, Durkheim and Rig Vedic hymn display the powerful natural and religious gods as creators and messengers from human to deity. This means fire and sun have cosmological, spiritual and practical supremacy which can be included in the curricular content of school science. This content can be provided through observation of natural objects. Students can also be asked to do project work about fire and the sun's spiritual and practical supremacy.

Shamanism in Cultural Practice

Shamanism is a system of religious practice; historically, it is often associated with indigenous and tribal societies. It has the power to heal the sick, communicating with spirits, and descent souls. Shamanism is “historically found in virtually every culture in the world, where shaman cure like doctors and perform miracles like magicians” (Bright, 2009, p. 3). They are used to care about the illness using supernatural or magical power, generally used by healers, religious leaders, and counsellors to obtain an ecstatic or trance state (Harvey, 2010). Hervey further added that only some shamans are therapists and only some shamans in the form of hunters.

Shamanism developed in the earlier period of human history from a common cultural practice in hunting and fishing societies. Shamanic therapeutic perspective relates to psychopathology, spirituality and transpersonal psychology (Bock, 2005). He further argued that "when nervousness and mental troubles increased in a person, shamans’ developed healing methods function as a means of symbolic protection for them with utilizing their faith personally or collectively" (Bock, 2005, p, 8).

Moreover, the shamans are versatile specialists. They are practitioners of the inter-spiritual world, contact people of spiritual entities, humanity’s first physicians, magicians, artists, storytellers, timekeepers, weather forecasters, and herbalists (Kaplan, 2006). Kaplan (2006) claimed that such practices first emerged in a hunter-gatherer society and persisted in settled communities combined with other religions. His further arguments clarified that shamanic trance states can be induced by a variety of means "including hyperventilation, audio driving, sensory deprivation, pathological conditions, migraine, pain, fasting, meditation, prolonged rhythmic dancing, flashing lights or drumming" (p. 2)

Shamans as herbalists, physicians, magicians, artists, storytellers, timekeepers, and weather forecasters can be content of the science curriculum. This content can be taught through fasting, meditation, prolonged rhythmic dancing, flashing lights or drumming.

Bock (2005) clarified that shamanic practices use both Tantric Yoga and meditation, and both roads lead to dopamine. He claimed that shamanism and its contemporary appeal are "rooted in psychobiological structures as content matter and basic functions of the brain, mind, and consciousness" (Winkelman, 2002, p 1875). The shaman is supposed to enter into the spirit world, where the dissatisfied spirit is appeased by fulfilling his/her demand, brought to the patient, and asking for well-functioning (Winkelman, 2002).

Here, shamanic practices evoke powerful emotions and healing through psycho- and socio-therapeutic functions and physical treatments as a methodological choice. The first theological and spiritual systems were based on biological and symbolic capacities. However, the scientific approach sees the link between cause and effect as false and interprets cause as psycho-physical treatments (Winkelman, 2002). At present, certain shamanic society believes a lost soul of a person cannot find the way without the intervention of a healer (shaman), to rescue/restore it to equilibrium. A shaman goes into the spirit world to search for the lost soul of a sick person (Cartwright, 2004).

Shamanism focuses on the physical or material world. The sacred manifests through wild nature as an infinite source of life. Shamans read "nature, regarding and interpreting the elements and events that communicate through soul at all times and places" (Bright, 2009, p. 4). Jungian psychology is also found compatible with

shamanism in another form- health as wholeness and pathology or lack of health as a lack of wholeness (Bock, 2005).

Shamanism is related to neurochemical, neuro-pharmacological, and neurophysiological evidence. Thus, one feels transcendental consciousness and feelings of ecstasy (Winkelman, 2002). It focuses on studying the religious system and altered state of consciousness [ASC] as ways of gaining knowledge that can be subjectively recognized by an individual (Peters, 1981).

Scholars argued that the Indo Aryan were also associated with shamanism for their practice of ASC by consuming *soma* around 4000 BC and supposed the ASC stage was divine intervention (Mahdihassan, 1984). They had a system of ritual consumption of a hallucinogenic mushroom called the fly agaric or soma (*Amanita muscaria*) as a divine gift of a hallucinogenic healer and painkiller. Medicinal application of shamanism is found practised since 3000-2000 BC, but the accurate time of such practices is unidentified (Cartwright, 2004).

The discussion above suggests curricular contents like healing, medicinal treatment and use of Soma, neurochemical activation and ecstatic. The methods of teaching science are social interaction, sharing knowledge with shamans, and practice of spiritual healing. The experience sharing of the students engaged in healing, medicinal treatment and use of Soma, neurochemical activation and ecstatic can be the evaluation system.

Many ethnic, caste, and religious groups of Nepal practice shamanism. They have their own *Dhami and Jhakri* (Witch doctors) who use spiritual techniques to care for the disease, especially chanting the mantra, sacrificing, and healing.

Archaeology of Social Development

Archaeology is essential to study the cross-cultural study of social development. Archaeology “provides a broad comparative lens to the study and practices of individuals across the social spectrum. Archaeologists search the materiality of ancient religious tradition-the entanglement of ancient beliefs and practices within the materials worlds” (Barrett, 2016, p.1). According to Barrett (2016), the contemporary archaeological study of ancient religion is a "deeply multidisciplinary endeavour, frequently requiring archaeologists to engage with theories, methods, and from the field that includes anthropology, religious studies, archaeometry, art history and philosophy" (p. 1). Archaeology helps to study the various religions in distinct paths.

The archaeology of social development gives content like materialistic ideology and artefacts. It can be taught through dialogue, museum visits, internet searches, cultural narratives, and storytelling.

Science in Shamanism

Shamanism is psychobiological structures and basic functions of the brain, mind, and consciousness (Winkelman, 2002). Winkelman further argued that Shamanism plays a central role in elucidating neuro-theology because shamanism constitutes humanity’s first theological and spiritual system. On the other hand, religion helps to promote interest in the search for a consistent scientific explanation of the origins of human religiosity, which includes "evolution – theoretical, neurobiological, psychological, sociological, and historical insight; engage in religious activities, helps in biological adaptation" (Voland & Schiefenhovel, 2009, p. 2). Voland and Schiefenhovel further argued that adaptive behaviours are brought about by religiosity and that the content of religion is shaped through natural selection.

The shamanic function yields content like the evolution of neurobiological, psychological, sociological and historical insights. The teaching methods may be discourse among shamanic healers and experience of shamanic practice.

The shamanic practice uses both Tantric Yoga and meditation, both roads lead to dopamine (plays several important roles in the brain and body) (Winkelman, 2002). The results support the notion that depletion of dopamine in delimited regions of the brain, which is typical for persons suffering from Parkinson's disease, is responsible for their less developed religiousness (Voland & Schiefenhövel, 2009). Shamanism is found in every culture of the world (Elide, 1974, cited in Bright, 2009) and the practice of shamanism is the oldest spiritual healing tradition still in use today, which is as old as human civilization. They further claimed that shamans "cure like doctors, perform miracles like magicians, linked to events surrounding life and death, healing and health, and spirits and the underworld; read nature, regarding and interpreting the elements and events that communicate through soul at all times and places" (p. 3-4).

Bright (2009) suggested that modern man has increasingly developed causal thinking and has pursued science and technology as our foremost religion. These modern people need "understanding the universals of shamanism and reveal the foundations of humanity's original neuro-theology, in where, a natural theological paradigm based on fundamental structures and operations of the brain" (Winkelman, 2002, p. 1876). Shamanism practices the ASC through, the first is the experience of "flying-the shaman leaves his/her body to enter the spirit world, second is through facilitators to reach the consciousness using drum or rattle, entheogens or fasting, sensory deprivation and postural discomfort, third, the shaman flies to and around the spirit world" (Carthwright, 2004, p. 13). These practices can be called methodological practices of obtaining a scientific treatment system embedded in shamanic practice.

About religious affiliation and reproductive success, Blume (2009) stated that "humans who are members of religious communities show statistically higher motivations towards marriage, children and family values, more cooperative orientation and finally higher reproductive success than their secular contemporaries" (p. 119). The characteristic of shamanism such as the soul-flight and death-and-rebirth experiences, are natural symbolic systems for self-representation (Winkelman, 2002). McClenon (2002) and Winkelman (2006) (cited in Voland, 2009, p. 13) further attempted to justify the use of spirituality "spiritual practice makes use of special mental states such as meditation, hypnosis, trance, and ecstasy, in where the neurochemical processes coincide with these mental states are associated with consequences for health and well-being". They further argued that "mystical experiences and therapy are separately linked and this is exploited by shamanism, a connection between therapy and mysticism, it is debatable as to whether or not shamanism belongs to the history of medicine or the history of religion" (p. 14).

The mystic elements in everyday living can improve one's physical and mental well-being and improve mastery of eventualities, where a connection has evolutionary feedback and shamanism is therapeutically successful in developing the religious aspect (Voland, 2009).

About the prehistoric shamanism system, Cartwright (2004) added that surgical and medical plants were used as magico-religious medicine, covers "ostracisation, sacrifice, art, burial practices, music, the use of certain natural places and other actions which may not to the modern mind be seen as medicine, but often are seen shamans, may also have been so for peoples in prehistory" (p. 2). These arguments indicate that plants that are toxic in larger amounts are taken by chimpanzees (ancients) in controlled doses to clear intestinal parasites and to treat microbial infections, whereas apes use more than 30 medical plants in ills, is used by local people for the same ailments (Cartwright, 2004).

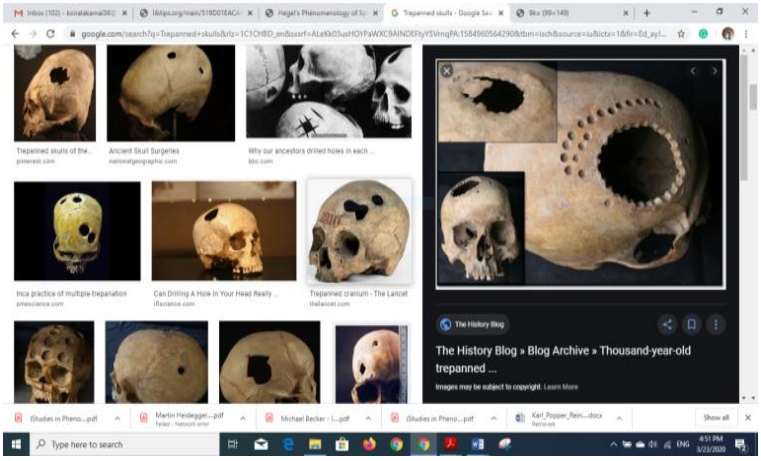
Mystical treatment, therapy, treatment of microbial infection, surgical instruments, use of medicinal plants can be the content of science teaching. Pharmacists' verification of medicinal plants and project work on using plants for treatment can be ways of teaching.

The use of Trepanation which was the oldest known surgical operation, was the practice of the early Neolithic and late Mesolithic people. It indicates the origin of shamanic practice in the West. Many archaeological studies showed that ancestors used trepanation for religious (amulets) and medicinal (surgical) purposes, which was found in trepanned skulls in Denmark. Moreover, it was supposed to use in skull fraction, epilepsy, serious headache and mental illness, but the evidence these reasons are not confirmed for trepanation (Cartwright, 2004).

Many Vedic hymns indicated that ephedra (soma) was used to increase immune power, as an energizer and treat the different by seer/ saint in Aryan culture as god soma near about 4000 BCE (Mahdihassan, 1984). Reg Vedic hymn stated soma as the food of the god Indra. Reg Veda (9. 69.8) has explained soma as food provider father and maker of the strength of life. Rig Veda (1. 56. 1) also states “Indra drinks the Soma juice which strengthens for great deeds. Rig Veda (1. 91.5), stated soma “thou art Auspicious energy”, typical of a plant with contains alkaloids like caffeine. The Aryans also took Soma with curds, milk, water, butter and barley mixed (Mahdihassan, 1984). They have a ritual of feeding a newborn child soma juice for immorality.

Use of Soma as medicine and energy source and juice for new born child for immorality and trepanation used in surgical instrument indicates the curricular content of science teaching. This content can be obtained through interaction and practice among shamans, surgeons and Vedic Gurus.

Figure 5 *Prehistorical Surgical System*



The methodological approaches of acupuncture, shamanism, surgery, and medical plant use is more strictly religious purpose rather than medical. However, one can see the scientific verification of religious wisdom on it. Reynolds and Tanner (1983, cited in Feierman, 2009) argued that "membership in a religious group and having religious faith increases one's chance of biological survival and reproductive success, in where religion to have evolved by natural selection and its components are called adaptation". Blume (2009) further critiqued that among recent homo sapiens supports the thesis of adaptive abilities evolved into human brain architecture and higher birth rates of religious-affiliated have been empirically verified globally.

Harris and McNamara (2009) connected religious value with the shamanism process of healing as science expressing the view that "religiousness increased across human lineages in tandem with innovations in healing practices or with new forms of cooperation, then it becomes more reasonable to link religiousness functionally and innovative healing practices or cooperative practices" (p. 205). Shamanic consciousness reveals that "basic natural structures of consciousness are concerned with human personal and social identity; relationship to the environment and animals;

linkages of self and other representations; transformations of self-representations; and integration of autonomic, emotional, and self-processes" (Winkelman, 2002, p. 1884).

The use of acupuncture, shamanism, surgery for treatment, a cooperative healing system and the use of the medicinal plant can be the content of the science curriculum. Experiment and discourse among the teachers, students, parents, and shamans can be the way of teaching.

Psychophysiological Linkage of Treatment in Shamanism

Shamanism's focus on the fundamental principle of the human nervous system, ecstasy, and brain relaxation reflect the presentation of symbolic capacity. It provides psychophysiological information, coordinates muscles, linkage somatic, increase immune power, and cognitive experiences. Shamanistic healing rituals alter physiological, psychological, and emotional responses, using activity and symbols to produce effects in the autonomic nervous system. "Shamanistic healing rituals provide physiologically and culturally mediated forms of adaptation to stress that are reinforced by procedures eliciting opioid release and enhancing serotonergic function" (Winkelman, 2002, p. 1885). About psychological aspects of shamanism (Winkelman, 2002) provide the views as follows

> Physiological aspects of ASCs facilitate healing and psychological and physiological well-being through physiological relaxation; facilitating self-regulation of physiological processes; reducing tension, anxiety, and phobic reactions; manipulating psychosomatic effects; accessing unconscious information in visual symbolism and analogical representations; inducing interhemispheric fusion and synchronization; and facilitating cognitive-emotional integration and social bonding and affiliation. (p. 1885)

In America, most people use 16 types of therapist modalities. Bock (2005) classified these modalities into "relaxation techniques, herbal medicine, massage, chiropractic, spiritual healing, megavitamins, self-help groups, imagery, commercial diet, folk remedies, lifestyle diet, energy healing, homoeopathy, hypnosis, biofeedback, and acupuncture" (p. 34). Bock further argued that shamanism is used to treat psychological problems such as abuse, addictions (e.g. chronic alcoholism), anxiety, depression, developmental deficits, obsessions, phobias, and varying levels of psychosis. It is implemented as a scientific approach to treat psychological and physiological diseases by indigenous practitioners and folk healers within their Ethno-culture.

Bock's therapist ways of psychological treatment include relaxation techniques, herbal medicine, massage, chiropractic, spiritual healing, megavitamins, self-help groups, imagery, commercial diet, folk remedies, lifestyle diet, energy healing, homeopathy, hypnosis, biofeedback acupuncture can be content for science teaching. Experience with the shamanic practice for relaxation and sharing with elders can be the ways of teaching

It is known that shamanistic practitioners use meditation which helps to stimulate the brain, reduce stress, activate individual power, connect community and the spiritual dimensions, and reduce addiction (Winkelman, 2002). We can observe such practices in the Vedas and the Vedic literature. God Mahadeva is credited for such therapeutic healing through the sound of the drum, dance, etc. Shamans practice it to draw the energies of the universe and reweave them through trance, dance, and power of intention to create unique healing rituals (Pratt, 2007). These deliberations above help claim that science is embedded in religion and shamanism.

Cosmological and Medicinal Science in Shamanism

A cosmological concept is a concrete mystical experience that shows the religious life of the people and the religious experience of shamans and then personal and ecstatic experience (Walsh, 1991). In ASC, one believes that a complex cosmos in which at least two physical and spirit worlds exist and certain people have the ability to control relationships voluntarily with the other world for practical purposes (Bishop, 2001), such as curing the sick, maintaining a good relationship with the powers in the other-world, to restore an upset harmony, to reclaim a lost soul, to make good hunting possible, to forecast the future, to cast spells, etc. (Clottes, 2002).

A shaman may also send their soul to the other world to meet the spirits and obtain their help and protection. Shamans will do so through trance. So s/he has a most crucial role as a mediator between the real world and the world of the spirits and a social role through arduous training (Bishop, 2001, Clottes, 2002). In the west, homo sapiens of upper Paleolithic people had an identical nervous system to ours and practised ASCs in various forms, including hallucinations (Clottes, 2002). For example, shamans speak to the trees in the forest to learn how to make plant medicine, dance to bring rain and journey on behalf of their patients to ask the spirits to heal the patients' bodies (Bishop, 2001). It means shamanism is no dogma, church, cult, or divine personification. It is only a spiritual discipline (Handziy, 2015; Pratt, 2007).

The Rig Vedic hymn shows Indra as a central shamanic cosmic power who drinks Soma and shows the cosmic dance (Carpa, 1975). According to Relic (2015), in ancient Vedic mythology, there was the concept of flight and insight into the philosophy of Yoga, which means soul flight, similar to the shamanic journey. There are a shamanic journey of God Indra dragged by horses'; where the fire, Agni as the

form of a horse, plays the role of messenger between the world (Relic, 2015; RV. 5. 43. 5). The Rig Vedic and the Atharvedic hymn also indicate that the herbs of Soma are related to the elements of magic and healing the connection with the Vedic god Indra. Its detail will be described in Vedic medicinal practice.

The concept that shamanic healing restores the health of the lost souls also assumes that "everything is alive, everything has spirit and awareness, and energy and matter are the same" (Keiraleyn, 2014, p. 2). However, this was separated by animism as soul and Ghost theory as a separate soul (ghost).

A shaman can journey to the place of power where the spirits live and where the power of shamans could be recharged (Pratt, 2007). Laszlo (2003) (cited in Handziy, 2014) viewed space as an energy-filled plenum (space filled with matter and tiny quantum energy having a wavelength 10^{-35} meters in a cubic centimetre of space) called cosmic energy. Modern scientist Newton called the same thing as space and later as the quantum vacuum. In the nineteenth century, scientists considered it filled with electromagnetic waves and regarded it as the ether (p. 7). Albert Einstein, in his theory of relativity, mentioned that space-time is physical quantities. It is a physical energy medium, also the idea of the plenum. This idea is supported by physicists such as Max Planck, Max Born and John Wheeler (ibid). These physicists believe that energy consists of it in absolute zero temperature called zero-point energy, which Max Plank got it from Black body radiation. The scientific understanding help claims that shamans use the cosmic plenum and spirit embodiments with controlling spirit (Pratt, 2007).

From the arguments above, cosmic plenum, quantum physics, its relativity and Shamanic spiritual energy practice can be curricular contents. Interaction with teachers, elders and Shamans can be the pedagogical process.

When a shaman receives a lot of energy to accomplish his or her task in the physical world, s/he enters the trance, and hence the spiritual world becomes visible to the shamans. They can communicate with the spirits and souls of people, both incarnated and non-incarnated states (Handziy, 2014). In this process, shamans use the energy of the cosmos to cure the patients through creativity and ecstasy and diagnosis, prescription and healing (Pratt, 2007). Shamans also use altered states of consciousness to see the true nature of the universe. Modern scientists describe the universe (cosmos) as made up of energy elements such as an electron, protons, photons, and neutrons (Carpa, 1975). Shamans believe the universe is made of vibrational energy, which is accepted that vibrational energy (quantum waves) has in every object. They use sacred songs, chants, and rhythmic drumming to harvest vibrational energy (Pratt, 2007).

Space that we know boils and becomes a froth of quantum foam, a combination of virtual Planckian black holes and wormholes; space-time ceases to exist inside Planckian black holes, and neither space nor time exists there (Pratt, 2007). Per Carr (2007), a multi-universe (parallel universe) connected by a wormhole will collapse. A person's body cannot travel there but in the shamanic state of consciousness, most of the person's soul stream can travel in it. According to Villoldo (2000), there is the "ninth Chakra resides at the heart of the universe, consisting beyond time and space, connected with the eighth chakra which consists above the head connecting with a luminous cord" (p. 106). The shamans can travel through this cord which is a dwelling place of spirit, which bound us to the space-time continuum and salvation called the eighth chakra, considered the entry point to the heaven of the spirit world (Pratt, 2007; Villoldo, 2000).

Micro spiritual energy as subatomic form, its travel over time-space as well as the heaven of the spiritual word can be the content of the science curriculum.

According to Peters (1981), an altered state of consciousness soul journey is the basic practice of Nepalese Tamang shaman, who believes that his soul leaves his body and traverses a visionary cosmos composed of heaven and underworlds. Then returned a soul stolen by a spirit of exorcising a possessing spirit, a potential cause of illness, then diagnosis and treatment of illness (Peters, 1981). In the spiritual world, individuals should hold the feeling of joy, love to everybody, and developed will can think about their stream of soul following inside the Planckian black hole. The shamanic state of consciousness can be achieved the first time when a person's soul goes through the eighth chakra (through the top of his head) and a stream of the soul becomes visualized to the ninth chakra which consists of the number of heavens and lower worlds, in which various gods and demons exists (Pratt, 2007; Peters, 1981). Einstein proved it by saying that a huge amount of energy is produced as cosmic radiation, which is invisible through our naked eyes.

Not only that, the contemporary shamans address a full range of health issues from the common cold to cancer, depression, fertility, and longevity; family problems, including issues that arise between spouses, parents and children, in-laws, and dead family members and their intention is generally benevolent. Similarly, witches, wizards, magicians, and sorcerers also draw on the spirit of nature and energies of the universe. But the problem is that they use it to serve their intentions, which may be generally malevolent, to gather power for personal means so that they cannot be considered a shaman (Pratt, 2007). Suppose the spirits of the death are attached to the soul of a living being who is lost in the Land of Dead (may be Upperworld and Underworld) before their time. In that case, other spirits are

malevolent, act as sorcery, and engage in malevolent missions; interaction with harmful spirits can create disorientation, disharmony, illness and possibly death (Pratt, 2007).

Cosmological and medicinal knowledge within Shamanism can be the content of school science

Cosmological and Astronomical Science in Shamanism

Cosmology and astrology are the science of the universe's origin, development, and function. Shamanism's cosmological and Astrological science is considered a true insight into the nature of the cosmos, having special meaning, expressing it as the Tree of life or World Tree, the spiral and the circled cross (Pratt, 2007). The Tree of Life is linked in the axis, the centre of the balance and the whole of the shamans universe called the central axis, Mundi, or world axis (Walsh, 1991). It symbolizes the connection of three realism of the spirit world: Upper World, Middle World and the Lower World (Walsh, 1991). Walsh (1991) considered it three-tiered, comprised of Upper, Lower and Middle worlds; the Lower and Upper worlds may be multilayer, making shamans cosmic travellers (sky and underworld from the earth).

Shamanism believes that the visible world is pervaded by invisible forces or spirits, which affect the life of living. A malicious spirit inspires the causes of diseases; both spiritual and physical methods are used to heal (Winkelman, 2002). Generally, Shaman enters the spirit world and beats the drum with a steady beat for several minutes until a different state of awareness. The soul flight and death and rebirth experience characteristics of shamanism are a natural symbolic system for self-representation (Winkelman, 2002), soul flights, or journeys as body experiences and near-death experiences.

Shamans use the World tree to represent life, fertility, and the sacred generation. The shamans can climb to other worlds (Walsh, 1991) and enter the in-ordinary reality, the branches providing a means to go Upperworld, roots as the Lower World, and trunks as Middleworld. By standing in the centre of the cosmos, shamans are connected to the whole and able to travel to any corner of it as the spider consists in the centre of the cosmic web and can feel and influence distance realms (Bright, 2009; Pratt, 2007, Walsh, 1991)). The mythical (cosmic) mountains at the centre of the earth and the world pillar hold up the sky (Walsh, 1991). About the interconnection of these three-spirit words and the physical world.

According to Walsh (1991), these three cosmic regions are connected by a "central axis, " consisting of an ‘opening’ and a ‘hole’. Through this hole, the gods descend to earth and the dead, through the same hole that the soul of shamans in ecstasy can fly up down in the journey" (p. 87).

Chapter IV

Philosophy and Science within Religion

Introduction

This chapter discusses Hindu, Buddhist, Jain, Charvak and Taoism as religions and philosophies. Russell (1945, 1995) stated that philosophy and science were not seen separately. They were born together in the sixth century, whereas religion was born before that time. Bloomfield (1908) mentioned that Vedanta and Samkhya are religio-philosophical systems: he observed twin forms in them. Varma (1973) added that Veda helped develop Buddhism's intellectual development. Jaina and Tao religions originated from the Vedic religion as a philosophical foundation (Saraswati Swami, 1995). So I have tried to see the linkage of the philosophy mentioned above with the science-like eye view drawing the curricular contents, methods and evaluation.

Philosophy within Hinduism

Philosophy is the study of the fundamental nature of knowledge, reality, and existence (Sharma, 1962). Comte (2009) included theology, metaphysics, and positivist science within philosophy. James (1987) on the other hand, included theology, spirituality, psychology, a system of duties and morals physics within philosophy. Philosophy for James is taken as something distinct from science or practical affairs and follows no method peculiar to itself. Indian continental philosophy in this sense is based on rational speculation in harmony with the Vedas. It aims to realise the highest perfection (moksha) attainable in human life. These philosophies focus on reality, human consciousness and human salvation (Varma, 1973; Vyas, 2016). According to Wright (1920), even western philosophy has roots in oriental soil and is irrigated by oriental thought.

Barua (1970) argued that the mere doubting processes of the human mind are in religious; and thought and consciousness of ultimate categories are in philosophy. He further argued that in the beginning, the individual thinker was a form of mythical state as a cosmological and psychological being, which later grew as a form of philosophical being (Barua, 1970). In this sense, Aryans simultaneously gave their philosophical, sociological and theological point of view (Saraswati Swami, 1995). He further argued that Hinduism only focuses on social life or the structure under "Varnashrama dharma" (Saraswati Swami, 1995). Philosophy and theology are mentioned in other Vedic literatures (Saraswoti Swami, 1995).

The science of pray, use of words for pray and the ways to harvest space can be the contents. Discourse and dialogue with religious elders can be the methods of teaching.

Veda was used as the religious scripture of Hindus. However, after the sixth century BCE, it was developed as philosophy in the form of Upanishad, Brahma-sutra, Vedanta, Brahmanas, Aranyakas, Bhagavat Geeta and Puranas. These Veda Sastras can be classified into the exoteric and esoteric; exoteric focuses on religious activities and sacrifice of natural Gods, but esoteric is the mystical approach to truth (Radhakrishnan, 1956 II). The mysterious process, according to Muller (1860), is "theological and philosophical works, as well as in poetry, incodes of law, in astronomical, grammatical, metrical, and lexicographic compositions, is called by one comprehensive name, the Veda" (p. 9). Vedic texts address different forms of knowledge (Krishnananda, 1994).

Comte (2009) perceived many scientific and philosophical arguments in Vedic literatures in the form of religion or spiritual or theological perspectives. In this

chapter I attempted to see the philosophical parts of these literatures and see their links with scientific worldviews.

Vedic Philosophy

The oldest eastern knowledge system is called the Vedic philosophy, which emphasizes the need for practical realization of truth. Brahman imparted philosophic knowledge in the form of *sabda* (spiritual sound) to his immediate sons, who are great sages of a higher planetary system (Swami, n. d). About five thousand years ago, Vyasa compiled the *sabda* into Sanskrit scripture, collectively known as the Veda today (Swami, n. d).

Basic knowledge of cosmic Brahman and the material world can be the content for school science. Argument and discursive analysis can be ways of teaching

The Rig Veda is, on the whole, the oldest and the most important of the four Vedas. Its language is priests, very high, and very literary speech (Saraswoti Swami, 1995). It focuses on the creation, cosmos, ritual, spirituality, astronomy, and Atma Paramatma and liberation. The Yajur Veda focuses on sacrifices, mantra, and bhakti. The Sam Veda focuses on Karma Kanda and rituals, and the Atharva Veda focuses on prayers, magic chant, medicine, and meditation (Radhakrishnan, 1956 I; Vyas, 2016). Each Veda has its Upanishad. The Upanishads are considered the essence of thought drawn from Veda's knowledge. It presents wisdom of Samhita, Aranyakas, and Brahmanas. They discovered the nature of unconditional existence, called secret knowledge or ultimate truth (Radhakrishnan, 1956 I). “The Aranyakas form the transition link between the ritual of the Brahmanas and the philosophy of Upanishads, where poets of Brahmanas related to the priest and the Upanishads the meditation is related to philosophies” (Radhakrishnan, 1956 I, p. 65).

Apart from the Veda, there are fourteen Dharmasthanas and four Vidyasthanas (see detail in appendix 1) (Saraswoti Swami, 1995). In addition to it, there are many Upanishads of each Veda. Among them the 108 Upanishads that have a link with the Veda (appendix, 2). Among them, the oldest Upanishad are Isa, Kena, Katha, Prasna, Mundaka, Mandukya, Taittiriya, Aitareya, Chhandogya, Brihadaranyaka, & Vetasvatara, Kaushitaki and Maitri (Ranade, 1926).

Vedic philosophy is divided into orthodox and heterodox systems. Orthodox (six system philosophy called astika) included Nyaya, Vaisesika, Samkhya, Yoga, Mimamsa, and Vedanta, which accepts directly or indirectly authority of the Veda and continuation of the Vedic tradition, in which Mimamsa emphasized the prescribed rituals of Veda; whereas, heterodox (nastika, not considered the Veda) Jain, Charvaka (materialism), and Buddhism (Sankar, 2011). Detail about orthodox and heterodox philosophy will be discussed in a separate heading. I present the relationship between different Vedic scriptures and the primary scripture, the Veda, in the following section of the chapter.

Natural Philosophy of the Veda

The glorious aspects of nature are considered the windows of heaven, through which the divine looked down upon the godless earth. The moon, the stars, the sea, the sky, the dawn, and the nightfall were regarded as divine. The worship of these nature as gods is the Vedic religion (Radhakrishnan 1956 I). Scholars thought that hymn of the Veda the earliest spontaneous outbursts of the primitive mind in face to face with the phenomena of nature. The poets of the Rig-Veda were supposed to be simple sons of nature (Bloomfield, 1908). All-natural gods are seen superior for specific purposes. Although, Indra, Varuna, Mitra, Maruta, Agni, Soma, Dawn, Dyaus, Aswins, Savitr, Aditis and Twastr are considered the essential sacrificial

natural gods (Muller, 1860) and their divine as well as natural, sociological, physiological, cosmological, geographical and sociological value is explored in briefly.

According to Barua (1970), the Vedic thinkers consider water as the primary matter and mighty force naturally occurring in the universe; other elements come after water. He mentioned that Rig Veda 10. 129.1 and 190.1-2 focus on the creation of the visible world from the warmth- creative fervour (Tapas) in the primitive substance of water. Going further, Bloomfield (1908) searched the meaning of day and night; of dawn, sun, moon, sky, thunder, and lightning; of atmosphere and wind; of earth and fire. The Rig Veda contains the earliest flashes of religious thought of awakening humanity. There are many beautiful hymns of the Rig Veda to clarify the powerful Vedic deity such as “Gleaming Ushas/Aurora hath prepared the way, delightful as the rhythm of the poem, she smiles and shines, to happiness, her beauteous face aroused us” (Rig-Veda 1. 92. 6). Similarly, stanza five also clarifies the power of Ushas indicating as: "her bright sheen hath shown itself to us; she spreads and strikes the dire black gloom. As one paints the sacrificial post at the sacrifice, so hath Heaven's daughter put on her brilliance” (RV 1. 92.5).

The Rig Vedic hymn, which was considered mythology, is the first and fundamental adjustment of the individual human life to the outer active, interfering and dynamic world, which surrounds and influences man from the movement when his opened eyes upon the wonders of its unexplained phenomenon, it is day what our empirical science says (Bloomfield, 1908). He further justified the natural God Savitar saying that the Rig-Veda says of God Savitar, the sun conceived as the promoter of life: "God Savitar, approaching on the dark blue sky, sustaining mortals and immortals, comes on his golden chariot, beholding all the worlds" (Bloomfield,

1908, p. 86). Sun is further considered as "life and light in the world, assigned supernatural power to him, called life moveth and standeth, is seeing all, looking down to man, protector of all that travel or stay, beholding right and wrong among men" (Radhakrishnan, 1956I, p. 80). The Veda classified Gods into three types- Agni (fire and light on earth), Vayu (air and wind in the atmosphere), Surya (sun in the sky). However, some scholars argued that there is only one deity, the great self-called Atman. Others call it as a Surya (sun). The Gayatri hymn is addressed to Surya in the form of Savitr. Savitr is considered to remove the sin, enlighten our minds, the creator God of all, removing obstacles and granting the blessing (Radhakrishnan, 1956 II). About the unified collection of natural god, RV. 1. 157.1 stated as

> Agni awoke upon the earth, and Surya rises;
> Broad gleaming Dawn hath shone in brilliance.
> The Asvins twain have yoked their car to travel.
> God Savitar hath roused the world in every place

Similarly, according to habitat in nature and their place or the cosmos, traditional Vedic Gods are divided into eleven catagory: each in the sky (heaven), mid-air (atmosphere), and earth (RV.1.139.11). There is no chronological study of which natural gods is earlier than other, but the most important Gods are classified as 1) celestial gods: Dyaus (Sky or Father Sky), Varuna, Mitra, Surya and the Aditya, Savita, Pushana, Vishnu, Usha and Asvins, 2) atmospheric gods: Vata or Vayu (Wind) Indra, Parjanya, Rudra and the Maruta, and 3) terrestrial gods: Prithivi (Earth), Agni and Soma (Bloomfield, 1907). Mind gods like Indra, Varuna, Soma, and the Asvins are called nature-gods/creative power (Radhakrishnan, 1956) but no one can say the time and origin of these gods. In the Rig Veda, Dyaus is called the Vedic god of the sky, the bright and shining one, and illuminating the world, called later Jupiter

in Latin (Muller, 1901), married with earth and father of Parjanya, Usha, and Ratri (Radhakrishnan, 1956), where Parjanya is called thunder gods, considered the father of Asura. So, Heaven and Earth are considered the supreme deities, and thus the gods are said to be their sons (Muller, 1901).

According to Radhakrishnan (1956) and Muller (1860), Indra is considered greater than all, the strongest god, rain god, natural god and national god of Indo-Aryan. Moreover, he is regarded as the god of the atmospheric phenomenon of the sky, burning in water and cloud, conquering darkness, bringing light and life, and giving us vigour. In the Rig Veda hymn, it is considered that on the birth of Indra, freshness blows with him, earth trembles, although it is represented elsewhere as a son of Dyaus, or as the son of heaven and earth (Muller, 1901). So, Indra is considered a ruler over heaven, earth, water, and sky and displays the Varuna from his supreme position in the Vedic pantheon (Rig Veda 1.61.9;10.89.10). The frequently described another god is Dawn (Usha), a young goddess, wealthy and immoral divine, called the friend of man, smiles like a young wife, and is the daughter of the sky (Muller, 1860). Another god Maruta is called comrades of Indra and sun of Dyaus, considered as powerful, destructive (Muller, 1901), militant as well as a sometimes beneficent god; he clears the dusty air and brings the rain. Like that, Tvastr is sometimes called Savitr, recognized as a constructor of the world. He sharpens the axe of Brahmanaspati, makes the cup for gods to drink soma, and give shape to all living things (Radhakrishnan, 1956 I).

Another interesting scientific and philosophical value is found in spiritual, omniscient, moral, forgiveness, the supreme god of gods, omnipotent guardian sky god Varuna, where the sun is considered the "eyes of Varuna, the sky is Varuna's garment and rivers flow on his command, the sun shines, stars and moons fear with

him" (Radhakrishnan, 1956 I, p. 77). Varuna is invoked as the poet's mind, supreme and almighty (Muller, 1860). In different Rig Vedic hymns 2.28.1-8; 5.85.1-8; 8.41.1-10, Atharva Veda, 4.16. 1-5 tried to justify the power of Varuna.

> He is the supporter of beings; he has spread the atmosphere over the forests; has put fleetness into the steed, and milk into the cows. He has placed intelligence into the heart, fire into the waters, the sun upon the sky, the soma-plant upon the mountains. He has opened a path for the sun; the floods of the rivers hasten seaward like racers obeying the divine order. (Bloomfield, 1908, p. 122)

The oldest Vedic god-king Varuna is considered as a custodian called *Rta*. *Rta* indicates law, the immanence of justice, called the father of all. Aditi, Heaven and Earth are the because of Rta (Muller, 1901), Indra leads the path of *Rta*, and Bishnu is the embryo of the Rta, light bringing gods are supported every morning to break open the dark café, and bring forth the cows towards the brighter place of the earth and the sky (Muller, 1901, Radhakrishnan, 1956 I). About the Rta RV, 5.62.2 stated that “the sun is supposed to yoke his horses in the morning and to run his daily course across the world, then Rta is called the place where they unharness his horses” (Muller, 1901, p. 246). Mitra represents the sun and is sometimes associated with the morning light as a truth-loving god.

Mitra and Varuna are representatives of day and night (Muller, 1901), jointly called the forgiver of sin, whereas Varuna is the night sky. Varuna and Mitra are called Adityas or sons of Aditi's, along with Aryaman and Bhaga and at last of the seven or even eight, i.e. solar deities, rising from the east (Muller, 1901; Radhakrishnan, 1956 I), Aditya is unbound or unlimited, invisible, the infinite; endless expand beyond the earth, cloud, and sky (Muller, 1901). He further clarified

that Surya; the sun is not called only Aditya. Though Aditi is more closely connected with the dawn, she is not invoked only in the morning, but at noon and evening also (RV, 5.69. 3), and Aditi is considered as the birthplace of immoral (RV, 1.24.1).

Another primitive natural and strongest god is Agni (fire). Many Vedic Hyman stated intellectual, discernment, truth and charioteer use of fire. The Rig Veda 1.1.1 stated the sacrifice uses of Agnimide, describing the source of heat and light. So, Anghelina (2013) once viewed that Agni is not a terrestrial god but it is the celestial origin and brings it from heaven to earth, need to be identified with the sun, indicates that Agni is also a celestial god. Moreover, RV, 2.1 describes the lord of man, the wise king, the father, the brother, the son, and the friend of men (Muller, 1860, 1901). Agni is called "divinity of the morning, rather than night. Fire becomes the mediator between gods and human or as high priests, not only stay on the hearth and altar but sprays the sky and atmosphere" (Muller, 1860, p. 548; Radhakrishnan, 1956 I, p. 83). It is cosmic and ritualistic, dispels the darkness, destroys the darkness at night, throws upon the gates of darkness, supports to lift eternally youthful sun to the sky to furnish light to the people, and earth and sky are seen when the Agni is born in the morning (Bloomfield, 1908; Radhakrishnan, 1956 I). This argument also supports Anghelina's (2013) View that Agni is the celestial god similar to the sun and provides the light to remove the darkness of the earth, sky and heaven (RV. 10.88.2).

Verification of Vedic science with the school science can be the content. The logical, documentary, and empirical arguments can be the pedagogical process.

Agni is considered the light of the knowledge of reality. The concluding Sukta of the Rig Veda 10.191.1-4 indicated that there should be higher significance than the national anthem of any country: "it is a prayer for amity among all nations, a true international anthem: may mankind be of the one mind, it goes united, may it have a

common goal, may all hearts be united in love. And with the mind and the goal being one, may all of us live in happiness" (Saraswoti Swami, 1995, p. 248).

Science Embedded within Vedic Philosophy

Monotheism is a Vedic tenet that proclaims being only one Brahman, called Paramatman. However, most of the Rig Vedic hymns focus on sacrificing different types of deities through Yagya (either Henotheism or Polytheism). Some Rig Vedic hymns addressed to a single creator lord of the universe, such as Visvakarman or Prajapati, would have satisfied the monotheism, in Brahmanas focus on the worship of a single god through sacrifice (Muller, 1901). Saraswati Swami (1995) claimed that Paramatma created much divine power and is also in charge of the forces of nature, feeling and urges of man. It is considered "the king of the world, he has the power to prolong man's life, and called the king of heaven and earth, Agni, Surya, Indra, and Bishnu" (Muller, 1860, p. 533-534). The Rig Veda 5.5.3 and the Atharva Veda 13.3.13-14 mentioned the polytheism nature of Agni and clarified that Agni, god of fire, is said to be Indra and Bishnu, Sabitr, Rudra, Pushana and Aditi (Muller, 1901). He further declared the dual deities: Surya, the sun, is identified with Indra and Agni; Savitri with Mitra and Pushan; Indra with Varuna; Dyaus, the sky, with Parjanya, the rain-god. Vedic mantra: The Vedas pray for the god of all creatures, including bipeds, quadrupeds, etc. Even grass, shrubs, trees, and mountains and from their benign purview (Saraswoti Swami, 1995) about Veda's pantheistic and natural philosophical nature. Aurobinda (1998) expressed the following views:

> Their formulas and ceremonies are, overtly, the details of an outward ritual devised for the Pantheistic Nature-Worship, which was then the common religion, covertly the sacred words, the effective symbols of spiritual experience and knowledge and psychological discipline of self-culture, which were then the highest achievement of the human race. (p. 8)

All these exclusive preoccupations with the natural element in the religion of the the Vedic Rishis (Aurobindo, 1998) indicate that Veda was not only dogmatic, mythological, monotheism doctrine, which included so many deities as a natural God which are sacrificed in different forms (polytheism) but also provide the knowledge of supreme power Brahman (Monotheism).

Scientific Argumentation on Natural God

The supreme unique God who controls the whole universe is called Ishwor (Ishwor is found recognized as God), who abode Paramapadam, Vaikuntham, Nitya-Vibhuti, and Aprakrta- Divya- Loka and is made of Sudha sattva which is said to be eternal and Aprakrta, so considered as omniscient, omnipresent, omnipotent, infinite, pure and blemishless (Saraswoti, 1935). Krishnananda (1994) argued that there are no intellectualistic differences between the concept of Brahman and Ishwor because Hiranyagarva, Virat, and Ishwor are comprehended in Brahman. Brahman but has several names such as Indra, Mitra, Baruna, Agni and Divya- one who pervades all the luminous bodies, the source of light, the protector and preserver of the universe; whose work is perfect, powerful like wind and mighty by nature (RV. 1.122, 164; Saraswoti, 1935). The form of Lord/Ishwor is assumed to have different functional features as Vasudeva, Sankarasana, Pradhyumna, and Anirudra, which is said to involve himself in cosmic functions while staying in control of the activities of the living being. Ishwor is the intellectual laws of the universe, considered infinite cosmic intellectual governing, show the different avatar in nature, seen as different idols, called universal god. It connects the oneness of all.

In Shaiva, Hinduism placed importance on the Ishwor Shiva at a great place and worshipped as the world's supreme being, pure consciousness, and absolute reality. But Vaisnami Hindiusim places the greatest importance of the Ishwor Bishnu,

considered Brahman's form (Sharma, 1991). The universe is thought to form the body of Ishwor or Bishnu; he is an all-pervading supreme being. However, Shakta Hinduism focuses on Shakti, or energy that embodies the universe, worshipped as feminine divinities called Devi. Therefore, Ishwor is a personal god, showing the supreme power in nature.

Ishwora, infinite cosmic intelligence, the macroscopic God, expands and is expressed as Devatas, the cosmic forces, called cosmic divines, also called cosmic Deities. Devas are universal power and are considered a force of energy and intelligence in motion (Russell, 1974). As already mentioned, the moon and the stars, the sea, and the sky, the dawn, and the nightfall, were regarded as devatas and worship of these natural gods in the Vedic religion (Radhakrishnan 1956 I). Similalry, Brahman, Bishnu, Shiva, Dhata, Mitra, Baruna, Aryaman, Twastr, Maruta, Pusha, Rudra, Savitr, Aditya, Saraswoti, Bharati, Ida, Surya, Anna, Plants, cow, horse, etc. are considered as devata. Energy is not devata, but Braham is itself energy, other devatas present as a form of energy (Dvivedi, 2004; RV. 2.1- 16)

Scholars thought that hymn of the Veda, the earliest spontaneous outbursts of the ancestral mind, face to face with the phenomena of nature, the poets of the Rig-Veda were supposed to be simple sons of nature (Bloomfield, 1908). All-natural gods are seen as superior for a specific purpose, although Indra, Varuna, Mitra, Maruta, Agni, Soma, Dawn, Dyaus, Aswins, Savitr, Aditis, and Twastr are considered the important sacrificial natural gods (Muller, 1860). These all are classified as Agni devatas burn from the earth, Vayu devatas from the atmosphere, and Aditya devatas from the sky (Kak, 2000)

Not only that some Supreme Natural gods are in a visible form, but they also support human being. Such as Bishnu is the younger brother of Indra, and he is

sometimes identified as Sun (RV. 1. 154.3- 5). The weapons of the lord, called Astras, are mystically driven forces, different from ordinary weapons, which can be directed by thought and will (Krishnananda, 1994). According to Muller (1882), deities' existence and their nature are attributes of omnipresent, omniscient, omnipotent, eternity, self-existence, and spirituality. The Vishwokarman is the creator of all things and the architect of the universe. Indra is called Vishwokarman.

Science Embedded within Upanishadic Philosophy

Upanishads are the foundation of Indian continental philosophy, systematic speculations on the nature of the reality that contain various aspects of truth (Bloomfield, 1908; Sanskrit, 2011). Upanishad means to sit nearby. The Upanishads are the teachings imparted by a guru to his students sitting by his side in holy reverence and obedience or leading him to Brahman to obtain wisdom (Krishnananda, 1994; Saraswoti Swami, 1995). However, Muller (1860) offered a broad philosophical meaning by saying, “destruction of passion or ignorance, employing divine revelation” (p. 318). The Upanishads are, to the seeker, the direct means of realizing or communicating the non-difference between the Jivatman (individual self) and the Paramatman and inquiry into the ultimate reality (Saraswoti Swami, 1995).

Krishnananda (1994) stated that the text known as "Upanishads are spread out throughout the range of literature of the Veda, and each section of the Veda has its own Upanishad or Upanishads" (p. 17). Although Varma (1973) focused on the Upanishadic religion and philosophy, which were traced from the Vedas and focused on the monotheistic absolute godhead of Brahman as a supreme power. Aurobindo (1998) also agreed with the above monotheistic philosophical, speculative value of Upanishad and stated that “the true foundation or starting-point of the later religions and philosophies is the Upanishads, which have then to be conceived as a revolt of

philosophical and speculative minds against the ritualistic materialism of the Vedas" (p. 5). About the supremacy of Brahman, the following version indicates that

The Brahman means realizing the highest Jnana (Aitareya Upanishad of Rig Ved).
I am the Brahman (Brhadaranyaka Upanishad of Yajur Veda).

The Paramatman and you are the one and the same (Chandogya Upanishad of the SamaVeda). This self is the Brahman (Mandukeya Upanishad of the Atharva Veda) (Saraswoti Swami, 1995).

Search for scientific concepts in Upanishad can be the curricular contents. Project work for the students will be the pedagogical process. Presentation among the teachers, parents, students, and community elites can be the evaluation process

Varma (1973) mentioned that Upanishads believed the cosmos's creator, sustainer and destroyer are God, who should be worshipped peacefully. He added that Upanishads focus on philosophically medication, spiritual worship of supreme God and a pluralistic pantheon. Varma further justified that Brahman also signifies the unity of microcosm and macrocosm or psychic or the cosmic principle. About the supremacy of Upanishads, the western philosopher Schopenhauer viewed that "it is what is known in philosophy as Monism the most uncompromising, perfervid monism that the world has ever seen" (Broomfield, 1908, p. 56). Broomfield further argued that the Upanishads, if not the most scientific yet intimate and immediate insight into the ultimate mystery of being. It contains facts, not the system of thought (Broomfield, 1908).

The Vedanta philosophy is considered the essence of the other five philosophies, focusing on Brahman's concept. A different system of Vedanta accepted the fact that the entire creation of the universe consisting of all insentient and sentient beings was possible by the mere Sankalpa of the lord, i.e. Brahman. According to

Dhakal (2019), Brahma was born before the creation of the Universe in the latent form of a Parabrahma, which consisted of a different form of Prakriti. Parabrahma is the womb (garva) of the universe from which the universe was expanded, within it eternal, absolute truth, consciousness, and bliss (Sat, Cit Ananda), as well as an omniscient, omnipotent and omnipresent character called Brahma. The above argument echoes Chhandogya Upanishad, which tells that being alone existed at the beginning of things. Ranade (1926) views reflect the same as the Chhandogya Upanishad's: in the beginning, there was fire, from fire formed water and then from water formed the earth, indicating that fire was a form of energy, which was Omnipotent energy Brahma as cosmic energy.

Relation between Brahma and the scientific notion of the unity of microcosm and macrocosm or psychic or the cosmic principle can be the curricular content. This can be taught through comparison, and students' presentations in the class can be the evaluation process.

About the evolutionary power of Brahman, Sharma (1991) viewed that "from Brahman arises ethers, from ether air, from air fire, from fire water, from water to earth, the cosmic Brahman is regarded as the causes of production, maintenance and destruction of this universe " (p. 27). However, Brahman is considered Atman, from where ether and other material bodies are created (Ranade, 1926). It means Brahman, or Atman has the cosmic power. In the Brhadaranyaka Upanishad, nature is considered the body of God, who is its soul. Moreover, "Earth, fire, water, air, ether, the sun, the moon, the stars, the sky, the quarters, the rivers, the mountains, in facts, all beings, all creators, all life, all senses, all speech, all minds are the body of God" (Sharma, 1991, p. 28), which is immanent in them all and control them holding together (Sharma, 1991).

Ranade (1926) views that by the command of imperishable Brahman, sun, moon and stars stands in their places; hours, days, months, seasons and years move on the command of the Brahman; rivers flows, and the mountain becomes white on the command of Brahman; indicates that Brahman has the cosmic energy. Moreover, it is considered that the three deities are formed from the fire (energy), where the red flame of fire is the sun, the white colour of fire flame is water, and the black colour of fire flame is earth (Ranade, 1926). They are called the primaeval Prakriti. It indicates that natural deities are formed from the cosmic energy of Brahman.

About the universal creation, the Mandukya Upanishad 8 and 9 hymn mentioned that Brahman produced Anna, from Anna produced Hiranyagarva or cosmic intellect, Hiranyagarva produced Biratsworupa mind (mana), from mind to Panchamahabhuta, from it produced different universe including earth and inhabited plants and animals, and then heaven and hell (Sharma, 2070 BS). The Rig Vedic hymn mentioned that in the beginning, there was the only asat from which sat was created by Brahman (RV.10.129. 4). It is considered that Prakriti and Purusha are inherent within Brahman before the creation of the universe, within Prakriti; satto, raja and tammo consist in equilibrium conditions controlled by the supreme Purusha (Brahman).

The Vedic notion of Brahma (cosmic energy) and the school science's notion of cosmic energy and rays will be the curricular contents. A comparative study will be on the methods of teaching. Race of the Vedic science and school science will be the assessment system.

According to the Visistadvaita, the Vedanta Paramatma is considered Bishnu as a trilogy form of Brahman, Bishnu, and Shiva, as functionaries of creation, sustenance, and destruction (Sharma, 1991). Brahman is an etymological exposition

in various names of God such as Virat, Agni, Bishwo, Hiranyagarbha, Vaayu, Taijas, Ishwor, Aditya, Prajna, and OM (Saraswoti, 1935). It indicates that Brahman is a formless, eternal, immoral and nonperishable natural source of a different form of cosmic energy. The Chhandogya Upanishad mentioned that the heart is a citadel of Atman as the universe itself is. Like outer space, "there is also unending inner space, which contains within it the heaven and the earth, the fire and the wind, the sun and moon, the lighting and stars; infinity is bliss and universe exhibit every stage the principle of sacrifice" (Ranade, 1926, p. 43). This indicates that inner sublime energy and altar sacrifice are compared with the grand universe as a form of Brahman's cosmic energy.

The Chhandogya Upanishad compared the human body with the universal cosmos, comparing heaven constituting head of the atman, the sun his eyes, air his breath, space his body, water his bladder, and the earth his feet (Ranade, 1926). It indicates that Brahman is the cause of the universe's production, maintenance and destruction. Eternal Brahman is considered as cosmic energy and the entire universal functions move on the command of Brahman called cosmic energy. The body of God is called earth, water, air, ether, sun, stars, sky, rivers and mountains, as well as natural deities, formed from Brahman's cosmic power.

Scientific Argumentation upon the Upanishadic Philosophy

About the evolutionary development of the Upanishad, many concepts are found. Although some westerners argue that Indian continental philosophies are Pantheism, Determinism, Karmism, A-moralism, and Pessimism, in the modern view, it is seen as a combination of Philosophy and philosophy (Ranade, 1926). Regarding Brahman's supremacy and natural power, Ranade viewed that Brahman's "dwelling is the light of setting suns, and the round ocean, and the living air, and the blue sky, and

in the mind of man" (p. 7). Like other natural gods, the fire was the first to evolve from the primeval being, and from fire came water, and from water the earth (Chan, Up., 6.8.4; 7.12.1; Sharma, 2070 BS). Space (Akash) is considered as a higher being than any of the conceptions that have been before reached; all beings emerge from space and are finally absorbed in space: space is verily (truly) greater than any of these creators (Chan. Up., 1. 9. 1). Space (Akash) is the final habitat, and the air is the final absorbent of all things (Chan. Up., 4. 3. 1-3). This idea is corresponds to Anaximander's infinite (Radhakrishnan, 1956 I).

Yet the Taitteriopanishad (2.1,10) describes the evolutionary cosmological view as- from the Atman, in the first instance, proceeded space; from space air, from air fire; from fire water; and water the earth. The gateway tools of knowledge and meditation to reach the Brahman through Tapa are eye, ear, atman, and speech (Taitteriopanishad 1.3,1; Sharma, 2070 BS). This indicates the presence of the physical substance to obtain the ultimate reality, i.e. Brahman. However, the Kenopanishad (1.3) stresses the Upanishadic philosophical reality of Brahman and his access as: where the eye cannot go, neither speech nor mind can reach.

So the concluding themes consist of a form philosophy of the Upanishadic peace and welfare, psychology, natural law, enlightenment, wisdom, and contemplation of true knowledge through the religious way to get the Brahman connection to the individual soul. About the concluding theme of the Upanishad, Krishnananda (1994) presented the following views.

> There is untruth is not, sorrow is not, because these are the misplaced values, and when they are placed in their proper context, they look beautiful. As ugly things do not exist in the world, absolute sorrows also do not exist, when things are not properly placed, it looks ugly. When the items are placed where

> they ought to be, it becomes beautiful, so that perception is the Dharma of the Upanishad gospel, and it seems perfection everywhere. The enlightenment of consciousness to this Perfect Being is the entire process of Upaniṣhad wisdom. (p. 35)

Vedic and school science's ways of finding the mind, matter and energy connection will be the curricular content. Documental analysis and presentation of the experts will be the methods of teaching. Students' personal reflection will be the assessment system.

Finally, we can conclude that the description of Brahman is a world soul in which all the other souls ultimately merge. Aranyakas, Brahmanas and Vedanta provide the epistemology on how to grow the honey/fruits be as a form of Upanishad through the medium of Vedas. The Brhadaranyaka Upanishad mentioned spiritual creator as an object of contemplation was found in Purusha sukta of the Rig Veda 10. 90, and the Atharva Veda 19.6 as a form of Birata Purusha, as an inventor of the whole cosmos. The above analysis made me realise that the Veda and the Upanishads are interconnected as scientific and philosophical doctrines. In the absence of one, another will not be complete.

Six Systems of the Vedic Philosophy and its Materialistic Worldview

The six systems of philosophy were developed in the sutra period as the last knowledge treatment of the Vedic philosophy. Different Indian continental Vedic philosophers attempted to search the truth through the multiplicity of the path to search the Vedic truth. Six different systems of philosophy have been pronounced by the thinkers to provide the systematic ways of the Vedic knowledge. Sankar (2011) considered it orthodox Vedic knowledge. Radhakrishnan (1956 II) called it a system of thought, darsana, or Brahmanical system since they all accepted Veda's authority.

The six systems of the Veda are considered six orthodox of Indian continental philosophy. The systems of thought which admit the validity of the Vedas or acknowledge the Veda as authoritative are called astika, and those which repudiate it are nastika (Radhakrishnan, 1956 II; Swami, n. d). Many eastern and western thinkers attempted to develop a philosophical understanding of the Vedic knowledge. However, but six systems of philosophy are mainly based on six Indian continental ideas to understand the Vedic knowledge and the word either theism or atheism. The focus of six systems of Vedic philosophy ranges from Jnana yoga to Vijnana, the practical realization of the ultimate truth (Swami, n. d).

Jyana and Vijnana of the six philosophies of the Vedic knowledge and the scientific knowledge and science that is being taught in school can be the curricular content. A comparative study and project work will be the methods of teaching.

Out of six thinkers/philosophers, a recognized philosopher is Vyasa. The Reorganizer of four Veda is Badarayana, called Vyasa Dvaipayana or Krishna Dvyaipanayana, who authored of Brahmasutra, Mahabharat, Uttar-Mimamsa sutra or Vyasa sutra or Vedanta (Radhakrishnan, 1956 II). Similarly, the Sankhya sutra was written by Kapaila, Purva Mimamsa sutra was by Gaimini, Yoga sutra was by Patanjali, Vaiseshika sutra was by Kanada and Nyaya sutra was by Gotama (Muller, 1899; Radhakrishnan, 1956 II; Swami, n. d). Vaisesika and Nyaya accept the god as the result of inference among these sutras. Samkhya is not theism because it doesn't say anything about the god, and Yoga is practically independent of the Vedas. The Uttar-Mimamsa is called the Vedant, which accepts the meditation and jnana to realize the god contains the philosophical issues of the Veda, but the Purva Mimamsa accepts the ritual and conception of deities from the Vedas. It indicates that six philosophies are seen more nastika than that astika (Radhakrishnan, 1956 II; Sankar, 2011).

According to (Swami, n. d) all six philosophies follow the common characteristic "the self is considered asan individual spiritual being of the nature of eternal consciousness, self acquires a succession of physical bodies through reincarnation under the law of *karma*, self-suffers because of its contact with matter, suffering the goal of philosophy" (p. 4). Chattopadhyaya (1993) clearly stated the antithesis of Indian idealism constituted by the "Lokayata, Samkhey, Nyaya-Vaisesika; characterized by secularism, rationalism, and science orientation; an essential materialist interpretation of its constitution, based on their respective theories of the nature of matter- namely the bhutas, pradhana and paramanus" (p. 404).

The short description of each system and its philosophical aspects based on content, methods and evaluation system are separately given below based on logic but not chronological.

The Nyaya Philosophy/ Science of Logical Epistemology

Gotama founded the Nyaya school of thought, an allied system of Vaisesika; the logical system included the physical sites mostly called the Nyaya- Vaisesika darsana (Radhakrishnan, 1956 II; Sharma, 1991). The Nyaya means arguments and suggests that the system is predominately intellectual, analytic, logical, and epistemological (Sharma, 1991). Sharma further argued that "it is Tarkashastra or the science of reasoning; Paramanashastra or science of logic and epistemology; Hetuvidhya, or the science of causes; Vadavidya or science of debate; and Aniviksiki or science of critical study" (Sharma, 1991, p. 191). So the Vaisesika is used as the supplement to the Nyaya. In the Nyayavartrika, both are included in combination form and believe in the plurality of souls, personal Gods, an atomic universe, and use common arguments (Radhakrishnan, 1956 II).

The difference is that the Nyaya is the critical examination of objects of knowledge utilizing the canons of logical proof of objects, the Vaisesika develops the atomic constitution of matter, which the Nyaya accepts without many arguments (Radhakrishnan, 1956 II). So, the Nyaya is a system of atomistic pluralism logical realism similar to the Vaishesika system (Sharma, 1991). Sankar (2011) somehow differently argued that Vaishesika develops metaphysics and ontology, the Nyaya develops logic and epistemology.

The Nyaya school of philosophical speculation is based on texts known as the Nyaya Sutras, and its methodology to prove the existence of God, based on the Veda, arguing it is based on the western science and philosophy largely based on Aristotelian logic (Sankar, 2011), to which Radhakrishnan (1956 II) says the subject of analytic investigation, method of critical inquiry, it may be called the science of sciences.

The Apara is generally an invalid category of knowledge and is divided into doubt (Samsaya), faulty cognition (Brahma) and hypothetical argument (Tarka) (Swami, n. d). They are considered not fixed knowledge because they are only a means of attaining knowledge (Radhakrishnan, 1956 II).

The Nyaya is metaphysics of reality that recognizes sixteen padarthas or categories called pramana, including six or seven categories of Vaisesika, called prameya (Sharma, 1991; Swami, n. d). These sixteens categories are pramaṇa (valid means of knowledge/proof/ evidence), prameya (objects of valid knowledge, hypothesis/ thing to be proved), samsaya (doubt/ questioning), prayojana (utility), dṛiṣṭanta (example/ metaphor), siddhanta (conclusion/ theory), avayava (members of syllogism/ side effect), tarka (hypothetical reasoning/ arguments)(Radhakrishnan, 1956 II), nirṇaya (settlement), vada (discussion/ including of opposite view), jalpa

(wrangling), vitaṇḍa (caviling), hetvabhasa (fallacy), chala (quibbling), jati (sophisticated refutation) and nigrahasthana (point of defeat/silence) (Dhakal, 2019; Swami, n. d)

Sixteen padarha, which are called pramana, can be the content of science. Prameya samsaya, prayojana, dristanta, tarka, vada etc., can be included as a logical pedagogical way of teaching.

Thus, it indicates that logic is the science of proof or the estimation of evidence and discusses the validity of the theory of knowledge to obtain the metaphysical reality. Nyaya "being realistic system, knowledge is defined as consciousness, either may valid or invalid, valid knowledge called prama or pramana, and non- valid knowledge is known as aprama" (Sankar, 2011, p. 24, Sharma, 1991, p. 192). According to Nyaya philosophy true knowledge corresponds to the nature of its object; otherwise, the knowledge is false, validity, and invalidity of knowledge depends on its facts (Swami, n. d). Valid knowledge is related to reality, it is produced by the four valid means (methods) of knowledge- perception, inference, comparison, and testimony (Sharma, 1991). Valid knowledge includes a memory (smriti), doubt (samshaya), error (viparyaya), and hypothetical reasoning (tarka) (Sharma, 1991). Therefore, the Nyaya theory of knowledge is realistic and pragmatic, realistic as regards nature and pragmatic as regards the test of truth (Sharma, 1991).

According to Nyaya, the body is considered as the "vehicle of actions, sense organs and objects, the soul exerts itself to gain of objects through the body, which is the seat of sense, mind, and sentiments, whereas the body cannot identify either consciousness or soul which possesses it" (Radhakrishnan, 1956 II, p. 146). The soul is considered the tool to identify mana, whereas mana is atomic in nature and cannot be the self more than the body can. If the self cannot be identified with the body,

senses, or manas since it presents when the body is lost, senses are cut off and manas are quieted down (Radhakrishnan, 1956 II). The Nyaya also believes pluralistic realism with theism (but original Nyaya was not considered as theism) and considered that human work under the existence of God (Radhakrishnan, 1952I) and God is the constituent operative cause of the creation, maintenance and destruction of the universe (Sharma, 1991; Swami, n. d). It was concluded that Nyaya also considered God as supreme, omniscient, omnipotent, and the human soul is infinite in number and different in each body (Radhakrishnan, 1952 I; Swami, n. d). So, the dualism between matter and soul is legitimate enough as a method and a procedure (Radhakrishnan, 1956 II). The authentic scripture, the Vedas and Upanishads, express such direct experiences of God. Therefore, God exists (Sharma, 1991).

Like another system of philosophy, the Nyaya system's ultimate goal of human life is to attain liberation, liberation from pain and misery, release the soul from pain and suffering by disconnecting from body, mind, senses, and other objects of the world (Swami, n. d) which is obtained by experimentally and meditation. The state of being out of the cycle of birth and death is called liberation.

Vaisesika Philosophy or Vedic Atomic Theory

The Vaisesika philosophy resembled with the Nyaya philosophy. The founder of the Visesika is Kanada known as Uluka, Kasyapa (Swami, n. d). While Nyaya's philosophy is concerned primarily with pramana, the Vaisesika philosophy is centred around prameyas. The system is called Kanada means kana also mean particle or a particular, and Kanada suggests one who lives on the philosophy of particularity-Visesa (Sankar, 2011). The Vaisesika system follows the ontology of the Nyaya system but different epistemology. It focuses on "Padartha (world), means object (experience) which can be thought (artha) and named (pada), and the entire universe (physical as well as experience) is reduced to six or seven padartha" (Radhakrishna, 1956 II, p. 183; Sharma, 1991, p. 175-76).

Radhakrishnan (1956 II) further classified the first three in the categories of substance, quality and action into Artha, and declared in treating in Yogic insight; and generality, particularity and inherence are considered as intellectual discrimination of logical categories.

According to Radhakrishnan (1956 II), the inclusion of non-existence in Padarthas suggests the transformation of an ontological into an epistemological scheme. Out of these, substance (dravya) is an important one and considered a materialist as well as a spiritual substance, and it further divided into nine types.

Muller further divided Abhava into four categories: "Pragabhava, Dhvamsa, Atyantabhava, and Anyonyabhava" (p. 448). It indicates that Vaiseksika philosophy is based on the materialist substance, which is called the atom. Atom, mind, the soul is infinitive in number and also display the content knowledge of teaching science.

Vaisesika believes that all material world is made by atomism or Paramanuvada, which further may not be divisible. This indivisible, partless and eternal particle of matter is called Atom (paramanu) (Sankar, 2011). Supporting with Sankar, Swami (n. d) is considered the smallest, partless and eternal particle of earth, water, air, and the fire is an atom (paramanu), but air, earth, water, fire are considered as non-eternal, which is seen similar to nuclear physics. Muller (1919) argued that the substance, qualities, and actions are form individual things, called atoms. The combination of atoms produces all physical things; the creation and destruction of universal materials depend upon eternal atoms; atoms are said earth, air, fire, and water are considered eternal (Radhakrishnan, 1956 II). He further argues that earth possesses four qualities: smell, taste, colour, and tangibility; the light of two colours and tangibility; while air has the quality of tangibility; and akasa, that of sound (Radhakrishnan, 1956 II).

The ultimate constituents of the concrete things of earth, air, light, and water are called an atom, these are both eternal and non- eternal (Sharma, 1991). So non-

eternal are divisible into eternal (atoms) but akasa (space)is eternal, unlimited, formless, colourless, non-perceptible, all-pervading and non-divisible (Swami, n. d). When the matter is divided into an infinitely small atom, it cannot be further classified are called material causes of effect (inference) (Radhakrishnan, 1956 II). The creation and destruction of the universe are depending upon the will of a supreme being, God, or soul (Sharma, 1991). According to Vaiseshika, unseen power (spiritual God or soul) produces these atoms' motions. For the creative purpose, the unseen (adrsta) force contact with the atom of air and air atoms create dyads, the dyad is also minute, short and imperceptible, which form triad (a mote in the sunbeam) and triad which is big, long and perceptible form larger compounds arising out of them (Radhakrishnan 1952 I; Sankar, 2011).

Similarly, God can will destructive motion in the atom of the body and senses or cosmos starts vibrating, compound things break down into simpler and simpler compounds, finally convert triads and dyads and ultimately into an atom (Radhakrishnan 1952 I; Sankar, 2011). In this way, physical elements earth, water, fire and air, and sense organs are disintegrated. After the dissociation of the manifested universe, four kinds of atoms of earth, water, fire, and air as well as the eternal substance of space-time direction, mind and soul according to past samskaras of individual beings was developed (Radhakrishnan 1952 I; Sankar, 2011).

Like that, Vaisesika believe an authority of the Veda. The Veda is the word of God; which believes that God is omniscient, eternal and perfect because of the supreme spiritual power (Sharma, 1991) i.e. the power of God did the material cause. However, the Vaisesika helps to develop the atomic theory as well as dialectic materialism in the world (Bhusal, 2068 BS; Sanskrit, 2014). Nyaya and Vaisesika, share similar principles, although the authoritarian of knowledge (pramana) in Vaisesika philosophy is thought of mainly as perception and inference, within

inference; comparison and verbal knowledge (sabda) are included (Radhakrishnan, 1956 II, 1952 II). As the comparison and sabda are embedded within inference, it indicates that the Nyaya is somehow different from Visesika in validating the Vedic knowledge i.e. tried to provide more accurate knowledge than mere speculation (Swami, n. d).

The Vaisesika system combines pluralistic realism with theism and believes in the existence of God as the supreme self (Sharma, 1991). God is one, infinite and eternal. He is omniscient, omnipotent, cause of the world's creation, maintenance and destruction (Radhakrishnan 1952 I). The liberation of the soul and the path to liberation are same as with the Nyaya concepts, which have already been discussed in Nyaya philosophy.

The potential content for school science that can be derived from Nyaya and Vaisesika schools/philosophies would be:

1. science in the Nyaya and the Vaisesika philosophies and their relation with school science
2. process of learning/teaching science in Nyaya and Vaisesika philosophies and school science
3. difference between bhava and abhava with that of the material and immaterial science
4. validity techniques in science and philosophies
5. scientific proof and philosophical proof
6. creation, expansion, and destruction of the universe in science and philosophies

Pedagogy could be literature review and discussion with experts. Project work could be the assessment process.

Samkhya Philosophy/Parinamavada

Samkhya is another school of thought in eastern philosophy. It seems to have been the oldest philosophical system in India because the Upanishads also found the Samkhya concept (Radhakrishnan 1952 I; Sharma, 1991). The Bhagavat Geeta was also found to describe the Samkhya Yoga. The Samkhya means the "right knowledge and right number, and dominantly intellectual and theoretical, where Yoga help to practical implications of theoretical metaphysical teaching of Samkhya, so-called Samkhay- Yoga philosophy" (Sankar, 2011, p. 11). This philosophical school of thought, also known as non-thesis dualism, was systematized by an ancient thinker Kapila (Swami, n. d; Sharma, 1991). Muller (1919) and Sharma (1991) stated that in the eyes of Brahmans, the Samkhya is atheistic and yet orthodox because, in Indian meaning, Samkhya is recognition of the supreme authority of the Veda. The Samkhya tendencies of thought pervade all over the literature of Indian continents, including Shruti, Smriti, and Purana (Sankar, 2011).

It is considered that all of the features of the Nyaya and the Vaisesika except Ishwora and God are summing up in Samkhya philosophy into two fundamental principles of Prakriti and Purusha. It is pluralistic spiritualism, an atheistic realism, and uncompromising dualism (Muller, 1919; Sankar, 2011; Sharma, 1991). Sharma (1991) further argued that “under the influence of Jaina and the Buddhist thought, it rejected theistic monism and content with spiritualistic pluralism and atheistic realism” (p. 149). So, it is considered as Badarayana and Samkara were opposed by the Samkhya. Muller (1919) classified Samkhya within twenty-five substances, which are classified as Prakriti (eight), Vikaras (Sixteen), and Purusha (one). According to Radhakrishnan (1956 II), Prakriti is never perishing, independent, one all-pervading, and eternal, which is not created.

The Samkhya philosophy believes in Satkaryavata that its causes are transformed into its effect (asatkaryavada), is seen in Parinamavata (Swami, n. d). Samkhya philosophy upholds the view of Parinamavada, according to which there is a real transformation of the cause into the effect, as in wood being transformed into a chair, or milk into yogurt, where chair and yogurt have already existence in wood and milk. It indicates that each effect is based on the existence of material substance, without which effects cannot be seen. The theory that causation means a real transformation of the material cause leads to the concept of Prakriti as the root - cause of the world of objects called Pradhana (Sharma, 1991). Rig Veda 10.72. 3 clearly stated that the sat is produced from the asat i.e. the cause of the creation of this universe is not God but first is Prakriti. Similarly, RV.10.72.6 mentioned that the deities are produced from the water, indicating there was first Prakriti, and then others are the cause of Prakriti.

In Samkhya philosophy, the world's supreme root cause is Prakriti (Sharma, 1991). Prakrti means exceptional ability. It is the beautiful nature out of which the vast material world takes shape in all its intricate permutation levels. *Prakriti* is characterized by the three power or *Gunas* of *Sattva, Rajas,* and *Tamas,* as the characteristic effect of the Prakriti (Sharma, 1991), and it contains the nature of equilibrium (samyavastha) form in the state of rest, recognized as the natural condition of Prakriti (tamas is preponderant than other two) (Radhakrishnan, 1956 II). When there is a disturbance (vikrti) the equilibrium state (rajas is preponderant than other two) of three Gunas, we have the destruction of quiescent Prakriti and Prakriti evolved under the influence of Purusha until all the selves are freed (ibid). So, Purusha is the cause of the excitement and manifestation (lighting) of Prakriti in three specialized states, then evolution takes place through dissolution (Dhakal, 2019;

Sharma, 1991), i.e. Purusha moves the world by the kind of action which is no movement. It is considered in modern science as an equilibrium condition of an atom's proton, neutron, and electron when the disturbance is applied, then changes the energy accumulated within it.

The condition of dissolution is called Mahat or intellectual cause of the whole universe, is the product of the evolution of Prakriti, when Buddhi (contain three Gunas) is used as the psychological aspect of Mahat, as cosmic sense, the Great, the Brahman, work as the form of Purusha, both eternal and non-eternal, exists as a seed force of the causal condition of Prakriti in the un-manifested state, when it is transferred into the condition of effect, it is called buddhi as a product of Prakriti and generator of ahamkara (Radhakridhnan, 1956 II). From the Mahat (buddhi), Ahankara (self-sense) or manas is generated, which is called tamma, and from it five sense organs, five motor (karmendriya) and five Tan-mantra are produced (Muller, 1899). Form five tan-mantras (hearing, touch sight, taste, and smell), five maha bhutas-earth, water, fire, ether, and air are produced (Bhusal, 2067 BS; Radhakrishnan, 1956 II; Sankar, 2011).

The five tanmantra cannot act as sense stimuli until they combine to form an atom. With the combination of raja, "it is transformed into subtle matter, vibratory, radiant and instinct with energy, and the tanantra arise Akash form the transition link between buddhi and tanmantras" (Radhakrishnan, 1956 II, p. 271). The distinction form between atomic Akash (the combination of buddhi) and non-atomic Akash, and help development of the atom of air. When the supreme pure consciousness and unconsciousness Prakriti combine, selfhood is produced.

Thus, in Rig Veda Purusha is considered as Visvakarma, Hiranyagarbha, and Prajapati, and Brahman as Atman (Radhakrishnan, 1956II). Radhakrishnan (1956 II)

further argued that the" initial doctrine Pancasikha adheres to theist Samkhya believes in the supremacy of Brahman and Prakriti and Purusha were not independent realities but only the modes of God"(p. 253). It does not believe in liberation and bliss (Sharma, 1991). It is declared that what to focus on and how to perceive the Samkhya is determined by its character of theism or atheism. It is the "soul, the spirit, the subject, the knower, without any qualities, subtle and omnipresent, neither body nor sense, nor brain nor mind (mana) nor ego (ahamkara) nor intellectual (buddhi), neither beginning nor end" (Sharma, 1991, p. 155-156; Radhakrishnan, 1956 II, p. 282). It is the essence of consciousness, pure transcendental consciousness (Sharma, 1991) as a product of Satto Guna, contains beyond time and space, and change of activities (causality) (Sankar, 2011). It is self-luminous, self-proved, uncaused, eternal, and pervading, form warp and woof of the mosaic of the empirical word (Radhakrishnan, 2956 II; Sharma, 1991).

According to Muller (1919), as a good agent, Purusha would do three kinds of actions- good conduct (dharma), indifferent conduct, and bad conduct. It indicates that these qualities of Purusha are the product of Prakriti, and these are embedded within the Prakriti, which is clearly stated in Bhagabhat Geeta 3.27; 13. 20-22, 24, 30 (Swami Pravupadha,1997). The creation (evolution) of the Samkhya is explained by the temporary union of Prakriti and Purusha (Muller, 1919).

Therefore, the Samkhya philosophy follows Prakriti and Purusha, although it focuses on materialistic thinking. The activity of Prakriti (object) must be guided by the intelligence of Purusa (subject); this cooperation between them is essential to the evolution of the universe (Swami, n.d). The Classical Samkhya was purely materialistic and repudiated the existence of God, but later, Samkhya writers attempted to revive God within Samkhya philosophy. Prakriti requires the presence of

Purusa to be known or appreciated, and Purusarequires the help of Prakriti to distinguish itself from Prakriti and thereby realize liberation (Swami, n.d). Through the interaction between Purusa and Prakriti, a great disturbance occurs between the equilibrium within Gunas held in prior manifestation (Sharma, 1991). A disturbance between Gunas (goodness, passion, darkness) releases tremendous energy within Prakriti completing twenty-fourstages (Muller, 1919). This indicates that Samkhya philosophy follows the dualistic nature as a form of Prakriti- Purusha.

As mentioned in Nyaya philosophy, the authoritarian of knowledge is nearly equal to Nyaya philosophy through sense activity-perception by using yogic perception through meditation; inference through observation, implication, and subsumption; and scriptural testimony, which is free from doubts and discrepancies (Radhakrishann, 1956 II; Swami, n. d). Samkhya liberation is a state of complete isolation, freedom from all pain, and a return of the Purusha to its pure nature as consciousness, Jivana Mukti, and Vedeha Mukti (Sankar, 2011). Thus, Samkhya philosophy is completely based on scientific verification.

Yoga Philosophy/ Mind-Body Connection

The Yoga system provides a methodology for linking individual consciousness with Supreme Consciousness and the process of validation of knowledge. Yoga complements Samkhya (Radhakrishnan, 1956 II; Sankar, 2011). So, Muller (1919) called it Sankhya- Yoga philosophy which is mentioned in Bhagabhat Geeta 5.5 that both are one (Swami Prabhupadh, 1997). Radhakrishnan (1956) also agreed with Muller and argued that “to attain spiritual unification, the consciousness of two in one is yoga” (p. 337). However, he commented that Yoga is nearer to the Kamra Mimamsa rather than the Samkhya for human activity (Radhakrishnan, 1956). There are various schools of *yoga*, among which *bhakti-yoga, jnana-yoga, karma-*

yoga, and *kundalini-yoga* are especially well known, called the Patanjali yoga system (Muller, 1919; Swami, n. d) as well as Astanga yoga which is closely related to the philosophy of Sankhya philosophy for liberation.

Radhakrishnan (1956 II) viewed that "Yoga provides the higher-level consciousness through the transformation of psychic organism beyond the human experience" (p. 336). The literal meaning of yoga is union which means the spiritual union of the individual souls with the universal soul as mentioned in the Vedanta. It is called the Patanjali yoga system because the sage Patanjali, as Patanjali yoga sutra systemized it; however, yoga doctrine is said to be as old as Brahma (Radhakrishnan, 1956 II).

According to Patanjali, "Yoga does not mean union, but the spiritual effort to attain perfection through the control of the body, senses, and mind, and through right discrimination/separation between Purusha and Prakriti" (Radhakrishnan, 1956 II, p. 337). But Swami (n. d) defined it somehow differently and said that the yoga system "attempts to explain the nature of mind, its modification, impediments to growth, afflictions, and methods for attaining the highest goal of life (absoluteness)" (p. 45). According to Patanjali, the Yoga is a methodological effort to attain perception through the control of different elements of human nature, physical and psychical (Radhakrishnan, 1956 II). In the Bhagbhat Geeta 2.48, Yoga is defined as Samtva, equilibrium or joining the deities (Muller, 1919), whereas BG. 2. 50 focus to devote yoga and left behind both good and evil deeds. These are used in Samkhya to consider that yoga also accepts the metaphysics and epistemology of Samkhya, follows the practical path, and leads to the Liberation/Samadhi (Muller, 1919; Radhakrishnan, 1956 II). Liberation is the isolation of Purusa from the Prakriti. While Samkhya holds

that "knowledge is the means of liberation, yoga insists on the methods of concentration and active striving, and helps to escape from Mahat, Ahankara, and Samsara" (Radharishnan, 1956 II, p. 344).

It is considered that yoga accepts the three pramanas: perception, inference, and testimony of authorization methods of knowledge of Samkhya and twenty-five metaphysical principles (Muller, 1919; Sankar, 2011; Sharma, 1991). It is also considered that it believes in God as the highest self-distinct from the other-selves and called theistic Samkhya than atheistic Samkhya (Sharma, 1991). However, Muller (1919) argues differently that yoga systematizes an ascetic discipline to attain concentration thought but devotion to God as part of that discipline.

According to Patanjali, yoga is the control or modification of the subtle mental body, liberation through mental discipline, linking the consciousness and the physical body, focus on controlling the mental body's transformation and unfolding its incredible power for higher attainment (Muller, 1919; Swami, n. d). According to yoga, the mind is like a vast lake, on the surface of which many different kinds of waves arise. Deep within, the mind is always calm and tranquil; these thought patterns are the waves appearing and disappearing on the surface of the lake of the mind (Swami, n. d). Sense perception and memory are considered the two main wave arriving sources when the water of the lake is stilled water and the water is clear, one can look deep down and see the bottom of the lake (Swami, n. d). Like that when one's thought pattern is quieted, one can see the innermost potential hidden deep within the mind.

Depending on the degree of the mind's transparency, it is classified into five stages: disturbed (ksipta), stupefied (mudha), restless (viksipta), one-pointed (ekagra), and well-controlled (niruddha). The predominance of rajas and tamas causes the mind

to be disturbed due to being a hyperactive mind and losing its quality of discrimination. The second the mudha is also dominated by the tamma and loses the capacity to think correctly and becomes null and negative. In the restless stage, the predominance of raja, the mind runs one object to another, never stays consistently, called a negative mind (Radhakrishnan, 1956 II). But last two one-pointed and well-controlled are called clam and peaceful, the predominance of satto, light aspect of Prakriti, "yoga system tried to put the mind in the consistency, manifestation of static energy, yogic practices help to attain last two types of mind through meditation helps to acquire the pure consciousness (Purusha) from the screen of the mind" (Swami, n. d, p. 47).

This day yoga is considered a science used in physical exercise and medical treatment. However, it was used before as a Vedic meditation system. Siddhartha Gautam has also used the yoga system to salvation from sin. There are eight limbs of yoga called Astanga yoga. They are "restraint (yama), observation (niyama), posture (asana), breath control (pranayama), sense withdrawal (pratyahara), concentration/contemplation (dharana), meditation (dhyana), and spiritual absorption (samadhi)" (Muller, 1919, p. 350). But Radhakrishnan (1956 II) included dhayana before than dharana. These are seen as scientific and applicable to both physical and mental fitness.

Yoga is not theism but accepts the existence of God and Patanjali defied "God as special kinds of Purusha, through God reach its highest of perfection, guide the evolution of Prakriti, creator of the world" (Radhakrishnan, 1956 II, p. 369), who is free from pains, actions, effects, and impressions, eternally free, no bound, above the law of karma; omniscient, omnipotent and omnipresent, and purest knowledge (Sankar, 2011; Sharma, 1991). It is called the higher level of perception, obtained new

intuitive knowledge, embraces past, present, and future and leads to final perfection, the distinction between Purusha and Prakriti is realized, and manifested spirit occurs in a higher form of Samadhi (Sharma, 1991).

In samyama state, the transmission of thought from one individual to another without the intervention of a normal communicating mechanism is possible (Sankar, 2011). Ultimately, Radhakrishnan (1956 II) argues that "Samadhi is a condition which few can attain and almost none can possess long since the call of life breaks in upon it, so final liberation is not possible until the body cast off" (p. 362). Therefore, the end of human life is not the union with God but only the separation of Purusha from Prakriti (Sankar, 2011) is the way of obtaining knowledge.

Purva Mimamsa/Empirical Science of Vedic Religion

The Purva Mimamsa is called the Karma Mimamsa as well as the Dharma Mimamsa because it investigates the nature of Dharma propounded in the former section of the Vedas- Karmakanda (Radhakrishnan, 1956 II, 1952 I). Karma refers to any action resulting in a reaction, whether good or bad, whereas Mimamas mean to analyze and understand thoroughly, and is considered the stepping stone of the Vedanta (Swami, n.d). It is a technique of teaching the Veda through Karma Kanda rituals, whereas the Vedanta uses the same methods in the transcendental knowledge. The Karma Kanda is called the Purva Mimamsa, means the earlier portion of the Veda i.e. "the mantra and Brahmana portion, while the latter portion i.e. the Upanishads is called Jnanakanda or Vedanta or Uttar Mimamsa, because the former deal the actions, with rituals and the sacrifice, the latter study the reality" (Sharma, 1991, p. 211). Investigation of the nature of Brahman in jnana Kanda is a practical way than speculation (Radhakrishnan, 1956 II, 1952 I; Sankar, 2011). The former deals with dharma and latter deals with Brahma and therefore former is also called

Dharma- Mimamsa, while the latter is also called the Brahma- Mimamsa. Ramanujan and Vaskara believed that these two are "integral parts of a discipline, in which study of former is necessary for the study of latter" (Sharma, 1991, p. 211-12). This indicates that the Purva Mimasa and the Uttar Mimamsa were moved collectively to get to the Vedic knowledge in different ways.

Generally, Purva Mimamsa is used to hold householders, whereas Uttar Mimamsa helps to reach the Sanyasa step. According to Swami (n. d), the main goal of the Karma-Mimamsa philosophy is to “provide a practical methodology for the utilization of the Vedic religion (dharma) for the satisfaction of the urges for wealth (artha) and sensual pleasure (kama) through sacrifice” (p. 59). In doing so, it provides a materialistic explanation of the Vedic ritual for the person of material desires, have blinded them to spiritual understanding through invoking different the Vedic gods and goodness, focusing science of sound and science of mantra, but being self-disciplined using the Yoga system (Swami, n. d). It is called human-centred as it presents the Vedic religion as a science of materialistic principle and dharma is justified as a materialist as being, which was the first Vedic thought written by Jaimini as Mimamsa Sutra (Swami, n. d).

In the Vedic ritual, dharma is considered as virtue, duties, morality, righteousness, or religion, which consists of the intrinsic nature of rta and the breath of cosmic life, and performing of *dharma* establishes peace and harmony in the breath of cosmic life, which helps to coordinate individual life with universal life prescribed in the Vedic scriptures. The *Karma-Mimamsa* proclaims that the Vedic rituals are the highest duties a *brahmana* has to perform. The science of the Vedic rituals is handed down by ancient sages, by qualified performers of rituals as methodology, the so-called practical science of higher authorities (Swami, n.d).

The Karma- Mimamsa focuses on the Vedic sentences such as vidhi (imperative/injunctions), hymn (mantra), nisedha (prohibitions), name (namadheya), and explanatory passage (arthavada) are the devotional sentences of praise (Muller, 1919; Radhakrishnan, 1956 II). The Veda is the embodiment of knowledge expressed in the form of sound and symbolically represented in the script. Karma-Mimamsa accepts "sound (sabda) as eternal, places greater emphasis on mantras than it does on gods and goddesses because it only believes in the validity of the science of sound on which the science of mantra is based" (Swami, n.d, p. 61). He further claimed that the Vedic rites are grounded in empirical science rather than religious faith as it does not view the performance of rituals as a means for imploring favors from deities (Swami, n. d). It studies the origin of the sound and its vibrational patterns for it, Vak is used in Sanskrit, which means “sound", or "speech." Vak refers to both thought and expression, while speech is the communication of thoughts and feelings through spoken words. Vak Shakti is the force flowing from a higher level of consciousness through the articulated level of speech, which is its gross expression (Swami, n.d).

It consists of two universal factors in manifestation: Sabda, the sound; the artha, the object denoted by that sound. There are four types of sound. The finest type of sound is called paraVak, which means perfect, which helps the ultimate attainment of consciousness (Swami, n. d). Second is pasyanti Vak, it is a subtle form of the universe seen with sound obtained from meditating upon divine sound such as Brahman saw the subtle sound of the universe by meditation (Radhakrishnan, 1956 II). The third is madhyama, which Vak consist of the above two sounds. The fourth stage of speech is "completely manifested and audible, sound belongs to a specific language that can be perceived through the sense of hearing, and these transcendent and eternal speeches of stream energy follow from the Vak Shakti" (Swami, n. d, p. 63).

Mantras are not mere words but specific sound vibrations (methods) experienced by sages in the deepest state of meditation, which are called cosmic forces, work as a bridge to reach the absolute truth. Mantras are capable of lighting in every human heart the eternal lamp of knowledge that does not flicker with the severe winds of worldly charms and temptations (Swami, n. d). The proper use of mantras with rituals leads one to experience the bliss and happiness within the mantra itself, so one should learn hidden and defuse mantras to awaken, concentrate, and utilize their potential as scientists use $E=mc^2$. So the Vedic mantras do, as do physicists of their formula (Swami, n. d).

In the Vedic tradition, invoked deities and demigods characterized/depicted/ analogically presented as a particular set of human qualities radiate energy like a cosmic power, which the Karma-Mimamsa receives as a specific physical form; but they would not contain a single form and would not see the different place at one form, so the Karma- Mimamsa thinks the form of demigods are imaginary (Swami, n. d). In this philosophy, the deities emerge as primal forms and sound-bodies (mantras) endowed with "perfect bliss and happiness beyond all mundane experiences and considered both mantra and deities are not separate but both are the same, deities consist in the physical form of mantra and a mantra is a subtle form of a deity" (Swami, n. d, p. 64).

When the vibration of mantra is materialized into a particular form or shape, it is called a deity. Similarly, a materialized form can be dematerialized and reduced to certain frequencies of vibration that will be heard as a mantra (Swami, n. d). Cosmic forces constantly supplying light and life to all beings can be compared to the conservation of energy into matter and matter into energy in atomic physics. This indicates that the Karma-Mimamsa is not merely ritualistic Karma-Kanda to earn

money and prestige. It is entirely scientific philosophical doctrine. Many commenters charge the Purva Mimamsa as an atheist. Muller (1919) and Radhakrishnan, (1956 II) also agreed with their arguments to some extent but they mainly focuses on the pantheism and polytheistic system.

The Karma-Mimamsa recognizes six valid source of knowledge (pramanas) : perception, inference, comparison, testimony, postulation/presumption and non-perception/apprehension (Radhakrishnan, 1952; Muller, 1919; Swami, n. d). However, "testimony is considered a more reliable source because it believes exclusively in the authority of the Veda and gives rise to knowledge of dharma" (Swami, n.d. p. 65, Sankar, 2011, p. 39). But according to Radhakrishnan (1956 II), Jaimini accepts the three Pramanas of perception, inference, and sabda or testimony as valid cognition of gaining knowledge. Later commentators added another. It does not pursue metaphysics but emphasizes the practical (focus on the experiment) approach of karma yoga through rituals as a pluralistic realist (Sharma, 1991). It considered the soul to be an eternal innumerable, individual, liberated, infinite substance with the capacity of consciousness, to believe soul with enjoy matter through Karma-Kanda (Muller, 1919; Sharma, 1991).

Uttara Mimamsa/Cosmic Brahman

The Uttar Mimamsa is called the Vedanta sutra. The Upanishad is considered as Vedanta, the conclusion of the Veda, the essence of the Vedic philosophy, the Brahma-Mimamsa, deliberation of the Brahman (called Brahma-sutra), the final form of the Veda, the Saririka sutra, the Absolute truth (Muller, 1919, p. 116; Radhakrishnan, 1956 II, p. 430; Sankar, 2011, P. 47; Swami, n. d, p. 66). According to Radhakrishnan (1956 II), the Purva Mimamsa investigates the "duties (dharma) enjoined by the Veda, joining it, the Uttar Mimamsa describes the philosophico-

theological view of the Upanishads" (p. 430). Together they provide the holistic framework of investigation of the contents of the whole the Veda. Hence the system of philosophy based on the Upanishads is called the Vedanta Darshanam, which speaks of the difference between the individual soul and the god and the matter (Sankar, 2011). Metaphysically, it deals with the theory of the Brahman as a central reality. Moreover, it deals with the nature of the Brahman, its relation with the world, and the individual soul (Radhakrishnan, 1956 II). According to Badarayana, the Veda is eternal, and the Sastra is a great authority, Tarka or reflection is no possibility to provide metaphysical knowledge, and Sruti and Smriti are only considered as the authentic source of knowledge (Radhakrishnan, 1956 II) and the Pramana includes perception, inference, and sabda for acquiring the knowledge (Muller, 1919).

The great sage Vyasadeva , known as Veda Vyasa, Badarayana, and Krishna Dvaipana , systematized the Upanishadic teaching in the Vedanta- sutra or Brahma-sutra, in where Upanishads attempted to identify the distinction between individual soul (Jeeva) with the supreme soul (Brahman) (Muller, 1919). Vedanta sutra consists of four chapters Samanvaya (reconciliation), Avirodha, Sadhana, and Phala (fruits) (Radhakrishnan, 1956 II). According to Swami (n. d), there are "five schools of thought called Vedantic Sampradayas which describe the relationship between God and the soul, the soul and matter, matter and matter, matter and God, and the soul and souls" (p. 66). According to the Vedanta- sutra, he from whom proceeds "the creation, maintenance, and dissolution of this universe, is Brahman, Prajapati, and that universe is created by God, which is revealed in the Vedic scriptures" (Muller, 1919, p. 123; Swami, n. d, p. 68). It defines God as a supreme being who is simultaneously the operative, material, formal and final cause of the cosmos; he is the operative cause; as a source of Prakriti and Purusha (Swami, n. d).

Another is the Caitanya school of thought which reconciles the disparate view of God's relationship with the world by arguing that the Vedic scriptures testify to God's acintya- shakti, inconceivable power. It considers god as powerful and causes the world for transcendental to the world (Dhakal, 2019; Swami, n. d). Another term is Vedanta, which considers reality is eternal, God and God's svarupa Shakti (spiritual energy), the temporary features of materials word are manifested to the Maya Shakti, not of God himself (Muller, 1919; Swami, n. d))

The contents could be

1. fundamentals of philosophy and fundamentals of science: the commonalities and points of departures
2. Tatwa of the philosophies and elements of school science
3. Prakriti and Purush of philosophies and negative, Yang and Yin of Taoism and positive and negative energy of school science
4. sound of school science and sound of philosophies i.e. six schools of thoughts

The contents above can be taught through comparative presentation and experts' sharing and project work can be the assessment technique

The above illustration of Vedanta shows that the individual soul and God are the same. Vedanta doctrine is wholly based on eternal Brahman understanding through spiritual perception.

Heterodox of Eastern Philosophy

The system of philosophy that opposes the Vedic or Vernashram and the ceremonial system is called the non-Vedic system. It is considered that "the religious system of Charvaka, Jainism, Taoism and Buddhism which denies the authority of the Veda, so-called materialistic/ heterodoxic or Nastika Philosophy" (Mcdonell, 1900, p. 386). It is considered that the Buddhist and Taoism philosophy was established near

about 500 BC, Jainism was before Buddhism, and Charvaka which is guided by the Yoga system is also maybe before the Upanishads. Buddhism and Jainism subscribed to their scriptures, but Charvaka is not found in separate scripture (Bhusal, 2068 BS). A short description of each philosophy and its materialistic understanding is given below.

Charvaka Philosophy and its Materialistic Implication

Charvaka philosophy, the oldest philosophy of the Indian sub-continent, is called the Locayata or materialistic philosophy (Chhattopadhyaya, 1993). Its concept is nearly Buddhist philosophy; many Buddhist doctrines mention the Charvaka philosophy. Sharma (2010) argued that Charvaka is the oldest non-Vedic materialistic philosophy. Moreover, Chattopadhyaya (1993) argues that there is a negligible difference between Samkhya and Locayata. The Brhaspati sutra is considered the main doctrine and Brhaspati is the creator of this philosophy (Sharma, 2010). However, Bhusal (2068 BS) argued that the real and original doctrine of the Brhaspati sutra is not found till now.

The Charvaka is considered Lokayata because it is the philosophy of the people. It believes material world only reality (Bhattacharya, 1952 I). It accepts the existence of only four eternal perceptible elements- earth, water, air and fire (but ether is not included due to imperceptibility); non-living materials, objects, plants and animals are made from these elements (Sankar, 2011). The materialistic value of the Charvaka is justified by Chattopadhyaya (1993) that the body is just a combination of the four material elements, earth, air, water, and fire, from which consciousness originates. It believes that the soul comes in being simultaneous with the body and ceases to exist as soon as the body is dissolved (Saraswoti, 1935).

It considers that consciousness is the combination of these four elements in a certain proportion, and perception (pratyaksa) is only one source of valid knowledge (Bhattacharya, 1952I; Sharma, 2010). The validity of inference, comparison, and testimony is rejected (Sharma, 1991). So, it is blamed that the Charvaka position is called sheer nonsense, no system of philosophy, and valid by it is often found untrue (Sharma, 1991). The knowledge obtained by sense organs is considered valid knowledge, others that are unseen are hypothetical (Chattopadhyaya, 1993, Sharma, 2010). It believes that the sense organs cannot perceive idea of God, soul, and akasa; therefore, they are rejected (Sharma, 1991). Death of the body means the end of the individual. According to Sankar (2011), it does not believe the existence of heaven, final liberation, any soul being in another world. Vernashramic extended "caste system and the material body is only objecting whose existence can be received and whose reality can be asserted, so materialism or theory of that matter is the only reality" (p. 56- 68).

Material bodies are made by earth, water, air, and fire. They are accepted by the bodies but ether is not accepted. The four material bodies can perceive but ether only inference but not perceived (imperceptible) (Bhattacharya, 1952I; Sharma, 1991). Spirit and consciousness are only a quality or cause of the mere intoxication of matter (Chattopadhyaya, 1993). Consciousness is the result of emergent and dialectical evolution and the by-product of the matter (Sharma, 1991). Chattopadhyaya further believed that consciousness is regarded as a "mere product of matter and on the combination of four elements, consciousness manifests itself in the living body, matter only secretes the mind, the so-called soul is simply the conscious of the living body, and product of matter" (Chattopadhyaya, 1993, p. 44). Consciousness arises out of the material body, only associated with vital breaths

(Sharma, 2010). It does not believe in the existence of a supreme God; God is considered an earthly king, the state's ruler, the arbiter of right and wrong in society (Bhattacharya, 1952 I). It believes that the world is created by material object but not God, so-called atheism (Sankar, 2011).

It believes in Anekantavata, which theory of multiplicity of reality (Koller, 2000). It explores the epistemological features of the theory of perspectival knowledge (nayavada) and qualified assertion (syadavida) designed to support the metaphysics of non-absolutism (anekantavida) (Koller, 2000). It also believes that the permanent and changing reality depends upon the matter's quality. In this sense, it is recognized as pluralist realism because it believes innumerable material atoms and souls, which are separately and independently real, being believe in positive facts and observable phenomena. Thus the charvaka Philosophy is called positivist philosophy (Bhattacharya, 1952 I). Being positivist, it neither believes in the soul as in entity different from the body nor there is the "dissolution of the soul from the body, there is no heaven and hell beyond this world, pleasure is heaven, pain is hell, so, there is no liberation" (Bhattacharya, 1952 I, p. 135). The goal of human life is “to attain the maximum pleasure in this life, avoiding pain, attain maximum enjoyment, a good action is one which leads to a balance of pleasure and a bad action is one which brings about more painful than pleasure” (Sankar, 2011, p. 60; Sharma, 1991, p. 46).

Out of four human values, it only believes Karma but rejects Dharm, Artha, and Moksya. It rejects the authority of the Veda and the denouncement of Brahmana priests are considered to help the downfall of the Charvaka philosophy (Sharma, 1991). Similarly, Jainism and Buddhism were continuously contemptuous of the philosophical ideas of the Charvak. Lack of moral, psychological, spiritual, and human values is also considered the cause of the downfall of the Charvakas (Sharma,

1991). Most ancient Indian continental philosophers charged the Lokayata philosophy as a monstrosity, vulgarity, impiety, and evil (Chattopadhyaya, 1993); however, it is seen as the basis for the development of the modern scientific theory of creation and is considered a materialistic philosophy.

Jaina Philosophy/Quantum Physics

Jaina's school of thought is another heterodox school of philosophical thought in Indian philosophy. Mahavira was a versatile thinker of Jainism who contributed to the development of philosophical ideas practically near about 600 B. C and was a contemporary of the Buddha (Bhatt, 1985). But Dwivedi (2017) argues that Mahavira was born in 599 BC and he is a historical founder of Jainism, focusing on non-violence and self-control for liberation. Both Buddhism and Jainism share many of the same ideological views and assumptions, as the Sramana tradition, different from the Vedic or Brahminical school thought for the attainment of the spiritual realization or liberation from the cycle of karma and rebirth (Long & Sarao, 2017). It is considered an independent school of thought that focuses on practicing ahimsa or nonviolence as the supreme form of religion and virtue of virtue (Dwivedi, 2017; Skoog, 2000). The basis of the practice of ahimsa is compassion (Daya), mercy (Hitanukampa), and a feeling of shame (Lajja) of the cruelty of killing and injuring life (Long & Sarao, 2017).

Jainism is considered a science because ancient saints discovered quantum mechanics before modern science, and Jain epistemology with the physics associated with Albert Einstein and his theory of relativity (Aukland, 2015). According to his, saying “may be” (syadvada) is based on logical prediction (Koller, 2000) and seems to imply relativism since contradictory viewpoints are integrated as different valid perspectives on a multifaceted reality (Aukland, 2015). Based on substance or

attributes, Syadvata is seven. They are: is, is not, is and is not, is unpredictable, is and is unpredictable, is not and unpredictable and is, is not and is unpredictable (Koller, 2000; Sankar, 2011).

There are two communities in Jainism, one is the Svetambara school of thought (wear white-clad), and another is the Digambara school of thought (Dwivedi, 2017, Sharma, 1991) (being naked or considered akasa as clothes or skyclad); however, both schools of thought could not see any theoretical difference, both are seen almost similar to Buddhism in content and style, important to save the heritage as the Brahmanism (Sanskrit) and Buddhism(Pali) of ancient India (Bhatt, 1985; Bhusal, 2068 BS). According to Mardia (1990), Jain law on nature, universe existents of soul, matter, time, space, dynamic medium, and stationary medium, above which space is considered as the home of the other five elements and bounded the all-subtle existence.

The Jaina metaphysics is "realistic, relativistic, pluralistic, and atheistic, the doctrine of plurality of reality, matter (pudgala) and spirit (jiva) are considered as separate and independent realities called Anekantavada" (Sharma, 1991, p. 50). The metaphysical side that reality has innumerable characters is called Anekantavada (Skoog, 2000), while the "epistemological and logical theory that we can know only some aspects of reality and that therefore all our judgments are necessarily relative, is called Syadvada" (Sharma, 1991, p. 51; Sankar, 2011, p. 66). As a fact, both Anekantavada and Syadvada are aspects of the same teaching-realistic and relativist pluralism as the two sides of the same coin (Sharma, 1991).

It is considered on the metaphysics side that reality has “innumerable characters called Anekantavada, while the epistemological and logical side that we can know only some aspect of reality and therefore all our judgments are necessary

relative is called Syadvada" (Sharma, 1991, p. 51). Jaina believes in the validity of perception, inference, and testimony. (Sankar, 2011). However, Aukland (2015) viewed somehow different four approaches to obtaining valid knowledge in the Vedic scriptures are: "perception, classification and postulates, inference, and judgment recording and theorization, indicating Jaina saints had used a scientific approach to the acquisition of knowledge" (p. 15).

These substances are called Jiva and ajiva (Sankar, 2011). However, Aukland (2015) considered it as 'life and matter'. It is that which always exists, as the universe, which has no beginning or end. Anything which has origin, existence, and destruction is a substance. The whole universe is brought under the two everlasting, uncreated, eternal, and co-existing categories, Jiva and Ajiva (Sankar, 2011). Jiva means the conscious spirit and Ajiva means the unconscious non-spirit (Sharma, 1991). First, Ajiva is a matter which is as real and eternal as the soul, and its total quantity always remains the same in the universe (Jain, 1997). According to Mardia (1990), Jiva or soul are four types: knowledge, perception, bliss, and energy.

Qualities or Guna is a substance having materiality in an atom that includes "existence, enjoyability, substantiveness, knowability, the specific character of the essence, and qualities of some kinds of the form" (Sankar, 2011, p. 61). Paryaya or mode indicates the qualities of a substance change its forms such as; the substance gold, with its qualities of malleability and yellowness, is not subject to change but can change in a different form (Sankar, 2011). Animate substance (jiva) is divided into liberated (mukta) and bound (banda) (Sharma, 1991). These bound souls live in the atom of earth, water, air, fire and the soul's essence is called consciousness and the lowest soul inhabits a material atom. However, Chad (1997) argued that the "soul is eternal, conscious, blisses, and pure has plurality and possesses infinite energy; and

existence is free from Karma" (p. 148). It is considered Jiva is a real knower (jnata), a real agent (karta), and a real recipient (bhokta) and it believes matters spread on space like a light to which the soul fills the space, so the soul is coextensive with the body (Chad, 1997).

The subtle form of Pudgala is called Karma, in which the soul binds and comes into existence (Sankar, 2011). Inanimate substance (Ajiva) includes "matter (pudgola), space (akasa), motion (dharma), rest (adharma), and time (kala) and they are without life and consciousness" (Sharma, 1991, p. 62; Sankar, 2011, p. 63). According to Jaina, time is not extended in space, it is infinite, not perceived; but make possible continuity, modification, activity, now or new, and then and old. Empirical, time is divided into "moments, hours, days, months, and years, and similarly space is also infinite, eternal and imperceptible" (Sharma, 1899, p. 64).

Dharma and Adharma are considered as rest and motion, both help each other for rest and motion which anticipated some of Newton's law (Chakravarti, 1952 I; Sharma, 1991). Pudgala drabya is in the Jaina philosophy which exactly corresponds to matter to modern science, called the smallest indivisible atom(anu) (Charkravarti, 1952 I), which combine senses, mind and breathe, cannot be further divide (Koller, 2000; Mardia, 1997; Sharma, 1991). Matter possesses qualities of color, taste, smell, and touch (Sharma, 1991).

Jainism is a religion without God (Sharma, 1991) or does not believe in a supreme being creating, destroying, and recreating the world (Jain, 1997). According to Chakravarti (1952 I), even gods cannot directly attain liberation, for this they must be born as human beings before they can hope to get salvation. He believes that the soul exists in the world from time eternal in association with a matter which is surrounded by a large volume of fine matter called Karma (Chakravarti, 1952I). Karma is the link that unites the soul to the body, ignorance of the truth, four passions

anger (kroda), greed (lobha), pride (mana), and delusion (maya) (Sharma, 1991). These are means to attract the flow of karmic matter toward the soul (Chand, 1997) and an influx of karma into the soul is called bondage (Sharma, 1991). To find consciousness in every part of the body, called samvara or stoppage, soul and matter dissolved, the soul shines intrinsically with infant faith, knowledge, bliss, and power (Sharma, 1962); which is called purification or moksya or liberation. It is called the path of salvation, the liberated soul dwells at the top of the world (Chakravarti, 1952I; Sankar, 2011). Jain (1997) mentioned seven steps of salvation:

> First, there is something called the living; second, called non-living; thirdly; that the two come to contact to each other; fourthly, the contact leads to the production of some energies; fifthly, that process of contact is stopped; sixthly, that the existing energy is could also be exhausted; and lastly, salvation could be achieved. (p. 19)

Consciousness is the characteristic of the soul, inherent in every living being, but its stage of development is different (Jain, 1997). Salvation is believed to terminate the cycle of birth and death and reincarnation, and when the soul is finally liberated to eternal bliss and internal knowledge, the liberated soul releases the infinite energy (Mardia, 1990).

Out of the discussions above the following contents can be derived for the school science curriculum:

1. Jainism's forces such as gravitational, electromagnetic, weak, and strong nuclear investigation, relativity, nuclear, ways of salvation, fusion and fission in comparison with school science
2. The materialism of Charvak, Buddha, Sankya and the materialism of school science

3. Theory of relativity and syadvada of Jain, Sankhya, Buddha, Tao with the theory of relativity of Einstein
4. Metaphysics of Jainism with school science
5. Ways of knowing the truth in philosophy and school science
6. Buddha's pratitya samapad and sunyabad with the theory of origin in school science
7. Thermodynamics of Taoism with school science

Self study and experts' lectures are the ways to teach. Besides, logical prediction and interaction can also be the pedagogical process to deliver the contents above. Finally, individual as well as group project work canbe used as an evaluation system.

The entire activities above are related to the magnetic field theory (karmic mater and soul attraction) and nuclear fusion and fission of modern atomic Physics. It could not believe any person has supreme authority; however, monks, certain teachers, and certain leaders are given particular respect (Mardia, 1990). Right faith (samyak darsana), Right knowledge (jnana) and Right conduct (charitra) are the three Jewels (tri-ratna)/ constitute of the path of moksya in Jainism (Sankar, 2011; Mardia, 1990).

Buddhist Philosophy and Materialistic Relativity

In this chapter section, I present a short description of Buddhist philosophy and religion, with its link to Hindu Philosophy and other heterodox philosophies, its materialistic characters, and the inseparable relation between cause and effect (Saraswoti, 1935), and its enlightened contribution to eastern philosophy.

Siddhartha Gautama was the founder of Buddha philosophy; however, Sharma (1962) argued that Buddha was primarily an ethical teacher and social reformer than a theoretical philosopher. Buddha's philosophy is pervasive and universal through

empirical justification without believing any supremacy (Varma, 1973). The thought he found was later developed as Buddha religion (dharma) and being pervasive world-wise as a Buddha dharma. But his idea was never directed toward religion (Sharma, 1991). According to Radhakrishnan (1956 II) due to animal sacrificial malpractice and supremacy of Vedic God in the Hindu religion, Buddhist and Jaina philosophy was born as heterodoxy philosophy.

Moreover, Varma (1973) and Radhakrishnan (1956 II) argued that even though the origin of Buddhism is the school of the Upanishadic thought, it rejects the Veda so-called *Nastic.* Both Jaina and Buddha's philosophies share many common arguments, and they are called materialistic philosophies. However, Muller (1919) argued that the Buddhist philosophy of Nirvana (samadi) is based on the Samkhya of Kapila and the Vedanta of Badarayana.

The Pali canon is called Tripitaka or the three baskets viz., Vinaya, Sutta, and Adhidhamba are considered the Hinayana as an original Buddhist doctrine (Bhusal, 2068 BS). Tripitaka was the first doctrine that collected the truth which was declared by Buddha, which consists of "Vinaya Pitaka related to the discipline of the order, Sutta Pitaka related Buddha’s Utterances (upadesh), and Adhidhamba Pitaka related to the philosophical discussion of Buddha" (Sharma, 1991, p. 71). Besides these, many rich commentary kinds of literature on the Tripitaka are found.

Buddha’s philosophical thoughts are based on four noble (Arya Satya) truths. Varma (1973) considered the ignorance of the four Aryan truths or Avidya as the root of suffering in early Buddhism. Firstly, life is suffering (duhkha means misery and pain)in terms of psychological and psychical experience (Varma, 1973), and way of cease; secondly, there is the "cause of suffering (duhkha samudaya), by the explanation of twelve dukkha samudaya; thirdly, cessation of suffering (dhukha

nirodha), removing cause and condition of suffering help to cease effect" (Sharma, 1962, p. 60); fourthly, way leading to this cessation of suffering (duhkha-nirodha-gamini pratipat), follows an ethical and spiritual path through which misery may be removed and liberation attained (Ghimire, 2014; Sharma, 1991; Varma, 1973). Buddha suggested Noble eight-fold paths to cease suffering from the right faith (samyag drsti) to concentration (Samadhi) (Sankar, 2011; Sharma, 1962). These all are related to ceasing suffering and getting enlightenment in life.

Not only that, Buddha was an analytical and skeptical philosopher. He applied both inductive and deductive logic to obtain the truth. Therefore, Buddhism is considered a "rationalist-atheistic, anti-Brahmanical, anti-caste and egalitarian religion" (Weber, 2001, p. 1), a realistic view of life, pessimism, pragmatism, and nihilistic. Buddhist philosophy consists of five subjects of the school of thought Madhyama Paripada, Pratityasamutpada, Nirvana, Ksanabhangavada, and Anatmavada.

Buddhism is divided into two schools of thought Hinayana and Mahayana. Hinayana like Jainismis religion without God, where Karma takes the place of God (Sharma, 1962). Its goal is the extinction of all misery and to obtain personal salvation, Nirvana, from the ocean of the samsara (Sankar, 2011; Sharma, 1991). But Mahayana believes that Nirvana is not the negative cessation of misery, "but a positive state of bliss, saints get bodhisattva through salvation, Buddha himself transformed God and worshiped, identified with transcendental reality, and said to possess the power of reincarnation" (Sharma, 1991, p. 75). It is a great vehicle, the great ship, which can accommodate a large number of people and can safely and securely take them to the shore of Nirvana from the troubled water of the ocean of samsara (Sankar, 2011; Sharma, 1962).

Buddhist philosophers classified Mahayana into two schools of thought 1) Nihilist or Sunyavadi or Madhyamika, 2) Subjective idealists or Yogacara. Hinayana is further divided into 1) Representationalists or critical realists or Sautrantika, 2) Sarvastivada or direct realists or Vaivhasika (Bhusal, 2068, 120; Saraswoti, 1935, p. 336). A short description of each is given below:

Madhyamika or Sunyavada. The founder of Madhyamika or Sunyavada is Nagarjuna, considered as related to Brahmavada of Vedanta philosophy, which is considered that there is nothing, mental or non-mental, which is real. It is regarded as the second and centred phase of Buddhist thought and denies the separate reality of the elements. If the substance is unreal, the modes and the attributes are also unreal (Murti, 1952 I). It considers the universe Sunya, or Void of reality. Behind this phenomenal world is a reality that is non-describable by any character, mental or non-mental, that we perceive (Sankar, 2011). All worldly things are unreal and only phenomenally real; absolute is the ultimate reality (Murti 1952 I). All phenomena are found to be merely relative (Sharma, 1991). Being devoid of phenomenal characters, it is called Sunya; however, it is the only negative aspect of the ultimate reality, it is the only description of what it is not. Sharma (1991) also viewed that “the reality is indescribable and beyond all the categories of intellect and that therefore it can be called neither Sunya nor Asunya nor both nor neither, was developed by Sunyatavada, and Vijnanavada developed the point that reality is consciousness” (p. 85).

According to this view, there is "no plurality, nothing is existent, nor is anything nonexistent; nothing come to being, nor does anything disappear: nothing is eternal and nor has anything and end; nothing is identical nor differentiated; nothing moves hither, nor moves anything thither" (Bhattachrya, 1952 I, p. 184; Chattopadhyaya, 1993, p. 543), helped to justify the accepted middle path known as

Madhyamikas (Sharma, 1962). It indicates two views *sat* and *asat*, which are found in RV. 10.129.1. Similarly, it uses the law of independent origination, i.e. origination of things being independent of the cause and condition (Pratitya-samutpada), called Sunya-vada (Bhattachrya, 1952 I). However, the real practice is different. It does not happen. If we believe so, there can also be no four truths of the noble, no rules of life-based on the knowledge of these truths, no fruit of good and evil deeds, no doctrines of Buddha, no monastic community, and finally, also no Buddha (Bhattacharya, 1952I).

Subjective Idealists or Yogacara. Subjective idealists or Svatantra Yogacara or Svatantra Vijnanavada are called Yogacharas because they emphasize the importance of Yoga for the realization of pure knowledge (Bodhi) to become Buddha by going through all the ten stages (bhumi) of Bodhisattvahood (Sharma, 1991). This school of thought accepts the "metaphysical truth of Vijnavada that reality is true consciousness and wants to support it with independent logical arguments, and the logical epistemological Critical Realism of Sautrantika" (Sharma, 1991, p. 124). This school of thought was founded in the fifth century before by Asanga, Vasubandhu, and Dinnaga (Bhusal, 2068BS). Buddhist logic is at once logic, epistemology, and metaphysics combined, logic consists of syllogism, inference, and words (Sharma, 1991).

The Yogacara school of thought agrees with the idea of Madhyamika as to the "unreality of the external objects, the Yogacara school of thought differs from them with the view that the mind (Citta) can be regarded as unreal" (Sankar, 2011, p. 76). It believes that the different ideas streaming into the mind are real, the things which are outside the mind are unreal, and the body, as well as to object, are merely ideas of the mind as a dream (Sharma, 1991)

Sharma (1991) argued that consciousness transcends the subject-object reality; it is self-luminous, the essence of true knowledge. The mind is considered a storehouse of all impressions, called Vijna-vadina's Alaya- Vijnana (lankavatara). It is regarded as the potential mind (soul)and answers to the soul of atman of other systems (Sharma, 1991), with the difference that it is not one unchanging substance like the soul, but the stream of continuously changing stages, the potential mind gradually moves towards the ideal state of Nirvana (Sharma, 1991). So the mind is only true and reality, its own place; it can make a heaven of hell and hell of heaven.

The yogic idea also does not believe in the physical matter, so-called Nissvabhava or theistic ideology (Sankar, 2011, Sharma, 1991), where the perception of an object is formed in consciousness- the soul (Saraswoti, 1935).

Critical Realist or Sautrantika. Sautrantika belongs to the Svatantra school of thought, which accepts the metaphysical truth of Vijnanavada that reality is pure consciousness and wants to support it with independent logical arguments (Sanker, 2011). The Sautrrantikas "do not accept the authenticity of the Abhidharma and the Vibhasa, Abhidharma, or metaphysical speculation is considered relevant by the Buddha is to be found in his discourses compiled in the Sutras" (Chattopadhyaya, 1993, p. 545). It wants to combine the metaphysical idealism of Vijnanavada with the logical and epistemological critical realism of the Sautratika School, called the logical school of Buddhism (Sankar, 2011). So, it is against idealism that favours the reality of the different mental world (Chattopadhyaya, 1993). Buddhist logic combines logic, epistemology, and metaphysics (Sharma, 1991). It is logical because it deals with syllogism (pararthanumana), inference (svarthanumana), and the import of words (apoha) (Murti, 1952 I).

It considered the epistemological investigation of sense perceptions (Pratyaksa) as the validity of knowledge, as a mean of cognition (Pramana) and

metaphysical discussion on the real nature of sensation. It believes that reality is supralogical, which Nagarjuna called Vigrahavyavarttani, a logical treatise or Buddha's Nyaya (Murti, 1952 I). It considers reality is not the only mind but external object also, as vijnana, moreover considered external object is separate from consciousness and meaningless because perception is simply on the mind, but other conditions also, such as visual and tactual, combined all generated mind is the effect of object, so the object is not perceived but help the consciousness to the mind to perceive (Bhattacharya, 1952I). Therefore, the external object is not directly perceived but only directly inferred (Sharma, 1962). Saraswoti (1935) also believed that complete perception arrived only by employing inferences.

Thus, Sautrantika's theory is called the theory of the inferability of the external object of the universe, which is considered as related to Locke's copy theory of idea, which seems to resemble of Jainism theory of Syadavada (Bhattacharya, 1952 I). This theory equates with relativity theory of Einstein.

Vaibhasika or Direct Realist. Direct realist while agreeing with the Sautranitikas regarding the reality of both the mental and the non-mental (external/physical), the Vaibhasikas, called the Sarvasti-vadins or Vibhasa, stand on Abhidharmas (Chattopadhayaya, 1993). It denies outright the existence of God, whose place is taken by Buddha and the theory of karma. The so-called soul is reduced to a fleeting idea and the so-called matter is nothing more than a series of momentary atoms of earth, water, fire and air (Sharma, 1962). According to Vaibhashika, external world is directly known in perception (Sharma, 1962). One who has never perceived, fire previously cannot infer its existence from the perception of smoke (Sharma, 1962). If external objects were never perceived, as the Sautrantikas hold, then they could not even be inferred, simply from their mental forms (Sankar,

2011). According to the Abhidharma Kosa, there exist three things: past, present, and future, one so-called the Sarvasti-vadins or metaphysics of Vaibhasika (Bhattachary, 1952 I; Chattopadhyaya, 1993). If unacquainted with the external object, the mental form would not appear to be the copy or sign of an extra-mental object, but the original thing which does not owe its existence to anything outside the mind; if the external object is realized, Vaivhasika thus hold the theory of direct realism (Sankar, 2011). It accepts seventy-five dharmas, the ultimate momentary elements of existence (Sharma, 1962)

From the above deliberations, we can conclude that there is some religious fervour, although it has focused mainly on pure transcendental consciousness of intellect, compassion, and deep and pure bliss. Although he used logic, and realized knowledge to know what is good and bad so-called omniscience, there is debate whether Buddha is omniscient or not. He is reliable due to his possession of true knowledge, full of compassion, and is overwhelmingly kind. His words are not false because of having realized true knowledge, the right path, and practice (Sharma, 1991).

Moreover, as Barua (1970) mentioned so many Buddhist and Jaina's materialist philosophy of relativism and Sunyavada is based on the Vedic hymn about the creation of the universe. Not only that, Buddhist philosophy has a connection with the relativistic version of the 'web philosophy' in modern physics. The cosmic web, finally, plays a central role in Tantric Buddhism, which means weaved in Sanskrit, a branch of the Mahayana that originated in India around the third century A.D (Capra, 1975). According to Barua (1970), the water is the elementary matter or abiding original ground of things, its inherent principle of movement, causes of everything, from where year, season and the air is formed (relativity), that water is formed from

the tamas (night or chaos) (RV. 10.190.1), which Buddhist mentioned it as SunyaVada (Barua, 1970). So many Vedic hymns indicate plurality about the cosmic desire (kama) (Rv. 10.129.4), which indicates that the base of the Buddhist and Jaina philosophies is the Rig Vedic hymn. So these are no less scientific doctrines than today's modern physics.

Taoism and the Tao of Quantum Physics

Taoism is found developed in Chinese culture. It began in the Chinese civilization, but no one has been identified as its founder. "Tao" (or Dao) means the way, the road people walk on, including direction, rule, ideal, and the operating principle of the universe. Tao helps ancient understandings of the word into Taoism (Hu & Allen, 2005). Taoists see nature's cycles and the natural world's constant change as earthly signs universal force called Tao (Harz, 1993). Moreover, it indicates the doctrine of any school of thought, focusing on the fundamental or natural way of all whose influences are found in pre-modern Chinese and western histories (Cullen, 2008).

Taoist attitudes, ideas, and values have helped shape the "minds and characters of millions of people in China, Mongolia, Hong Kong, Taiwan, East and Southeast Asia, Korea, and wherever Chinese communities have become established throughout the world" (Hu & Allen, 2005, p. 3), and the popularity of Taoist ideas and practices throughout the United States. Many books are written in English about Taoism in different subject areas such as living in balance, Tao of healthy eating, Tao of mediation for the body and soul, Tao of daily living, Tao of womanhood, Tao of music and psychology, ecology and medicine practice (Hu & Allen, 2005), This indicates that Taoism is the behavioural science of daily life rather than religious doctrine.

Taoist masters have “recorded the medicinal uses of thousands of plants-trees, herbs, flowers, fruits, and fungi-and have studied nutrition with healthful diet and exercise” (Hartz, 1993, p. 10). Moreover, microcosm and macrocosm work in the same way: the body becomes a microcosm so that we find heaven and earth, sun and moon, stars, mountains and valleys, rivers and oceans, snow, rain, dew, cloud and wind (Catherine, 2019, p. 3, Hartz, 1993, p. 9).

Heaven, fire, mountain, water, earth, thunder, lake, and wind were what the ancient Chinese people considered essential elements in their life (Hu & Allen, 2005). The Tao scripture identifies three Original energies: the Ultimate Yin, the Ultimate Yang, and the Harmonious Neuteras. These three energies are expressed in the “three Embodied Forms of Heaven, Earth, and human beings, namely fathers, mothers, and children” (Hu & Allen, 2005, p. 22). It focuses on the natural equilibrium between nature and humidity where neutral appears between Yin and Yang. The harmony and prosperity of human life depend on the interaction and balance of different forces (Hu & Allen, 2005).

According to Chinese cosmology, in the natural world, there are five basic elements: Earth, Metal, Wood, Fire, and Water, and each has Yin and its Yang, which Chinese philosophy is based on (Hu & Allen, 2005). There is a balance among these five elements as they work against one another: “Wood weakens Earth, Earth weakens Water, Water weakens Fire, Fire weakens the metal, and Metal weakens Wood, and they also benefit one another: Wood enhances Fire, Fire enhances Earth, Earth enhances Metal, Metal enhances Water, and Water enhances Wood” (Hu & Allen, 2005, p. 31). And these five celestial bodies that correspond to the five major planets: Jupiter, Mars, Saturn, Venus, and Mercury, respectively (Hu & Allen, 2005). Moreover, “in colours, there are green, red, yellow, white, and black. There are sour,

bitter, sweet, spicy, and salty in taste. In human internal organs, there are the liver, heart, spleen, lungs, and kidneys" (Hu & Allen, 2005, p. 31). This indicates that Taoism is based on the natural phenomenon of the universe.

Moreover, Taoism consists of the Eight Trigrams stand for sky, earth, thunder, wind, fire, mountain, lake, and water (Capra, 1975). It indicates Tao's movement is readily observable in natural phenomena and is based on the interaction between two opposing forces of nature (Hartz, 1993). Taoism sees all things relative to everything, i.e. it is very hot in the summer, it gradually becomes cold, and the coldness of the winter is replaced by the heat that is returning (Hu & Allen 2005); the brightest part of the day always gradually recedes to the darkness of the night and vice versa (Capra, 1975; Hartz, 1993; Hu & Allen, 2005). Like that second law of thermodynamics of entropy which scientists considered heat flow is followed by Taoism, which indicates heat flows from hot to cold, string milk into coffee always mix it, never unmix it (Capra, 1975). Friction slows things down; never speeds them up (Sharp, 2019), indicating it is related to the relative theory of modern physics. Not only that, this version also shows Taoism is based on relativism and cosmology as well as a two-way non-ending natural process that also indicates the

The Tao gives birth to the One;
The One gives birth to the Two;
The Two give birth to the Three;
The Three gives birth to all things.

The Tao is great;
Heaven is great;
Earth is great;
The King [representing humanity] is also great.
These are the four great powers of the universe.'

Palmer, 1993

Moreover, the Yin and Yang always represent any conceptual pair (binary opposition), such as high and low, cold and hot, beautiful and ugly, weak and strong, female and male, life and death (Harz, 1993; Hu & Allen, 2005)

One of the most critical insights of the Taoists was the realization that transformation and change are essential features of natural phenomena (Hu & Allen, 2005**).** The empirical attitude of Taoists came into prominence in his work "Science and Civilization in China; it has made Taoism the basis of Chinese science and technology" (Capra, 1975, p. 34). In Taoism, this notion of observation is embodied in the name of Taoist temples, Kuan, which was originally meant to look. Taoists thus regarded their temples as places of observation. It indicates that the experimental stage in scientific research seems to correspond to the direct insight of the Eastern mystic and the scientific models and theories (Capra, 2010).

Eastern mysticism is based on "direct insights about reality, and physics is based on the observation of natural phenomena in scientific experiments" (Capra, 2010, p. 13). In both fields, the observations are then interpreted, and the interpretation is often communicated by words so that Modern physicists and Eastern mystics are alike (Capra, 1975**).** It is argued that the world is connected as an inseparable dynamic web, called the cosmic web, which changes, grows and moves continuously as perceived by modern physics (Capra, 1975).

The matter arises in quantum theory due to the wave nature of subatomic particles. It is even more essential in relativity theory, where the unification of space and time implies are not separable (Capra, 2010). The similarity is found in the world of stars and galaxies if the observation is made through a powerful telescope. These pieces of evidence show that modern physics was developed based on the eastern philosophy of Taoism.

Chapter V

Vedic, Ethno and School Science Curriculum: The Meeting Points

Introduction

Indigenous knowledge is considered an Ethno science (Semali, 1999). This knowledge comes from what local people knowledge and do for generations through trial and error to cope with change (Siambombe et al., 2018). However, limited researchers have valued the use of indigenous science knowledge in science education in south Asian countries such as Nepal (Upadhyay et al., 2020) and African countries (Semali, 1999). This chapter presents the Ethno and the Vedic practices of different knowledge and their connection with the school science curriculum. I have tried to dig out science-related content from the Vedic and ethno practices. Finally, I tried to link the Vedic and the ethnoscience with the school science curriculum.

Branches of Ethno Science

Ethno-Ecological Knowledge

Ethno- Ecological knowledge is considered Traditional Ecological Knowledge (TEK), called traditional science. It is recognized as traditional knowledge, indigenous knowledge, traditional ecological knowledge and wisdom, traditional environmental knowledge, and local ecological knowledge depending on the situation (Uprety et al., 2012). Ecology is narrowly recognized as a branch of biology in the domain of modern science. It studies the relationship between living beings and the physical environment resulting from the people's close relationship with their natural environment and life experience (Shizha, 2014; Snively & Corsiglia, 2000). Laudari (2010) viewed that TEK encompasses "factual knowledge about ecological components and process, knowledge put into practice about environmental use, cultural values and philosophies that human relationships with their surrounding environment and wider perspective of the natural world" (p. 6).

"Ethno-ecology especially focuses on the idea, perception, and classification of the environmental classification of the members of a particular community or culture" (Slikkerveer, 1999, p. 170). It is collectively owned in the form of stories, songs, proverbs, beliefs, rituals, community laws, the local language, and agricultural practices, including the development of plant species and animal breeds (Laudari, 2010), which have been developed from the empirical observation and accumulation of facts by trial and error. It consists of indigenous agriculture, indigenous land management, Ethno Botany, Ethno zoology, Ethno veterinary, Ethno pedology (soil study), and Ethnomedicine and is based on cultural practice, spirituality and ways of indigenous people's lives (Laudari, 2010). This indicates that Ethno ecology covers a broad area of sociocultural knowledge.

From the above argument, the following content knowledge can be included in the curriculum. They are: people's life experiences and relationships with the physical environment, indigenous agriculture, indigenous land management, Ethno botany, Ethno zoology, Ethno veterinary, Ethno pedology (soil study), and Ethnomedicine and its cultural practice spirituality. Discourse analysis, observation project work, field visits, and interaction with the social organization can be the teaching methodology.

TEK represents experience acquired over thousands of years of direct human contact with the environment and knowledge built by generation living close to land, focusing on contemporary environmental issues (Shizha, 2014; Snively & Corsiglia, 2000). Not only that it helps create social, economic, and political space for recognizing the traditional way of life, which can be important for land rights, poverty alleviation and political sovereignty of traditional people (Uprety et al., 2012). Today, TEK recognized the equal status of scientific knowledge; however, some western

scientists continue to resist the formalization and legalization of indigenous knowledge in the school education system (Shizha, 2014). TEK encompasses local knowledge of plants, animals and soils, its wisdom, and the interactions of humans with the environment (Slikkerveer, 1999). The elders and specialists of various kinds understand anthropology, ethnology, ethnobiology, ethnography, ethnohistory, and mythology (Slikkerveer, 1999).

It is considered a holistic approach of study that views the world as interconnected and focuses on morals. People understand ethnoscience by "observing, questioning, inferring, predicting, problem-solving, classifying, monitoring, interpreting and adapting, guided by respect, ethics, sharing, harmony, reciprocity, holism and spirituality by holistic connecting the knowledge of different WMS categories" (Snively & Corsiglia, 2000, p. 12) which help to resolve the global environmental problems. The traditional community obtained several services from the ecosystem- foods, water, medicine, craft, spiritual satisfaction, and others (Subramanian & Piasupati, 2010). The elders did experimental innovation by observing ecological phenomena as scientific as Western Modern Science (WMS). Snively & Corsiglia (1991) viewed:

> Observations are made over a lifetime. Hunting peoples carefully study animal and plant life cycles, topography, seasonal changes, and mineral resources. Elders speaking about landscape, climate, and ecological changes usually base their observations on a lifetime of experience. In contrast, because much scientific research in the north is university-based, it is organized around short summer field seasons. The long-term observations included in oral accounts provide essential perspectives on the questions scientists are studying. (p. 28)

Snively & Corsiglia's argument shows anthropology, ethnology, ethnobiology, ethnography, ethnohistory, and mythology. Animal and plant life cycles, topography, seasonal changes, and mineral resources, and elders speaking about landscape, climate, and ecological changes can be the curricular content of science teaching. Their understanding shows the potential methodology for teaching can be observation on lifetime experiences, questioning the natural phenomena, inferring, predicting, problem-solving, classifying, monitoring, interpreting and adapting; respecting, sharing, harmony, reciprocity, holism and spirituality holistically connecting the knowledge to resolve the global environmental problem, experimental innovation by observation of the ecological phenomenon.

Humanity, nature, and the supernatural are not separated but are united within a single cosmos. Haverkort and Reijntjes (2010) claimed that a human (social), natural, and spiritual world are inseparable and integrated. TEK can join traditional knowledge's details with traditional wisdom's values and ethics, where oral tradition is considered a significant source of historical and ecological information (Snively & Corsiglia, 2000). In the present context of education through the "medium of the majority languages or colonial languages has been the most powerful assimilating and homogenizing force for both indigenous children and immigrant/refugee minority children" (Maffi, 1999, p. 46); the curriculum should be developed addressing the cultural and linguistic minority people about the local ecosystem and traditional knowledge of indigenous people as mentioned by Maffi (1999). He illustrated how publications of books on ethnobotany, hunting, traditional foods, traditional history, and narratives to support traditional linguistic and cultural identities; children have generated more ecological information in Haulapai (Maffi, 1999). Moreover, it connects the ecosystem and their dynamic relationship to social values, activities, and

patterns of resource use (Upreti et al., 2012). It is based on ecosystem management, conservation of resources, and sustainable development program.

From this discussion, we can derive the links between the human world, social/cultural world and spiritual world, preserve historical and ecological information, ethnobotany, hunting practice, traditional foods, traditional history, and narratives to support traditional linguistic and cultural identities, ecosystem management, conservation of resources, sustainable development, preserve sacred grove, preserve spiritual-related plants, animals and places as the potential the content knowledge of science teaching.

These contents can be taught through observation, interaction with knowledgeable elders, listening to the narrations, viewing the preservation practices, involving field visits and project work, dialogue with community members, and collaborative and cooperative work with community members is the way of teaching. Observing behavioural and attitude changes can be an assessment method of the above knowledge.

Nepal lacks an indigenous educational policy. Policy formulation is still driven mainly by western, scientifically trained people, largely unaware of the available relevant TEK in Nepal (Uprety et al., 2012). Although it is challenging to collect and adapt TEK due to cultural, communication, and language issues, educational documents/policies could be better developed/reformed in the local language on the support of the local knowledgeable person to preserve both traditional languages/ knowledge, its preservation and transformation in the new generation and enhance the academic performance of the students.

Ethno-Technological Knowledge

Ethno-technological knowledge has helped people to preserve and use natural and cultural resources for thousands of years (Jain, 2017). In the past, people prepared "basins, pots, jars, jugs, storage pots, braziers, legged vessels, beakers, semi-globular round-bottomed bowls, cooking pots, pedestal vessels and bird-shaped vessels by using indigenous innovation skills for storage and cultural purposes" (Emeagwali & Shizha, 2016, p. 4). These artifacts were used for agriculture, food preservation and conservation, health care, and education (Gumbo, 2016). The literature shows some evidence of the preservation of such traditional practices. For example, in India, the Himalayan Environmental Studies and Conservation Organization (HESCO) is trying to develop a model for promoting social and economic development of the poor rural communities, focusing on natural resources for decentralized and rural development called local technology (Jain, 2017).

Westerners believe South Asia, China, and many African countries have developed scientific and technological traditions without accepting western science. For example, the first indigenous people of Tanzania used the steel industry, and Nubia innovated and designed the artifacts and jewelry of gold at the local level in about 2500 BC (Emeagwali & Shizha, 2016). The acceptance of western science without any adaptive Ethno knowledge in Latin America declined indigenous technological advancement (Emeagwali & Shizha, 2016; Haverkort & Reijntjes, 2010). According to Jegede (1995), Africans had their science and technology guided by morality and based on “utilitarianism and naturalism such as smelting, iron and steel, blacksmithing, gold/silver smithing, and herbal medicine, but this practical knowledge was blamed not to be valid and replaced saying morality based knowledge cannot be generalized as a whole” (p. 16).

Local knowledge such as melting, iron and steel, blacksmithing, gold/silver smithing, and herbal medicine preparation can be used as content of school science teaching. Such knowledge can be imparted through direct observation, project work and experimentation in the field.

It is considered that local technology helps sustainable development with the priority of environmental protection and economic independence (Jain, 2017). Watermills (pani ghatta) are considered an eco-friendly technology for lighting and grinding (Kutani Pisani) for domestic use at a low cost. Local technologies are mainly used to control natural disasters, plant local crops, prepare water dams with local materials, help afforestation, preparing biomass, making utensils by the blacksmith, make agricultural tools, etc. Indigenous technological knowledge is used in agriculture, fishing, harvesting forest products, managing atmospheric and climatological knowledge, making textile, jewellery, and brass work manufacture (Hoppers, 2002). However, the indigenous property right of indigenous peoples and local community on traditional knowledge and its innovation was lacking in the context of Nepal (Secretariat of the Convention on Biological Diversity, 2005)

Local technologies, planting local crops, water dams preparation using local materials, use of biomass as energy, ploughshare making for agriculture with local woods, utensils making for daily agricultural use, eco-friendly fishing materials, use of local material for jointing the metals in *Aran(blacksmithy)*, preparation of different types of clothes and food for traditional can be the content knowledge of teaching science. The teaching methods include observation, lab practice, interaction, fieldwork, project work, collaboration, etc. Observing the used local technology is a way of assessing learners' achievement.

Fishing industries are important in South Asia, such as Nepal and India. The fisherman never overfished the resources and considered the water level, changing seasons, and the quality of fish to not harm the ecological system (Kothari & Das, 1999). I know the indigenous people of Nepal; generally, the Magar community used dhadiya (*Vook*) for fishing from which small fishes are passed from pores, and only big fishes are trapped within it. However, people use modern fishing methods such as bomb blasting and chemicals to kill the fish. These practices destroy the aquatic ecological system by killing small fish and other marine animals, so comparing indigenous fishing techniques with modern fishing and its socio-cultural impact.

The practices of food preservation are common in every endogenous culture. Aikenhead and Ogawa (2007) reported that ancient Japanese collected different types of wild root crops from the forest and flatland in autumn and stored food for winter consumption using indigenous preservatives. Japan restricted European to contact with the Japanese. European technology and natural philosophy (known as a science after 1543 AD) were imported to Nagasaki. Dutch books and Chinese translations were used. This indicates that the Japanese conceptualized European technology and knowledge, but their language, cultural hegemony, and ways of knowing nature were not accepted. In Nepal, many culturally sanctioned technologies are also used to preserve food and seed for future use. My one neighbour told me that he used to collect Ghee in a wooden pot almost a decade ago. My mother also preserves seeds from worms by putting Timur (*Zanthoxylum armatum*) and Ash (kharani) in the airtight pot. These examples show that local knowledge and skills are based on scientific knowledge because they used their knowledge and skill, like modern technology, to preserve food for a long time. NGOs and INGOs are currently distributing hybrid seeds, destroying our local seed preservation technology. The

knowledge practised by ethnographers is called Ethno-science or Ethno knowledge which is superior epistemology of knowledge preservation and transformation. This knowledge is verified by long-term experience and transferred from elders to the new generation through testimony (sabda) and mental intuition, which modern scientist Descartes called rationality.

Preserving seed in close and airtight pots using Ash and Timur, use of sugar and local fruit grinding machine and science used in it, sun drying food for long-term preservation, and preparing and using the local grinding machine may be the content of the science curriculum. This knowledge can be provided through interaction, observation and experiment. This knowledge can be assessed through observation of traditional practices.

Another important Ethno technology practised from the Vedic period until now is the smiths' industry. The smiths are the most industrial workman; they prepare "all necessary household and agricultural implements, they are miners and smelters of ore; they dig the iron and other metals from the earth's bowels and melt it very simple process" (Spaulding, 2016, p. 200). For that, they prepare a furnace, to which a leather sack is connected to blow air, collect coal for heating, melt different types of metals at varying temperatures and convert them according to their needs (Spaulding, 2016). They prepare agricultural and architectural tools, cooking pots, cutting utensils, weapons, wearing ornaments, idols of gods, and different types of knives. They use pine in cutting utensils for the strength and sharpness of the edge of the utensil, which indicates that smiths are not less scientific than modern mechanical engineers. I realized that base of the modern metal industry is the smiths' ancient knowledge of Arron technology.

Science and technology embedded in blacksmith technology and alcohol preparation technology can be the content for the science curriculum. Direct observation, field experiments and project work could be the way of providing this knowledge.

My neighbours prepare the local alcohol for different religious and drinking purposes. For example, they use the scientific process of fermentation of millet entirely with the help of marcha (yeast used as a catalyst for fermentation of millet) which is applied to break down or convert sugar into alcohol. It indicates that ancient indigenous peoples and local communities had advanced scientific content knowledge used on local materials. They applied both condensation and fermentation methods to provide a good yield. The constitution of Nepal 2015 also supported the preservation and innovation of such traditional knowledge of Dalits and other cultural people (The Constituent of Nepal, 2015). As the Secretariat of the Convention on Biological Diversity (2005) said, they did not get the patent right of their knowledge. However, Ethno-practitioners' knowledge is found to be completely scientific and organic type.

Figure 6 *Ethno Engineering used by Villagers*

Figure 7 *Alcohol Preparation Using Traditional Technology*

Ethno- Medicinal Science

Indigenous or traditional medicine as a knowledge base has been passed to successive generations for thousands of years to treat and prevent disease (Nimoh, 2014). Traditional healers, medicinal herbs, and medicinal plants have all played

essential roles in serving our healthcare needs long before the emergence of mainstream medicine (Nimoh, 2014). It is traditional medicine based on ethnobotanical knowledge of medicinal plants for the use of plants and animals. Oskaya high school in Canada used to walk and listen to students and learn about plants as a healing journey for youth. Seven healing fires are singing, dancing, laughing, talking, listening, playing, and crying (Settee, 2007). Elements of local knowledge that are scientifically understood and validated are accepted for conserving local knowledge. Such as, Aspirin is made based on a local practice already used by the Ancient Egyptians and Greeks, without their knowing its active ingredient. Local medicinal practices for malaria treatment, adoption of Arab mathematics and Chinese gunpowder by western scientists are some examples of ancient knowledge (Haverkort & Reijntjes, 2010).

In Bangladesh, eighty percent rural population depend upon medical plants for their primary health care; women as a healer and herbalists comprise a significant part of traditional medicinal plants (Castillo & Castillo, 2010). In the context of Nepal, women of the Himalayan region cultivate, collect, harvest, and sell Ayurvedic medicine. However, marketing authenticity about their knowledge is being criticized. Traditional medicinal practitioners in Nigeria are women (Castillo & Castillo, 2010). The indigenous and traditional health care system serves more than seventy percent of the population based on India's rich diversity of medical plants and associated knowledge (Kothari & Das, 1999). More than 2700 medicinal plants are documented in Ayurveda and a Rig Veda Hymn, composed thousands of years ago. More than eighty percent of the world's population depends upon indigenous healthcare based on medicinal plants, whereas indigenous people use at least 20,000 plant species for medicine and related purposes (Shizha, 2014). Shizha further argues studies of South

Africa and Bostwana communities revealed that about 80% of those communities rely on indigenous herbal plant medicine to sustain their health need (Shizha, 2014).

The above arguments show that local medicinal plants and treatment systems can be content for the school science curriculum. The knowledge can be provided through lab experiments of locally available plants, observing the treatment system, collecting the medicinal plants, planting and preserving the medicinal plants, and discourse with local healers and Baidhya (herbal medicinal practitioners) about the local medicine and treatment of diseases. Observations of fieldwork and habits are the ways of assessing the learned knowledge.

I observed that my parents know about many medicinal plants used to treat different human ailments. They used to feed us a mixture of local herbal medicine according to disease symptoms. We did not use allopathic medicine to cure diseases in our childhood. They used to provide freshly prepared homoeopathic treatment to cure the disease of the whole family. The Constitution of Nepal (2015) also emphasized the ayurvedic, Natural and homoeopathic treatment system. It indicates that indigenous people have as significant knowledge for curing diseases as modern doctors do. However, due to the lack of documentation on this knowledge and the hegemonic impact of westerners' knowledge, such knowledge will disappear soon. In my view, in the present scenario, the authentic local government should have to start to research such knowledge as well as herbal plants, and start to preserve such knowledge, and start to harvest and plant such types of herbal and medicinal plants. The local level should be ready to create, manage, and develop a need-based and skill-based school-level curriculum as far as possible.

As Foller (1999) mentioned, the practical knowledge of traditional medicine and its technology are neglected and blamed as unscientific; acupuncture as a

treatment instrument was thrown out as a form of modern scientific knowledge. Nimoh (2014) pointed out that ecological and biodiversity conservation is decreasing because people no longer depend on traditional plant-based medicines to treat diseases such as constipation, nausea, indigestion, headaches, and dizziness as authentic knowledge of treatment has ceased to pass on next generation. Maden et al. (2008) also recommended that "Kirat shamans are found actively participating as medical practitioners and herbalists. They have remarkable knowledge, skills, and practices of biological resources gained from time immemorial in verbal form and transformed from generation to generation" (p. 95). However, the use of this knowledge is decreasing day-by-day.

Ethno Science with Cosmological Understanding

It is related to celestial knowledge, influencing human living, weather forecasting, and disaster prediction. Baker (2016) argued that modern theoretical physics uses metaphors consistent with First Nations' cosmological practices. Ethno science and cosmological relationship are found interesting in the Maori worldview of the origin of life.

Indigenous people know the day cycle in several ways, including the sunrise. Every sunrise meant a complete day. Indigenous people count the day cycle, celestial cycle season, and daily cycles in leaving the landmark through the varieties of observation (Mpofu, 2016). My own experience is that when I had no watch to know the time, I used to get up looking movement of stars (looking at the position of *Sukra* in the sky) and cock-crowing being morning before (caring about the cock-crowing time and following it), went to school looking the distance covered by the sun in the sky and measure the shadow distance of the house and my own. Similarly, I went to sleep looking at the distance covered by *Tintare* in the sky. At that time, our clock

was the universe (Lee et al., 2012). Our every function was dependent on universal celestial activities. We used the universe for every action based on the spiritual concept, believing God created this universe. This knowledge of cosmology was based on the movement of stars, moon, and sun (Lee et al., 2012) as a natural event which I learned from my parents from observation and oral tradition within real-life activities of passing knowledge (Mpofu, 2016). Furthermore, when the workers work in the fields, they judge the time to return home as determined by the weather conditions, the length of the return journey, and the sounds of certain birds and insects.

From the above discussion, it can be concluded that cosmological knowledge of the people on stars, moon, sun, own calendar, and weather forecasting can be taken as the content of the science curriculum. Discourse with social elders, observation, field experiments, and project work are the ways of teaching. Students' knowledge development can be assessed through learners' everyday behaviours.

My parents predict weather patterns through a deep understanding of the behaviour of other living animals in their environment. They learn the meaning of the pigeon's singing from their experiences. My mother predicts rain by listening to sounds and looking at pigeons' dance, which is justified by the rainfall. By observing the condition of the cloud, my mother predicts a rainy or windy day. This cultural protocol is followed by thanking the ancestors for the good rains and crops (Mpufo, 2016).

Similarly, the appearance of certain insects is associated with the beginning of the harvesting and cultivating season. My father used to treat my headache by blowing on my forehead at the time of sunrise. My mother used to sun-dry or fire-dry

meat and vegetables for preservation. She knows that moisture needs to be evaporated to preserve foods. All these events show that indigenous people have contextual knowledge about cosmology, and this knowledge should be transformed into a new generation through the science curriculum.

Ethno Science with Agricultural Knowledge

Technologies such as genetic modification, fertilizers, and pharmaceuticals have transformed gardening and breeding to a large extent. Still, ancient intuitive ways of knowing those activities are found in contemporary cultural components (Aikenhead & Ogawa, 2007). High lighting indigenous agricultural values, Anne Parrish argued that "an understanding of indigenous agricultural knowledge may be necessary to any successful twenty-first-century effort to feed the world" (Semali & Kincheloe, 1999, p. 16).

Ethno science is used to control different pests that harm crops. For crop protection, farmers have different pest control methods in different areas. In Indonesia, the grasshopper (pest in rice crop) is trapped at night and eaten or sold as bird food in the market. Similarly, rural inhabitants eat termites and crab, damaging rice stalks in Thailand (Alteiri, 1993). Again, Pest in the soil is controlled by burning dry plants (called ghaseta) to kill the pest before planting crops in Nepal.

Moreover, farmers know how crops should be rotated in their farms to maintain soil fertility and which plant products have insecticidal or medicinal properties. Local agriculturalists use Titepati (*Artemisia vulgaris*), Asuro (*Adhatoda vasica*) and Khirro (*Wrightia arvorrea*) to get organic fertilizer (Rai & Singh, 2015), which provides more potash, phosphorus and nitrogen than chemical fertilizer. These examples indicate that people practice mechanical and physical control, cultural,

biological, insecticidal, and religious or ritual practices to control the agricultural pest in different countries according to the nature of crops and available pests. (Haverkort & Reijntjes, 2010).

Pest and its control, food and its preservation, local fertilizers its use and composition of a different chemical substance; burning local *ghaseta* (dry vegetation) and its impact on land; agricultural use of Titepati, Asuro and Khirro and its chemical composition could be the content of the curriculum. Fieldwork, field observation, experimenting, interaction with local knowledge farmers, and project work can be the way of teaching.

The mixture of cow urine is also sprayed over the crops plants to control the crop pest. When the fertility decreased on the cropland, the farmers used ash in the land, which helped to neutralize by preventing the soil's acidity. Animal dung is used as fertilizer to increase crop production on the land, ultimately saving soil compactness and fertility.

Nowadays, many farmers in Nepal are using varieties of imported crops for fast and high-yielding purposes, but they are confronted with climate change. As a result, many hybrid crops have lost productivity- adaptability and weather resistance capacity (Boedhihartono, 2010). Pests easily damage such types of crops in the field and the store. However, local crops grown with seeds are more nutrients, pests resistant and have long storage life. Ultimately, indigenous agro-ecological/local agricultural farming helps for "sustainable biodiversity in the environment, promotes the use of local resources, increases momentum on traditional knowledge as a holistic, contextual, and adaptive way" (Rengalakshmi, 2010, p. 161). However, farmers are facing unfavourable environmental and agricultural conditions because of climate change and the use of seeds developed by modern western science.

Cow dung and urine and its use as fertilizer, the chemical composition of cow dung and urine, antiseptic power in cow urine, use of local seeds for farming and sustainability, ash and its value as fertilizer, and way of natural pest control, can be the content of science curriculum. This knowledge can be provided through the direct involvement of students in the observation and plantation of the crop in the field, use of organic fertilizer, project work, and lab experiments of cow dung, urine and ash. A learner's knowledge can be assessed by observing agricultural productivity and seeing the changed behaviour to do the farm practice.

Spiritual Understanding and Practices of Ethno Science

The spiritual practice of Ethno people is related to protecting the natural phenomenon in a sacred way. Gray (1999) showed the deep spiritual relationship of indigenous people with the environment. He argued that indigenous people respect the earth's ecology and can communicate with the nonhuman world through invisible spirits and shamanic activities (Gray, 1999). Scientific practice with spirituality is found in Hawaiian families who follow diet from natural resources (McGregor, 1999) and through understanding the life-cycle of the various natural resources, "how changes in the moon phase and the wet and dry seasons affect the abundance and distribution of the resources, the subsistence practitioners can plan and adjust activities and keep the resources healthy" (McGregor et al., 2003, p.108). They transfer such knowledge from one generation to a generation.

In the past, people strongly believed in the healing power of plants and animals or parts of them, providing people with physical and spiritual strength and the ability to be in tune with the universe (Senanayake, 1999). The indigenous notion that existence is manifested through a flux of spiritual energy has drawn comparisons with theories of quantum physics (Peat, 1994). Specific forest sites such as groves, trees,

or animals are considered sacred and valued on special cultural occasions, which support biodiversity conservation (Secretariat of the Convention on Biological Diversity, 2005). Historical symbols of different communities are especially found in Hindu culture in Nepal. Especially near the water resource, people grow the trees considered sacred trees and worship them on special days so that communities preserve these trees, which ultimately helps to save the water resource and forest.

The cultural significance of different groves, trees, and animals as sacred and their value on special cultural occasions can be parts of the school science contents. Project work, involvement of students in observation of sacred groves, trees, and animals and discourse with elders can be the way of teaching science.

Forests are an essential component of the culture. According to Senanayake (1999), cultures are materially and spiritually built upon the physical world of the forest as people obtained their material resources for food, shelter, and other daily life materials from wild vegetation and natural resource from ancient time. In forest conservation, spirituality is considered in open virgin forest consumption in the Philippines. In a virgin forest, ten cooked sweet potatoes are placed; if they are touched or removed, it is a sign to remove clearing due to the presence of spirit in that spot (Posey, 1999; Senanayake, 1999). Similarly, if they intend to cut the large tree, they light the fire tree; if the fire goes out, it is a sign of being protected by the spirit and should not be touched. Spiritual forests are in the village near the temple in Nepal. Spiritual beliefs encourage people to protect them.

The spiritual practice of preserving forests can be the content of teaching science. Observation of the spiritual practice in forest preservation is the way of evaluation.

The concept of cosmology or cosmovision is related to farmers' agricultural experimentation relating to the word cosmos or universe (Slikkerveer, 1999). It includes holistic natural elements such as plants, animals, and humans, as well as spiritual elements such as spirit, ancestors, and future generations. Dwivedi (1994, cited in Kothari and Das (1999), argued that most world religions, through various "writing, exhortations, preaching has provided a system of moral guideline towards environmental preservation and conservation for which Hindu religious scriptures emphasized to connect community life with nature, helped to preserve biosphere and enhanced the evolution of all species" (p. 187). Similarly, the ethics of non-violence propagated by Buddhism and Jainism entailed compassion towards all living creatures, such as a baning on killing animals and protecting trees (Kothari & Das, 1999). Similarly, Sikhim proclaimed the glory of God in nature and the environment. Sacred groves, sacred ponds, patches of grassland, animals, and others are examples of traditions of conservation backed by religious sanctions. For that, various water bodies (village tanks, ponds, rivers, and others) are attributed to sacred qualities and are protected against over-fishing or over-extraction of any other resources. These overall activities support the conservation of biodiversity

Sacred groves, sacred ponds, the sacred river, sacred lakes, spiritually protected areas for fishing, patches of grassland, animals, and plants can be the curricular content of teaching.

Similar practices of environmental protection for spiritual causes are found in Nepal. Nepal has many lakes, ponds, and rivers that restrict killing fish and the sacred grove. Chopping trees in those areas are considered a sin. Many animals are preserved as sacred animals, and people are punished if anyone kills them.

Plants and animals are worshipped as totems that symbolize kinship ties between nature and humans. Tulasi (*Ocimum sanctum*) is worshipped as the god of Bishnu (spiritual value) as a sacred plant which has medicinal properties. It indicates the spiritual and medicinal values of the sacred plant helps the preservation of natural resource and provides ecological balance in nature. Modern medical science has verified such plants' antifungal, antibacterial, and immune-boosting properties. For example, Bar, Peepal, and Swomi planted at chautara and worshipped as religious entities have medical values as well as ecological importance in nature.

Many cultural groups go for an oil massage to a newborn child in sunlight as a ritual in Nepal. Modern science has proved that sunlight provides Vitamin D. This practice has been possessed by indigenous people without studying science. This knowledge has been transformed by a new generation from the elders and preserved as traditional knowledge till now.

Scientific Understanding and Practices of Vedic Science

The name Vedic science indicates both the “ancient traditional origins of this body of knowledge and the modern commitment to experience, system, testability, and the demand that knowledge is useful in improving the quality of human life through pure consciousness”(Chandler, 1987, p. 8). The Vedic Science (VS) is a scientific practice mentioned in the Vedic period through Vedic and religious scriptures. It is mainly related to consciousness and creation, found in ancient eastern sacred scripture (Rose, 1988). There are several philosophical interpretations of the Vedic knowledge and its spiritual and social aspect. Modern science is based on assumptions and cannot be valid in nature. Still, the Vedic science is entirely based on the "observation of nature and intuition, which is valid for the entire universe in all time, past, present and future" (Das, 2018, p. 129). Earlier Lowe (2011) asserted that

"the Vedas are more complete and accurate than modern scientific theories because, unlike scientific theories, they can be falsified" (p. 57). We can do more scientific research on Lowe's claim why modern science can not meet the Vedic knowledge.

However, Chandler (1987) viewed that "Vedic science and modern science are now seen as a complementary for gaining knowledge of same reality- the unified field of all the law of nature, one through empirical methods and another exploration of the excited state of consciousness" (p. 5). First, the Veda, considered eternal or apauruseya (Kak, 2000), was created as a religious aspect; however, many scientific thoughts can be found in the Vedic hymns, which our ancestors practised. Not only that, Vedic science gives "complete knowledge of consciousness or the knower, complete knowledge of object known, and complete knowledge of the process of knowing, i.e. three unified states of knowledge" (Chandler, 1987, p. 5-6). The combination of school science and the Vedic science in a single unified body of knowledge is called the science of creative intelligence (Chandler, 1987).

It is considered that Prajapati considered three lights (Jyotis) at the time of the Vedas. They were Agni, Vayu, and Aditya. Agni was born from the earth, Vayu from the atmosphere, Aditya from Sky (Kak, 2000). The tripartite division of the cosmos into the earth, space, and the sky is reflected in the tripartite psychological aspect of tamas, rajas, and sattva (Kak, 2000). Further, the Veda divided the Vedic gods into three realisms: the terrestrial (bhuloka), the atmosphere (antariksyaloka), and the celestial or sky (dyuloka) from lower to higher level gods. Moreover, heaven is considered a father and earth is a mother, generating air, water, and fire (Barua, 1970). The different branches of the Vedic science are discussed below.

The Cosmological Verification of Vedic Science

Acharya Kapila, a founder of the Sankhya philosophy, who was born about 3000 BCE, is celebrated as the father of cosmology and produced famous cosmic

thoughts of Prakriti and Purush. Prakriti is a simple matter of creation and the mother of cosmic creation and energies. The Vedic cosmology is found ancient Vedic science. Its findings are confirmed by the results of modern science (Osborn & O' Hara, 2010). The cosmology of the Vedic science indicates how the universe was created. RV hymn 10.72.2 showed that Brahmanspati generated the Vedic gods from non-existence Brahma to an existing form. Brahmanspati describes Aditi's endless expansion beyond the sky as a daughter of Daksa- the potent energy, cosmic force, and immoral and non-existence substance (Barua, 1970). The universe was first non-existence; there was neither heaven nor the earth nor the atmosphere. It desired to be nonexistent, and a cosmic process set in, through which smoke was produced. "Smoke was followed by fire, fire by light, light by flame, flames by rays or radiance, that by the blaze, which becomes condensed like a cloud of vapour mass" (Barua, 1970, p. 24). That vapour was converted into water, and from water formed the earth, middle sky, and sky (heaven). The non-existence mind is created, and the mind created Prajapati, from where all world beings were created (Barua, 1970).

Barua's argument indicates the materialistic understanding of the cosmos found in Veda can be taken as the content of teaching science. This knowledge can be provided through the narrative of elders, the study of Vedic scripture and discourse analysis among the knowledgeable Vedic Pandit.

According to Thomson (2004), the creation process of material elements is generated in the following order: "mahat tattva, false ego, mind, intelligence, sound, ether, touch, air, form, fire, taste, water, order, and earth" (p.95). In the ancient period, it was found that the moon and other planets are illuminated through the light of the Sun (BG, 15.12), indicating that our seer sees out there is no light in the Moon and other planets, only illuminated through the light of the Sun. The restless motion is

mentioned in the RV hymn 1.164.31, indicating that the Sun constantly travels; moves on its fixed and familiar path across the sky. The Moon and Sun move ceaselessly in the opposite direction (Barua, 1970).

The Rig Vedic hymn 1. 164. 4 mentioned that Sun is boneless and Moon is bony. It is considered that Moon has bone-like spots visible in its orbit, but Sun is boneless because such spots are not seen by the naked eye, whereas Sun is immortal and Moon is mortal (RV, 1.164.38). Hence, it provides heat and light continuously without wax and wane. They said that cloud is formed in heaven and sunray carries the water vapour comes towards the earth as a form of water and provides life for the whole universe (RV, 1.164. 42 & 52). Moreover, the RV hymn 10.121.7-8; 10.129.1; 10.91.6; AV, 1.16.1.1; Manusmriti, 1.8 mentioned that there was water in the beginning, covering the whole universe and from which Agni, Sky, and human beings were produced. The AV 18.1.4 also mentioned that Gandharva and Yosha (women) were reproduced from the water. The above verses indicate that there was matter (water) earlier than Brahman.

The Rigvedic and the Manusmriti's hymn related to science can be the content for teaching science. Interaction and discourse with knowledgeable Pandit and science teachers is the way of providing knowledge.

The RV hymn 10.82.5-6 indicated that Vishwakarma is the first and last God. Before the visible universe created, he had existed in all cosmic forces that came into being. Vishwakarma is considered as a father procreator of all being including water (RV. 10.81.1). The Purusasukta indicates the symbol of cosmogonic elements. Three elements of the human body are compared to the three elements of the cosmos; head: heaven, naval: atmosphere, and feet: earth (RV, X.90. 11-14). According to the Samkhya philosophy, three qualities are Sattva, rajas, and nature. In its undeveloped

state, cosmic matters have these qualities in an equilibrium state which has no form or character is called Sunyavada (BG, 14.5; RV. 10.129.3). In the Brhadáranyaka Upanishad, one reads: “there was only water in the beginning. From it emerged Satya (the Real), and this Satya is the All-Pervading one (Brahma)(Raman, 2011).

Vishwakarma, Brahman, destruction of satto guna, sunyavada, human body and three elements of the cosmos are the contemplating content of science curricula.

The first Indian philosopher and scientist Agamarsan mentioned that from meditation Rta or truth was produced; from it, the night was created and from it, the ocean was made (RV. 10.190.1). However, scientist Bamdeva mentioned that in the beginning, there was a fire (energy) and from it, other substances of the universe were evolved (RV. 10.88.2). His ideas are similar to the idea of modern big bang theory of the creation of the universe (Bhusal, 2068 BS). As the world evolved, one and other of these elements became preponderant in different objects or being, giving specific character to each (Kak, 2010). The Vedic speculation led to the belief in a universe that goes to the "cycle of creation and destruction with a period of 8.64 million years old and light travel 186000 miles per second" (Kak, 2010, p. 32).

Comparative understanding of Vedic science (e.g. RV. 10.88.2) and scientific theories can be the content for the science curriculum. The juxtaposition between Vedic and modern science can be the approach to teaching.

All these arguments/evidence indicate that the Vedic Seers had materialistic cosmological knowledge, which is no less scientific than what we call Western Modern Science.

Astronomical Knowledge in Vedic Science

Vedic astronomy is considered the oldest calculation and measurement of stars and planets. French Astronomer Jean- Claude Bailly corroborated the "antiquity and

accuracy of the Vedic astronomical measurement as ‘more ancient than those of the Greeks and Egyptians, used 4500 years ago, was accurate as today’s western astronomical instruments" (Osborn & O' Hara, 2010, p. 25). The Vedic seers focus on the sky as a source of visible and invisible force through the Vedic hymns. Astronomy is "one of the six Vedangas, subsidiary sciences, of the Vedas, the others being phonetics, ritual, etymology, grammar, and metrics and the beginnings of these sciences can be traced to the earliest parts of the Vedic literature" (Kak, 2000, p. 1). The Sulbasutrasas, the part of the Kalpa-sutras, are considered a valuable astronomical instrument consisting of two old names of astronomy or Jyotish, the science of light and nakshatra vidya, and the science of stars (Kak, 2000). It is considered that "Astronomy is described in Chandogya Upanishad, but only for its popularity, it was called Jyotish in the narrow meaning of astronomy which is a most basic science" (Kak, 2000, p. 3). The Vedic astronomy was explained in the Siddhanta Shiromani by eleventh-century astronomer Bhaskarachary and Arya-Siddhanta, sixth-century astronomer Aryabhatta. Aryabhatt is considered a master astronomer and mathematician who wrote a text on astronomy (Chandler, n. d).

Astronomy as one branch of Vedanga, Sulbasutra and its branches Jyotish and Nakshatra vidya, Siddhanta Shiromony of Bhaskaracharya, Arya Siddhanta of Aryabhatta and their connection with corresponding modern science can be the curricular content of teaching science. Interaction with elders, the narrative of elders, and discourse with local Jyotish could be the way of teaching

About 500 CE, Bhaskaracharya formulated the process of calculating the motion of planets and the time of the eclipse and first proclaimed the earth is round, it rotates on its axis, orbits the sun (the heliocentric theory) and is suspended in space before 1000 years than Copernicus and Kepler calculated the radius of sun and earth

and their period of rotation around the sun (Chandler, n. d). He first formulated the value of (pi) 3.1416 and contributed the value of zero, without which modern computer technology cannot function.

In Surya Siddhanta, he wrote about the force of gravity, the attraction force of the earth, and an attraction between solar planets. Surya-Siddhanta is regularly used in India to prepare the calendar and perform astrological calculations in the Vedic time by observing the heavenly body (Thomson, 2004) as the methodological way of learning.

In Shidanta Shiromani, the planetary position, eclipses, cosmography, mathematical techniques, and astronomical equipment are described; Surya Siddhanta describes the force of gravity, the attraction force of the earth, an attraction between solar planets, Surya-Siddhanta and its use to prepare calendar and performing astrological calculations in Vedic time. Contents like this can be prescribed as curricular contents of school science teaching. This knowledge can be provided through comparison, critiquing, and discourse. Students' comparative knowledge can be an assessment tool.

The Rig Vedic hymns reflect the astronomical support initiated and expressed by our ancestors through testimony. The Rig Veda (RV) 1.164.2 also indicated the Asva as the Sun and its seven colours which was identified by Newton in the seventeenth century in modern science. Similarly, RV 1.164.1 and Taitariya Upanishad 1.5. 10- 11 indicated the three forms of the universe where the Sun is in the sky, the air is in the atmosphere and fire on the earth, whereas three sound; Bhuh from RV, Bhuvah from Samaveda, and Svar from Yajurveda, indicates earth, sky, and heaven respectively (Sharma, 2070 BS). RV 1.164.11 stated that the Sun is the centre of the solar system, called the cosmic wheel and RV 1.164. 13 mentioned that different planets move to make the Sun centre with a fixed orbit. The Sun also moves

in its orbit, being sometimes far and sometimes near the earth (RV, 10. 89.2; YV, 37.17). This indicates that the Vedic seers saw the whole universal system and gravitational attraction between these heavenly bodies as well as earth, heaven, and sky in a fixed place (RV, 1.121. 5) in their period, which was found in modern science as a heliocentric theory and gravitation force only after the sixteenth century.

Vedic heliocentric theory and gravitational force could be the contemplating content for the science curriculum.

Many Vedic hymns indicate present modern knowledge prescribed as science. The Vedic ritual was based on the time of the full moon, new moon, solstices and the equinoxes, and the year of 365-366 days. Moreover, the RV indicated 34 lights, including the sun, the moon, five planets, 27 nakshatras (Kak, 2000). There are 88 constellations, of the 12 are on the ways of moving sun and moon. These twelve constellations are called the zodiac. To move one zodiac Sun, stay near about 2000 years. According to Dvivedi (2004), Sayana did the commentary on RV. 1.50. 4 and calculated the velocity of light as about 187000 miles per second, nearly equal to modern scientific calculation (186281miles per second). Yajurveda 2. 31 mentioned twelve tropical months and six seasons. They are Madhu, Madhava in Vasantha (spiring), Sucra, Suci in Grisma (summer), Nabha, Nabhasya in Varsa (rains), Isa, Urja in Sarada (autumn), Saha, Sahasya in Hemanta (winter), Tapa, Tapasya in Sisira (freeze).

Vedic hymn and Dvivedi's argument related to planets, stars, and moon-related calculations about the distance of each other, masses, and characteristics; Zodiac and its structure, nakshatras, number of the constellation, seasons can be the content for science. Teaching science through comparison can be the method of teaching. Showing connections and differences between the sciences of the Vedic texts and the school science text can be the evaluation approach.

Surya Siddhanta, written in ancient times based on the geocentric theory, presented a picture of the relative motions and positions of the planets Mercury, Venus, Earth, Mars, Jupiter, and Saturn that agree quite well with modern astronomy (Thomson, 2004). Like those planets, Pluto is also recognized as the king of death (AV, 1.14; RV. 135). The ancient Hindu Mythological thought of the astronomical Siddhanta seems to have much more in common with western astronomy than with Puranic cosmology. They seem to be even more closely related to the astronomy of the Alexandrian Greeks (Thomson, 2004). According to the Surya Siddhanta, the distance between the earth and the moon is about 285000 miles which is in reasonable agreement with the modern value. Aryabhatta only systematized the ancient Vedic astronomical knowledge seen from the view that "by the grace of Brahma the precious sunken jewel of true knowledge has been brought up by me from the ocean of true and false knowledge through the boat of my intellect"(Thomson, 2004, p. 19).

Calculating the distance between earth and moon, solar and lunar eclipse, Rahu and Ketu mentioned in Vedic hymn could be the content for school science. Contemplation, intuition, and revelation are the way of teaching the contents.

The Atharvaveda (AV) 19. 9.10 hymn *Dhumaketu* mentioned along with Sun, Moon, and Rahu, which indicates Ketu is a visible celestial object found by our Vedic ancestor through intuition, revelation, and contemplation (Lyengar, 2016). Moreover, the RV hymn mentioned the solar eclipse, which is the cause of the presence of the moon between the Sun and Earth, and the opaque of the Moon is considered as Rahu (RV, 5. 40. 5-6), which is verified by modern science and technology.

Technology and Architecture in Vedic Science

Art, technology, and engineering are highly developed in the Vedic culture. It is considered that science and mathematics were introduced into Europe and Egypt

from India, possibly through Persia, Arabia, and Mesopotamia or directly (Chandler, n. d). Many Vedic hymns indicate the full development of science, technology, arts, and engineering in the Vedic time. As the centre of the Vedic culture, the Indian continent had developed technology in ancient times. For example, '*Vigyana Silpasastrayo*'(Prapanacharya, 2050 BS) described a 22-foot-high, six and half-ton Iron pillar found in India, prepared with high metallurgical scientific knowledge in ancient India near about 300 BCE (Osborn & O' Hara, 2010).

The Vedic Rishis Rivu prepared a soundless watch in which a vacuum was created (Prapanacharya, 2075 BS). Similarly, Rivu designed aeroplanes consisting of three wheels, which could fly in the sky and heaven faster than the mind without a horse and spoon feeding (RV. 4. 36. 1- 2, 4). Rivu prepared a car that moved without the horse and was used in battle (RV. 1.20.3 &1.112.12); Aswinikumar moved faster than the mind towards higher hills to treat the weak man and cows (RV. 10.39. 12-13). These examples indicate that the Vedic Seers were scientists and contributed to the technological development in the Vedic period.

The binary system zero and one, essential for computer calculation, was used in the Vedic verse meters, developed in India called 'Arabic number', and passed into Europe through Arabia (Chandler, n.d). Moreover, counting numbers were first invented in the Indian continent, inspiring Einstein to say, "we owe a lot to the Indian [Indian continent], who taught us how to count, without which no worthwhile scientific discovery could have been made" (Chandler, n. d, p. 28-29). The sacred architecture was famous in the Indian continent in the Vedic period. It included geometry, drafting, stone sculpture, bronze casting, woodcarving, and painting (Osborn & O'Hara, 2010). This architecture can be seen in the oldest temples, sacred buildings, and palaces. Students can observe to understand ancient technology. These

buildings are built using organic materials such as stone, bricks, wood, mud, plaster, metals, etc., which are considered the adequate conductor of cosmic energies. Most of the sacred buildings are covered by Gold, which helps to attract cosmic energy from the Sun.

High technological development is found in the Vedic period. The Vedic architect prepared three-story aeroplanes, and the electric aeroplane flew far distances using solar energy (Prapanacharya, 2050 BS; RV. 9.62.17). Moreover, the Vedic scientist Varadwaj prepared a ship using gold to move in the ocean (RV. 6.58.3). This indicates the Vedic period fully advanced metallurgical technology, and they used golden materials in the architectural procedure. Nagarjuna (100 BCE) was considered the wizard of chemical science. He discovered the alchemy of transmuting base metals into gold and contributed to the field of curative medicine (RV. 1.84 13-14). Twasta prepared the weapons of Iron (RV.10.48.3) (RV 1.116.12), which was lost in battle.

Examination of Vedic science-related examples such as Aswinikumar connected Iron leg to Silpala, he moved faster than the mind towards higher hills for treatment of the weak man and cows; used golden materials in the architectural procedure; used binary system first using zero and one. Scientific and technological knowledge like this can be included in the school curriculum. Project work, cross-verifications with Vedic experts, studying the historical books and observing archaeological places can be the pedagogy. Observing the discursive capacity of the student can be the way of student assessment.

Tvastr is sometimes called Savitr, recognized as a constructor of the world. He is considered a sharpener of the axes for Brahmanaspati, makes the cup for gods to drink soma, and gives the shape to all living things (Radhakrishnan, 1956I). The

Vedic seers prepared and used Agni Astra (called agnibana) in the battle, which makes enemies blind, unconscious, powerless, knowledgeless, and damages the whole energy (AV, 3.1.6; 6.67.2). Vayu Astra, Brahma Astra, Pasupat Astra, Baruna Astra, Samohan Astra, Tamas Astra/ Bajra, and other hundreds of weapons were mentioned in Rig Veda and Atharva Veda (Dvivedi, 2004). In 800 BCE Acharya Bharadwaj prepared three categories of flying machines (Vimana): 1) one that flies on earth from one place to another, 2) one that travels from one planet to another, and 3) one that travels from one universe to another. It was prepared by applying sunlight and wind force, which is amazing for modern technical engineers. Thus, Bharadwaj was recognized as the pioneer of aviation technology.

Science and technology like Tvastr constructed Agni Astra, Bayu Astra, Brahma Astra, Pasupat Astra and different weapons, preparing flying machine, wind energy and solar energy; prepared thousand pillars place; air-conditioned houses can be the content of science curriculum. These contents can be taught in archaeological and historical places.

The Vedic period was not only used for technological development, it was fully used for architectural development. RV (2.41.5 & 5.62.6) mentioned that king Mitra Baruna's palace was made of thousand pillars, King Baruna's house was also made of thousands of pillars (RV, 7.88.5). The protective big city was made of Iron, where cows and meals were kept, and it was safe from the enemies in battle time (AV, 19.58.4). Similarly, the Vedic architectural knowledge helped design air-conditioned houses with tanks and gardens free from air and water pollution (Dvivedi, 2004). This discussion indicates that the Vedic period was highly developed in architecture and technology.

Ecological Knowledge in Vedic Science

Ecology is a branch of biology that deals with the relationship of organisms with the physical environment (Dvivedi, 2004). Many Rig Vedic hymns show interconnections of living beings with the physical environment. RV verses stated that the sky is like father, the earth as mother, and space as their son (Renugadevi, 2012). RV and AV hymns also mentioned the importance of air, water, and green plants for human existence. Although different Vedic gods or ecological elements are worshipped as rituals, they help to maintain ecological balance. The Vedic hymns also talk about the sacrificing value of different plants and animals, which ultimately help to purify the environment. In the Vedic terms, after the creation of the universe, the whole universe is considered a sacrifice (Yajna) and natural cycles such as the carbon cycle, water cycle, nitrogen cycle, Saurya cycle, Moon cycle and Ritu cycle help to protect the environment and save from pollution (Dvivedi, 2004; RV, 10.90.6 & YV, 31.14). Yajna is considered the centre of the cosmic cycle in which the water provides satisfaction to both heaven and earth (YV, 23.62; RV, 1.164.51).

Due to the impact of Yagya, the Antarikshya devata, Bhu devata, and Dhulok devata, Rainfall devata, Nakshatra devata, different planets, meters, different metals, agricultural products, medicine, day-to-day foods and nutrients would be strong (YV, 18.9,12,13,14,18, 19& 1.164) and maintain the ecological balance. Similarly, many of the RV hymns mentioned the utility of fire, which provides heat and light energy, and helps to control the expansion of various diseases. Similarly, Peepal (BG,10.26; 15.1) has been worshipped as a form of Bishnu and protected as ritual value since the Indus valley civilization; however, it ultimately helps to control the air pollution by absorbing the pollutants(Carbon-dioxide) from the atmosphere, provide a considerable amount of oxygen and used as Ayurvedic plants (AV, 5.4.3; Kumar,

2008). Continuous production of heat and radiation from the Sun kills the microorganism, which consists in our atmosphere. With the sun's rise in the morning, all types of poisonous (Bisalu) animals die and disappear or are converted into nectar objects (RV, 1.191.1-16), making life possible in this universe possible.

In ancient times, there was an ecological balance between living and non-living natural things. The AV.12.1.3-4 hymn mentioned the appropriate use of water resources, their usability for fruit and vegetable production, their human consumption for health, and overall development. This indicates that there was full knowledge of ecological and sustainable development in nature. Westerners are showing concern about these issues nowadays. Moreover, AV. 12.1.11 mentioned, "O earth, pleasant be thy hills, snow-clad, mountains, and forest; O numerous coloured, firm and protected earth, on this earth I stand, undefeated, unslain, unhurt" (Kumar, 2008, p. 301).

Based on the above arguments, the interrelationship between living and non-living things, their preservation, the balance of human utility in the ancient period and challenges for future conservation could be the content of the science curriculum. It can be taught through direct involvement in the protection of natural objects, spiritual participation in the use of natural resources, interaction with elders, collaborative work and project work.

Many RV and Upanishadic hymns mentioned the relationship between 1. Earth or land, 2. water, 3. light or luster, 4. air, and 5. ether. Nature has maintained a status of balance among these constituents or elements and living being present in the natural environment. AV.18.1.17 mentioned that water, air, and herbs or plants were available everywhere from the beginning. The Vedic seers assigned attributes of

different gods in their natural forms and activities, such as fire is bright, soma is green, the air is fast-moving, and the sun is the remover of darkness. Aditya is considered devamata, the mother of natural energies and symbolizes nature.

The Vedic hymns also mentioned three gods (Agni in the earth, Vayu or Indra in the atmosphere, and Sun in heaven) as three different types of energy in the Vedic period, which maintained the balance and harmony between universal natural phenomena. The water cycle is described in AV. 4.27.4 mentions that Maruta carries water from the ocean and reaches the sky and from the sky comes back to the earth; that water helps to grow rice, wheat, barley, and other medicinal plants on the earth (AV. 4, 27.2). This shows that there was full agricultural development and environmental balance. All Vedic Rishis were serious about water pollution and its impact on living and non-living beings. Manusmriti 4.56 described the methods of protecting the water and keeping it clean. It instructed people not to throw excretion, urine, blood, animal meat, and poisonous substances in water. Many Puranic verses mention that if anybody pollutes the pond water, wells, or lakes, he must go to hell to suffer (Tiwari, 2016). It proves that Vedic seers were aware of environmental preservation and protection. Unfortunately, the ecological balance is diminishing these days.

Atmospheric purity is discussed in the Vedic scripture. YV. 5.43 instructed not to destroy anything in the sky, not to pollute the sky and not to destroy anything of the Antariksha and abide with the earth. Yajurveda 3.37 mentioned the nutrient foods, the use of Agni for the protection of all living beings, healthy and save the life of animals; AV. 11.2. 8 mentioned the protective layer of an atmosphere which protects us from the unwanted radiation (ultraviolet rays) of sunlight which is now called the ozone layer (AV,4.2.8). Moreover, AV. 11. 2.24-25 mentioned about value of water and its

relationship with the forest and terrestrial living being and their extension all over the universe. RV 1.23.19-23 mentioned the value of water as nectar for health, longevity, life energy, and prosperity. Water is considered as medicine, bathing and pure drinking water destroy all diseases (AV, 3.7.5). The water produced from the high Himalayas and mixed within the ocean has unique medicinal values (AV, 6.24.1-2). Yajna is a way to protect against water pollution through smelting Vayu (RV, 1.23.18). So that water pollution would be prevented through means of sacrifice. All these phenomena mentioned in different Vedic literature show that the Vedic ecological knowledge was pervasive, which is still relevant to protect the environment from the different types of pollution.

Air pollution and its protection; the relationship between air, water, and human being; water and air as a form of medicine; Yagya as a way of protecting water pollution could be the content of science teaching. It can teach through direct interaction, practical involvement in the protecting function, project work, and problem-solving. Observing the changed behaviour of learners is the way of assessing (un)achieved knowledge.

RV.10.97.2 also mentioned the relationship between plants and vegetables as a form of medicine as addressed, “O mother; hundreds of your birthplace and thousands of your shoots, and these plants have come into existence in the earth before the creation of animals, protected and supported to all living being found in the universe”. The AV. 12.1.57 mentioned the relation of plants with the earth, ‘The earth is the keeper of creation, the container of forests, trees, and herbs, and provide the healthy, longevity and prosperity (YV, 36.23) towards all the living being contained in the earth (AV, 12.1 62). In the environment, all elements are interrelated and dependent on each other. Sun draws water from the ocean through rays; Earth gets

rain from the sky and grows plants (Tiwari, 2016). Plants produce food for living beings. This whole process mentioned for maintaining the natural environment is called Yajna (Manusmriti, 3.76; YV, 9.21). Thus, *Yajna* helps " minimise air pollution, increase crop yield, protect plants from diseases, and provide a disease-free, pure and energized environment for all, offering peace and happiness of mind" (Tiwari, 2016, p. 166).

Ancient seer knew about various aspects of the environment, cosmic order, and their coordination between all-natural power for universal peace and harmony (Tiwari, 2016). This challenge for the western scientist today. The pray of *Shanti mantra* coordinates the interrelationship among all-natural powers and regions. The prayer says that not only regions, waters, plants, trees, and natural energies but all creatures should live in harmony and peace (Tiwari, 2016). The *mantra* talks about the concord with the universal-peace of the sky, peace of mid-region, peace of earth, peace of waters, peace of plants, peace of trees, peace of all-gods, peace of Brahman, peace of universe, peace of peace; May that peace comes to me (AV, 19.9.14, Tiwari, 2016 &YV, 36.16)

The Santi mantra, which can help protect worldwide peace among living and non-living things, could be the science teaching content. The pedagogical process can compare the meaning of peace education, peace for education, and peace in education with Shanti Mantra. Viewing the comparative knowledge of the student can be a way of evaluation.

Energy Consumption and Preservation in Vedic Science

Energy is an important part of school science and Vedic science. In Vedas, Agni is considered energy. Albert Einstein concludes that energy can neither be created nor destroyed; it can be transformed from one form to another, which is found

in many Vedic hymns. Agni is considered indestructible, and its potential energy is mentioned in Yajurveda hymn as a powerful, highest, and forever energy (YV, 12.24-25). According to Dvivedi (2004), Agni's power is considered a form of energy. Baisanar Agni is considered the highest of all power and a centre of all universal things. It consists of water, plants, medicine, hills, and human being as a nutrient (RV, 1.59.1-3). However, the RV hymn 2.1.1 mentioned that Agni (energy) sources are water, air, plants, stones, and medicine. It indicates that there is preservation and conservation of energy in different forms, and energy is transferred from one form to another.

Agni as the energy source, its preservation, conservation and transformation can be the contemplating content knowledge of present science teaching.

In the RV hymn described energy as a different form of deities such as Indra, Bishnu, Brahman, Mitra, Varuna, Aryama, Twasta, Rudra, Matura, Pusha, Aditi, Bharati, Ida, Saraswoti, etc (Dvivedi, 2004, RV, 2.1.3,4,6,11). However, the main form of Agni (energy) consists of Brahma as creator, Bishnu as prosperity/intellectual, and Maheshwar as destruction (RV. 2.1.1, 3). The four Vedas mention energy is omnipresent. It is produced from water and consists of heaven, atmosphere, and earth (YV,12.23). Agni (energy) passes away in an electric wave as the wave of ocean moves (RV, 1.44.12). Moreover, Agni (energy) is produced from the friction of the Arani plant as well as Atharva Rishi produces it from friction in the atmosphere and lighten by Dadhichi Rishi as electricity (RV.3.29.1-2, YV. 11.32,33). Similarly, Atharva Rishi produced electricity (energy) from the water collected in the lake (RV,6.16.13). Atharva Rishi produced energy as a form of oil, petrol, and gas from the inside of the earth (YV, 11. 28-32). Modern science also described the different form of energy. It clarified that various forms of the substance are collected

as energy inside the earth, which is now used as the primary petroleum energy source worldwide. As mentioned in modern science, RV. 8.3.23 also expressed ten types of energy consisting of the universe.

The reference to the Vedic texts above indicates that different devatas are the form of energy; Athrava Rishi produced electricity and energy from oil, petrol, and gas inside the earth. These concepts can be the content knowledge of school science teaching.

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Different types of energy are found in the whole universe in another form, which the YV 12.47-48 explains this. Agni (energy) covered the entire heaven as a light, covered the earth as medicine, and consisted of electricity in water and the sky as a form of omniscience. Agni (energy) is also found in water, stone, metals, medicine, plants, different types of animals, birds, heaven, earth, sky, wind, and electricity (AV, 3.21.1-7). Moreover, Agni (energy) is found in heaven, sky, and earth as a form of heat and light and it consists of an atomic structure. It means energy consists of an atomic substance (RV, 1.149.4) justified by modern science.

The RV hymn 1.64.9 clearly mentioned that Maruta functions as a carrier of electricity from heaven to earth as an electromagnetic wave, which was found in modern science recently. Vedic seers identified it. Similarly, the AV. 14.1.2 mentioned that Aditya had Som (which means hydrogen), which helped produce a huge amount of energy continuously and made the earth luminous. Not only that, the AV. 9.3 mentioned the smallest part of water consists of Surya is Hydrogen and another smallest particle called Helium is also mentioned in that hymn. Moreover, it produces life energy (oxygen gas) from water, which is required for respiration (YV, 3. 7). Nowadays, modern science declares that Sun has 90% Hydrogen gas, 8% Helium gas, and 2% other gases. Due to the thermo-nuclear reaction, hydrogen continuously converts into helium, and tremendous energy is released continuously

(Dvivedi, 2004), which Dhirgatamas Rishi observed. Mitra Baruna is considered a positive and negative charge produced in Sunrays. They expand as electromagnetic waves from the Sun to the Earth (RV, 8.101.1-2). Sun evaporates the water consistently in the ocean and irrigates the earth's surface (AV, 13.3.9).

The examples above indicate that Maruta carries electromagnetic energy; Aditya has soma (hydrogen) as a form of energy, Mitra- Baruna as a positive and negative charge. These concepts could be the contemplating content knowledge of the science curriculum. This knowledge can be taught through a comparative study between Vedic science and what we call science. Students' argument is one of the ways of assessing (un)achieved knowledge.

Sun is considered the father of a newly born child (AV, 7.22.1) because Sunlight kills unwanted diseases, guides toward discipline, and provides medicinal nutrients, health, and longevity (AV, 7.23.1-2; RV, 8.72.16). Not all types of Sun rays are helpful. Some rays are harmful. RV. 10.27.22 suggests that harmful rays consist of Sun rays which are harmful to man and agricultural products (Dvivedi, 2004). Sun rays consist of seven different types of rays (seven rays of the sun indicate the metaphor of seven horses). These seven rays of the Sun have various capacities, frequencies, and characteristics (RV, 3.35.2;4.50.4 &5.45.9). The rays help kill several types of diseases. Not only that, but our Vedic seers also found that Sun has exerted the gravitation force to attack the earth, including other planets, Nakshatra, and atmosphere, so that earth, atmosphere, and heaven never detach from their positions (RV,10. 65.4 &149.1).

Values of the Sun as the form of energy, seven types of rays, sun rays for killing germs, sun rays for nutrient sources, sun as gravitational forces, evaporation of water, and sun drying practices can be the content knowledge of science teaching.

Conservation of mass and energy is mentioned in RV 10.72.4 as the form of daksya (energy) and matter (Adity) related to the Einstein theory $E= mc^2$. Similalry, RV. 9.33.1 & 10.123.2 mentioned the tidal energy of the sun and moon on new moon day, and its impact is seen mainly in ocean water. Many Vedic hymns provide the knowledge that Vedic seers had seen the energy in natural gas, which is found both in water and inside the land.

Ayurvedic/ Medicinal Knowledge in Vedic Science

Ayurveda is the Veda (knowledge) of ayus (life or longevity) (Engler, 2003). Ayurvedic knowledge is the Indian continental medicine system, which is holistic to health that builds upon the tripartite Vedic approach to the world (Kak, 2010). It represents the ancient practices of drugs and therapies developed by Hindus (Kapoor, 1993) and most of the medicine is derived from the plants which grow in India and Asian countries.

The principles and herbs of Ayurveda were described first in the Rig Veda, and then Atharva-Veda, Charak Samhita, and Sushrut Samhita. They are considered an encyclopedia of Ayurveda. Schneider et al. (2002) mentioned that the Vedic medicine, including Ayurveda, has been recognized by WHO as a "sophisticated system of natural medicine with a detail scientific literature consisting of classical medical text, the oral tradition of classical knowledge, and [the width] and breadth of clinical procedure relevant to prevention and treatment of acute and chronic diseases" (p. 61).

Ayurveda provides the causative, preventive, and curative aspects of good health, and ways of achieving it can be taken as content knowledge. It includes internal medicine, surgery, ayurvedic psychiatric, physiology, embryology, gynecology, ayurvedic toxicology, nutritional science, digestion, metabolism, and sexology (Chandler, n. d; Kapoor, 1993; Shivakumar, 2010).

The practice of Ayurveda in internal medicine, surgery, ayurvedic psychiatric, physiology, embryology, gynaecology, ayurvedic toxicology, nutritional science, digestion, metabolism and sexology can be the content of school science teaching.

The ayurvedic practice believes that health is maintained through the balance between three basic senses of humour (dosha) of wind (vata), water (khapa), and fire (pitta) (Engler, 2003). Charaka and Sushruta were considered earlier physicians of the Ayurvedic knowledge and considered father of medicine (Kak, 2010). Plastic surgery and bone setting are considered highly advanced skills in the Indian continent. Sushrut prepared and used more than 125 types of surgical instruments (Chandler, n. d) and did more than 300 types of simple to complex surgical operations, plastic and brain surgery as well. Acharya Sushrut is considered a great person in medical science.

The complex surgical operation, plastic surgery and brain surgery found in Veda can be the contemplating curricular contents for school science.

From different Vedic verses, we can assume that an advanced treatment system was developed in the Vedic period. It was arrived at or extended through processes of experimental verification or falsification (Engler, 2003). Most of the Vedic seers were Ayurvedic healers who used observation and empirical knowledge to treat the patients. They developed different surgical instruments. Aswinikumar connected the iron leg in Silpala using Ayurvedic medicine. The Vedic seers considered water as medicine. Pure water was used to protect from disease and provide prosperity in the whole universe (Yajurveda, 36.12). Pure water is regarded as a nutrient like milk of the mother (YV. 36.16; Samaveda, 2.4.4). Similarly, the YV. 36. 17 mentioned that water, medicine, and plants provided peace in the earth,

atmosphere, and heaven (YV. 12.48; 36.24). This indicates the Sun provides the power of long life with health and prosperity. It pervades heaven, earth, and the atmosphere as a form of light, medicine, and water.

The Vedic seers knew about diseases verified by modern science after the sixteenth century. They identified cough, goitre, wound, and tuberculosis (YV,12. 97-98). Milk, ghee, honey, and soma were used as nutritional as well as medicinal value (YV, 21.33) and rice, wheat, til (sesame seeds), kush, jwano, bayar, katusha were used as nutritional foods and medicinal purposes in different Yajurvedic and Athrvedic hymn.

As mentioned earlier in the philosophical part of the IV chapter, the Vedic seers discovered Soma as a highly medicinal plant. The Rig Veda 8.48.4, 9.96.10; 9.97.24 described "Soma as the king of the world, has the power to prolong the life of men, and is called the king of heaven and earth, of men and gods" (Muller, 1901, p. 294).

Moreover, Ayurvedic seers believed that "we can attain divine through physical intoxication; it acquires medical powers, helping the blind to see, and the lame to walk" (Radhakrishnan, 1956 I, p. 84). But according to Kapoor (1993), this Soma plant with fifteen leaves is extinct now. These events show that the Vedic period fully developed Ayurvedic medical science. Reliable testimony, inference, perception, and yukti are considered to provide authority to the Vedic Ayurveda (Engler, 2003). Ayurvedic medicine is mainly used to treat high blood pressure and serum cholesterol, chronic bronchitis, obstinate skin disease, and other digestive and respiratory diseases (Kapoor, 1993). Not only that the Charaka Samhita inquires the facts on human anatomy, embryology, pharmacology, blood circulation, and diseases like diabetes, tuberculosis, and heart disease. However, standardization of the Ayurvedic and botanical medicines is challenging in the present scenario (Patwadhan et al., 2004).

Treatment of high blood pressure and serum cholesterol, chronic bronchitis, obstinate skin disease, diabetes, tuberculosis, and heart disease with Ayurvedic medicine can be the content of science teaching. Experimental work with pharmacists and medical doctors or the analysis of the allopathic medicinal ingredients with the Ayurvedic can be the approach to teaching. The innovation will be the evaluation system.

World Health Organization (WHO) and other health-concerned international organizations have started creating a new mechanism to induce and regulate quality control and standardization of Ayurvedic and botanical medicine world (Patwadhan et al., 2004). They further suggested that to regulate Ayurvedic and traditional medicine, a newer guideline for standardization is required (Patwadhan et al., 2004). I believe preclinical studies and evidence-based approaches to the Ayurvedic medicine are more important for validating drugs for producing well-tested and safe Ayurvedic medicines. For the validity and standardization of the traditional wisdom of the Ayurveda, it would be better to connect it with modern science and technology.

Agricultural Knowledge in Vedic Science

In the Yajurvedic hymn 23.45-46, Brahman asked about the appropriate place to cultivate the seed, and the answer was earth. This indicates that agricultural practice started in the Vedic period (Dwivedi, 2004). People began agrarian practices such as ploughing, sowing, reaping, and harvesting only on auspicious days. Few people made crop fields their modern laboratories and studied the nature of crops and plants. It is assumed that the Vedic economy was developed as the rural agricultural economy. Agriculture was the main occupation of the Aryans (Kaur, 2014). Grow more food (YV. IV. 10) was the common slogan of the Vedic poets.

The Vedic agriculture was appropriately performed by understanding the weather condition. They grew wheat, barley, and other edible nuts, as the primary

food items. People throw waste such as leaves, cow dung, and other materials on the fields to let them decompose as compost manure. The whole process of farming has been described in four words Karsana (cultivating the field), Vapana (sowing seeds), Lavana (reaping the harvest), Maida (threshing) in the Satapatha Brahmana (Kaur, 2014). About irrigation, the Rig-Veda mentions four kinds of irrigation systems. They are a. Divyah (Rainwater) b. Khanitrimah (Water of wells) c. Svayamjah (Springwater) d. Samudrarthah (The water of the rivers falling into the sea)(Kaur, 2014, p. 361; RV. 7.49.2). Rain-water and streams were known as natural sources of irrigation, while wells, tanks, and canals were considered artificial sources in the Vedic period (Av, 1. 4.3;6.4). Similarly, the YV, 22.25 also mentioned well water, reservoir water, stream water, wind consisting of water, stream water, ocean water, and spring water as the water source for good irrigation purposes. The Vedic Indra provided the nutrient food by preparing agricultural land and watering it (AV.3.17.4). And sharp agricultural tools were recommended for the cultivation and harvesting of crops (AV.3. 17.2).

The analysis of Vedic hymns Karsana (cultivating the field), Vapana (sowing seeds), Lavana (reaping the harvest), Maida (threshing); Divyah (Rainwater), Khanitrimah (Water of wells), Svayamjah (Spring water), Samudrarthah(The water of the rivers falling into the sea); Indra and its linkage with water and nutrient food, cow dung as fertilizer, indicates that Vedic agriculture, organic agriculture, and modern agriculture: the commonality and differences can be the content for science curriculum. Practical work on agriculture could be the method of teaching. The product and the market analysis will be the evaluation process.

The YV.3.14. 1-3 mentioned the need for a shed to keep cows and its milk and ghee as nutrients and cow dung for good fertilizer.

The Rigveda mentioned harmful pests such as insects, birds and locusts as the most dangerous to the crops. Rodents, insects and demons were considered harmful to the crops, which were kept away by charms (magic). We find an entire hymn consisting of mantras in the AV (VI. 50) which express prayers for farmers to Asvins against petty destroyers of crops (ibid). Ancient Vedic seers used cow dung with urine as antiseptic; rich in bacteria that compete with pathogens; good medium for biocontrol agents; and is beneficial to *Rhizobium* and *Azobacter* (Gupta et al., 2026; Nene, 2017). Moreover, a mixture of cow dung and urine consists of crude fibre, hemicelluloses, pentosans, and micronutrients. The urine portion of cow dung contains nitrogen, potash, and sulphur and traces of phosphorus which modern science describes as an excellent organic fertilizer (Gupta et al., 2016). The demands of organic crops, vegetables and fruits are increasing nowadays.

Yogic Knowledge and Practices of Vedic Science

Ancient Yoga Sutras of Patanjali is one of the critical books of the Vedic literature. Yoga changes mental attitudes, diet practicing specific techniques in Yoga such as a yoga aasana (postures), breathing exercises (pranayamas), and meditation help attain a higher level of consciousness (Balaji et al., 2012). It helps to connect the individual consciousness with the universal consciousness through the vital force of energy (Balaji et al., 2012). Yogic science approaches outer science with an inter vision and turns them into inner sciences. Through the transcendental meditation, Sidhi program, the mind gains the ability to function from the level of the self-interacting dynamics of the unified field of nature called higher-level consciousness (Chandler, 1987; Morris, 2018). It focuses on “inner subjective experience is marked by the onset of a unique constellation of physiological, neurophysiological, and biochemical changes and focus on pure consciousness of waking, dreaming and deep

sleep states of consciousness" (Hagelin, 1989, p. 7). Divine consciousness or God-consciousness as the "ultimate goal of human life and spiritual development is the best and only solution to all issues of moral behaviour, physical well-being, societal harmony, creation of world peace, and the field effect of consciousness" (Lewe, 2011, p. 58; Morris, 2018, p. 18).

Scientific findings from the international research program about Transcendental Meditation (TM)- Siddhi found: increased "intelligence and creativity, improved academic performance, lower stress, and anxiety, improved physical and mental health, effective rehabilitation of prison inmates, reduced drugs and alcohol abuse, improved productivity, job satisfaction, and profitability in the workplace" (Morris, 2018, p. 18); and increases in measures of human development and moral reasoning (Morris, 2018). TM increases health conditions highly, boosts immunity, reduces blood pressure and helps to reduce the crime rate and accident rate unassertively (Balaji et al., 2012; Morris, 2018). Moreover, the electroencephalograph (EEG) record shows that the person who has practised the meditation decreased heart rate and oxygen consumption rate of a person (Hagelin, 1989)

It was found that it makes holistic functioning of the brain (Morris, 2018) and "makes the realize the ancient dream of flying through the air, and developed highly enhance the power of hearing, seeing and intuition that extends the senses far beyond the limit of currently conceived to be possible" (Chandler, 1987, p, 20). It helps outer sciences make inner sciences so that diverse subjects from astronomy, mathematics, music, and grammar can be understood through the Yogic spiritual paths (Frawley, 2010) this works to develop the outer as well as the inner science from the ancient time.

Frawley (2010) further believed that outer science, such as physics, can be understood through the spiritual or Yogic paths of self-realization connecting with

universal being, developing the consciousness within ourselves and the world. Lowe (2011) viewed that the Vedic seers linked parts of the human brain with the Sun and planets of our solar system by making a schematic diagram of the whole universe and the solar system. The Vedic science recognizes the importance of sensory perception and intuitive understanding. Meditation is considered the main instrument to reflect reality beyond the limitation of senses through the silent mind through Patanjali's Yoga sutra (Lowe, 2011). The transcendental meditation (TM) techniques refine the mental activity and go beyond all excited states of the mind to the less excited state of mental activity, called transcendental consciousness (TC) (Maharishi, 1969 cited in Alexander et al., 1987). TC-Siddhi uses higher-level cognitive techniques that enhance mind-body coordination and foster the ability to operate from the level of TC. The Vedic seers applied such a technique to understand the whole system of the universe.

Different meditational practices can be the curricular contents. Practices in school will be the methods of teaching. Observation of their behaviours can be the assessment process.

Patanjali views that when the mind reaches the state of Samadhi, it consists of peace and balance and can directly perceive the nature of things. The meditated mind in Samadhi is regarded as the appropriate instrument for knowing inner reality and pure consciousness (Morris, 2018). Hagelin (1989) stated that the unified field of modern theoretical physics and the field of consciousness are identical to the state of Samadhi. According to Frawley (2010), scientific discoveries were made by scientists when they were in the trance of an inspired, concentrated, or peaceful mind, similar to a kind of Samadhi. He further argued that deep research and concentrated thinking also develop the mind in a state of absorption and concentration identical to a

Yogic way of Samadhi. Recent ECG shows that the experience of TC during TM practice is highly correlated with enhanced alpha and theta levels (Alexander et al., 1987). When TC refines, the ordinary nervous system is called cosmic consciousness. When engaging in this level of mind with mental activity at the more expressed level of feeling and thinking, an individual obtains the bliss of enlightenment about the creation (Alexander et al., 1987).

As we develop unified states of consciousness through Yogic meditation, then we reach an understanding (cognized) of the whole universal (object) phenomenon in our mind as scientists use living organisms and function by using the brain (Alexander et al., 1987). Moreover, if scientists understand the conscious universe more, Yogic and Vedic science approaches are guaranteed to become more relevant. The meditative mind helped Thomas Edison also for the invention of electricity (Frawley, 2010)

Meditation also activates the midbrain. When the midbrain activates, anyone learns “only to read books by reading a page at a time they can; be read by simply flipping the pages, called quantum speed reading (QSR), does not require a book to be opened at all” (Shah et al., 2017, p. 2). The book is simply held up in front of the reader's face and the pages are flipped rapidly using the thumb, much like when preparing to shuffle playing cards, the pictures coming out of the pages and understanding everything in the book (Shah et al., 2017). It is thus a truly revolutionary advancement in the education system, invented by Yumiko Tobitani 40 years ago, published a book Quantum Speed Reading (QSR), practised in Japan and South Korea.

Developmental Practice of Modern Science

Modern science emerged in Europe in the seventeenth century at the beginning of the enlightenment through the “process of rational reasoning, logical

thinking, empirical perception, measuring, quantification, and experimenting within physical, biological and social reality" (Haverkort & Reijntjes, 2010, p. 13). It is influenced by Descartes' philosophy and "Newton's shaping of scientific communication mainstream Western Modern Science (WMS) and its product, school science, the discovery of universal truths based on objective, reproducible experiments stripped of emotion, cultural contexts, and value" (Chinn, 2007, p. 1251). Modern science developed as a mechanistic system that "captured the attention of Galileo, Descartes, Bacon and Newton" (Davis & Sumara, 2006 cited in Baker, 2016, p. 25). It is considered a closed system, which functions independently of context, started as Greek philosophy and developed as a form of modern science (Baker, 2016).

Chalmers (2013) suggested that science is commonly thought of as 'proven knowledge, where "personal opinion or preferences and speculative imaginings have no place" (p. 1), and knowledge is reliable because of its objectivity (Desmarchelier, 2016). Western Modern Science (WMS) operates based on a Cartesian materialistic world that is both reductionist and mechanistic (Ogawa, 1995). It focuses on the main history of the Scientific Revolution, Enlightenment and succeeding modern scientific era (Desmarchelier, 2016).

The historical origins and evolution of "science within Euro-American cultures and its practitioners' scientist to embrace certain fundamental world views, epistemologies, ideologies and values; all related to science's origin and evolution, started as Greek philosophy and now called modern science" (Aikenhead & Ogawa, 2007, p. 541). Science is the organized body of knowledge obtained through observation by testing facts about the physical world, natural law and society. The scientific inquiry also applies the above procedure, including the evidence-based study of the natural world (Bybee, 2006).

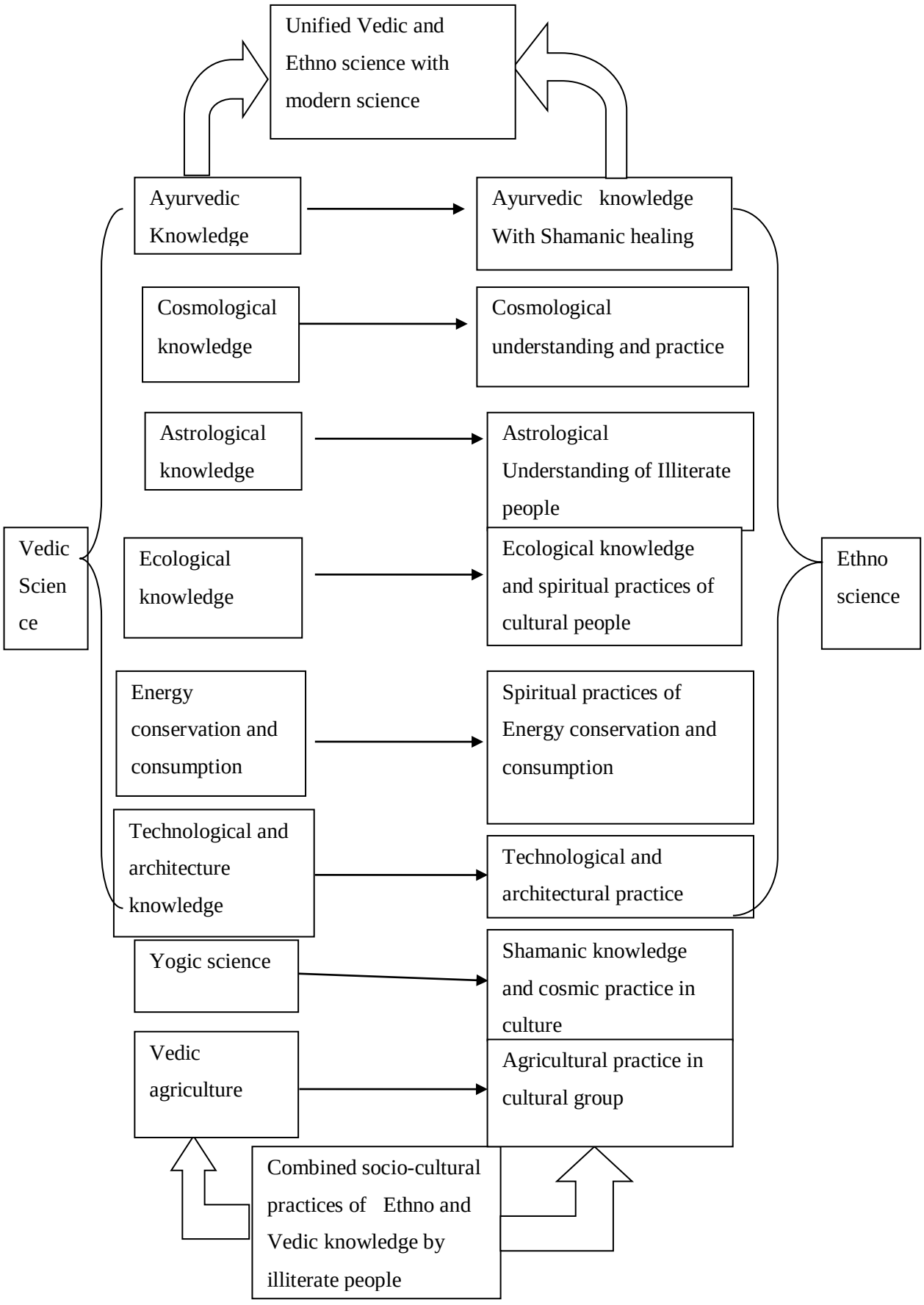
It is considered that the social transformation in Europe was the renaissance movement. It eventually created the need for 17th-century natural philosophers such as Galileo, Kepler, Descartes, Wallis, Leibniz, Roberval, Huygens, Halley, and Newton. Their work is based on the "authority of empirical evidence as opposed to the authority of church and royalty" (Aikenhead & Ogawa, 2007, p. 541). It is labelled as a Eurocentric knowledge system, Western or Western modern science (Aikenhead & Ogawa, 2007). Where mathematical knowledge is a “precondition for understanding mechanics, mechanics for physics, physics for chemistry, chemistry for the science of living beings (biology), and biology for human activities which can be understood by anthropology, psychology, sociology, history, and economics” (Haverkort & Reijntjes, 2010, 13-14). It focuses on induction and deduction by formulating a research hypothesis based on theories, systematically collecting and processing data (Haverkort & Reijntjes, 2010) and analysing using experimental verification through observation.

The scientific evolution of modern science is considered to have started in 1633 when Galileo was sent to jail (Das, 2018). In the meantime, Newton introduced the first law of motion to teach at the school level. However, it was criticized for isolating the environment because there is no unique body and straight line in the universe. In 1543, Copernicus's heliocentric theory was published, and in 1609 Kepler's theory of planetary motion was published (Chalmers, 2013). When Kuhn published the book “the structure of scientific revolution” in 1962, then new paradigmatic changes were seen in the school science curriculum worldwide. Science was seen as continuously changing knowledge based on experiment and observation and new knowledge is generated or falsified the old understanding based on fixed evidence.

Nepalese curriculum system regards modern science as a source of verified and authentic knowledge; however, western textbooks and teaching leave students with the view that other sciences are equally valid (Bybee, 2006). A centralized curriculum system has been implemented throughout the country without considering the socially diversified knowledge of the local people in Nepal. So that singular Neoliberal context (Desmarchelier, 2016) to a scientific method gives no recognition to the diversity of approaches to the culturally diverse students to understand science whenever it is thought to focus on the theoretical part only. Cobern and Loving (2000) viewed that good scientific explanations will always be universal even if indigenous knowledge is incorporated as scientific knowledge (Govender, 2014).

The materialistic worldview and mechanistic paradigm of modern science have still been dominant in scientific communities across the globe. However, from the beginning of the twentieth century, this worldview has been challenged by new scientific worldviews such as quantum physics, relativity and chaos theory (Haverkort & Reijntjes, 2010). New ways of knowing from other cultures have influenced in western approach to knowledge. Consequently, the post-modern scientific paradigm was developed, and different epistemologies of acquiring knowledge are emerging. People believe science cannot provide the single ultimate truth because the mechanistic and materialistic paradigms can only offer an approximate truth (Haverkort & Reijntjes, 2010). Along with quantitative research, qualitative and sociocultural-based participatory research are used to study diversified social values. The modern positivist, rationalism and objective thinking are becoming increasingly destructive for the majority of the world's people, and people are placing more importance on cultural liberty: the right of each people to choose and create their own culture, values and skills (Haverkort & Reijntjes, 2010).

Figure 8 *Connecting Vedic and Sociocultural Science with School Science*



Chapter- VI

The Curricular Policies and Practices of Science Teaching

Introduction

In this chapter, I have tried to study what policy says about the application of eastern philosophy and modern practices to implement in the school curriculum. I reviewed National Education Policy, currently applying basic level (grade eight science and environment; and occupation, business and profession) curriculum and tried to find the grey areas and constraints to link with theVedic and Ethno science.

Curricular Policy and Practices

National Education Policy 2076, National Science Technology and Innovation Policy 2076, and National Curriculum Framework of School Education 2076 attempted to link indigenous knowledge, skills, and practices related to Information Science and Technology (IST). These documents aimed to enable students to identify science and technology in their everyday experiences and support students' natural tendency to integrate their personal understandings of their social, technological and natural environments (Aikenhead, 1994). It also focuses on the application of scientific knowledge, technical expertise, social understanding, and humane compassion (Aikenhead, 1994). Science Technology and Society (STS) mainly aims to develop the critical thinking, logical reasoning, creative problem-solving, and decision-making capacities of each social person. It is considered that STS science is student-oriented rather than scientist-oriented and conveys the images of socially constructed knowledge (Aikenhead, 1994). STS science seems to be relevant in the context of the Nepalese curriculum for linking the holistic development of science and technology for social development. Figure 9 shows the relationship between Science, Technology, and Society.

Figure 9 *Relation Between Science Technology and Society*

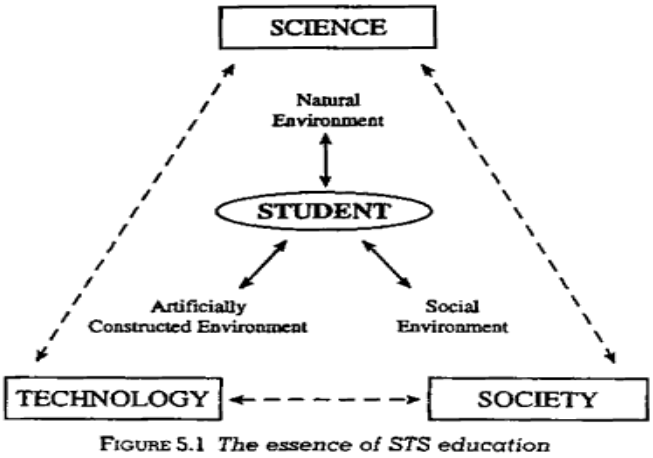
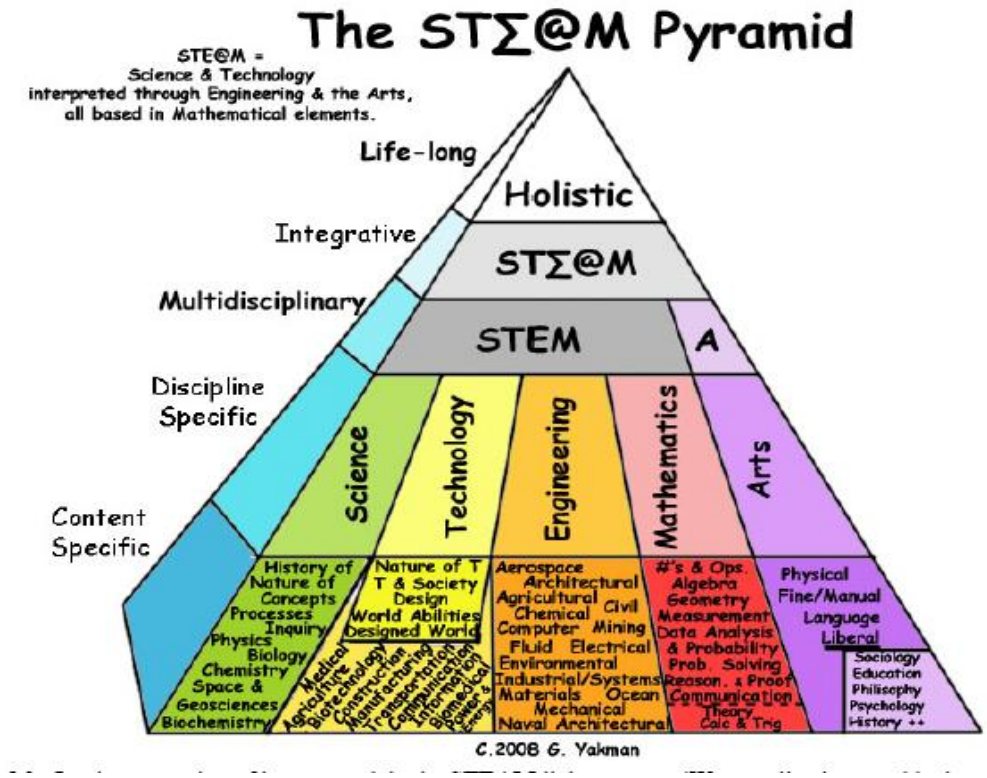


FIGURE 5.1 *The essence of STS education*

STS promoters have developed an interdisciplinary learning approach for enhancing creative, collaborative, and problem-solving skills for learners to achieve the sustainable development goals of the United Nations. The Secretariat of the Convention on Biological Diversity (2005) also focuses on the recognition of indigenous knowledge and indigenous property right. Considering this, the National Education Policy [NEP] 2076 of Nepal mentioned that the government would establish specialized Science, Music, Sports, Ayurveda, and Ethnomedicine teaching secondary schools (MoEST, 2076 a). Policy 9.33, 10.55 emphasized Science, Technology, Engineering and Mathematics Education (STEM- Education) at all levels of a teaching institution. It would have integrated other subjects such as language, art, culture, history, and geography in an integrated form. It indicates that it attempted to link the education system with life-related knowledge, skills and competency (MoEST, 2076a). The model proposed by Yakman (2008) also indicated the ultimate teaching of STEAM education aims to develop lifelong holistic knowledge, skills and attitude.

Figure 10 *Holistic Approach of STEAM Education*



Source: Yakman (2008)

Belbase (2019) argued that STEAM education is a transformative curricular and pedagogical approach. STEAM aims to provide 21st-century skills, including creativity, problem-solving, critical thinking, communication, self-direction, initiative, environmental and technological literacy and collaboration (Biffle III, 2016; Decoito & Myszkal, 2018). It is based on the theory of socio-constructivism, inquiry learning and context-based pedagogy (Upadhyay et al., 2021). National curriculum framework 2007 attempted to reflect STEAM education at the primary level from the first grade to the third grade by integrating language, mathematics, creative arts, social studies, and local need-based education to some extent, although it has not labelled it as STEM or STEAM education (Belbase, 2019). However, it has not been fully implemented in the Nepalese context of education in the absence of teaching-learning facilities in the schools (Dahal, 2018).

Figure 11 *Developmental Approach of STEAM*

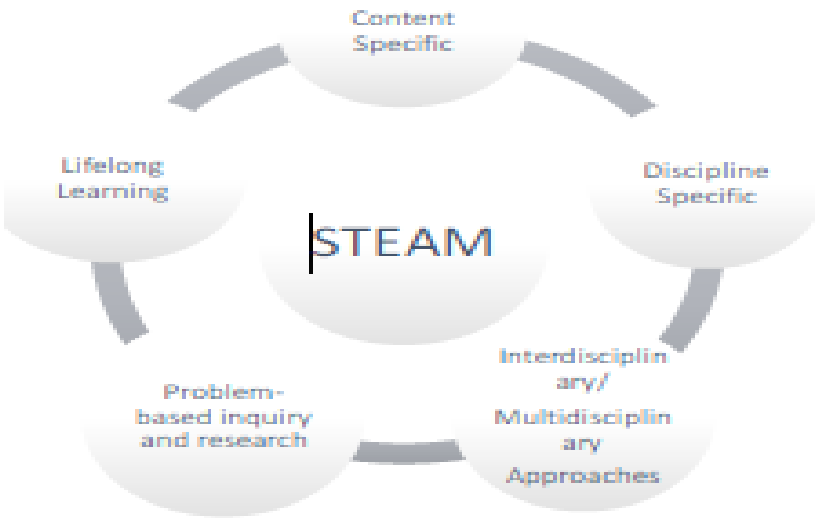


Figure 11 presents the branches of STEAM and how it works for the development of life-learning skills. It guides the inquiry-based and problem-based holistic approach to knowledge and skill construction at the school level.

The Constitution of Nepal (2015) focus n science, technology and innovation to preserve and modify the traditional knowledge of different cultural groups. Considering the Constitution of Nepal (2015), Education Policy 8. 13 of Nepal stated that science and technology would be used to link traditional and modern technology for nation-building. Moreover, policy 10.11.2 in the same document stated that technical and vocational education would be established based on the local needs, characters and possibilities, which indicates the priority of the education system for the sociocultural need-based integrated science curriculum (MoEST, 2076 a). The National Science Technology and Innovation Policy [NSTIP], 2076 (policy 8.22-23) also added that there would be teaching-learning about traditional innovative knowledge, technology, and skills from the basic level, and science teaching will make a behavioural change and practical application focusing on evidence-based research (MoEST, 2076 b). Moreover, NSTIP policy 8.25 focused on traditional

innovative knowledge and skills, will be prioritized and sent to the national and international markets. Policy 9.28 stated that the government will establish innovative technology for processing expensive medicine for sustainable natural resource development (MoEST, 2076 b).

Policy 10.20.4 mentioned that international students will be attracted through the program such as medical, engineering, energy, processing local medicine, agriculture, cash crops, flower and fruits, food technology, veterinary, mountain climbing, travel and tourism and hotel management (MoEST, 2076 a). Additionally, policy 10. 24. 1-3 mentioned that government will establish a centre for studying Hindu, Buddhist and eastern philosophy, culture, civilization, national philosophy and tradition, Ayurveda, Yoga, Meditation, and Naturopathy (MoEST, 2076 a). Local technology, national arts and culture, totem, traditional art skills, music, songs and traditional values will be researched by establishing a separate university. It will be conducted with the collaboration and cooperation of the central, provincial and local governments (MoEST, 2076 a). Similarly, policy 10.43.13 mentioned that the capacity of the school and local government would be enhanced to prepare local curriculum, textbooks and learning materials.

National Curriculum Framework of School Education [NCFSE] 2076 consists of the provision of National Education Policy 2076. It has attempted to prepare a multidisciplinary integrated science curriculum from Grade one to Grade three (CDC, 2076) (It can be considered as a synonym of STEAM education) and a single (disciplinary) track curriculum from grades 9 to 12. However, it has made provision for science and technology subjects to integrate natural science, ICT, and natural and environmental science from Grade four to Grade eight.

A review of the literature on international practices (e.g America, South Korea, Japan, Australia) shows that they have already implemented STEAM

education up to Grade 12. However, they have not discussed ways of implementing STEAM education at the school level curriculum. In the case of Nepal, Higher-Level National Education Committee 2075 and National Education Policy 2076 attempted to address STEM education to some extent; however, the government of Nepal is not yet implemented it. In a workshop on integrated curriculum dissemination for basic level organized by Gorkha Municipality on dated 2021- 8-30, of the 63 headteachers who participated in the workshop, none heard about STEAM education and its implementation system at the basic level.

Kathmandu University School of Education (KUSOED) (2018) has prepared its MPhil course (12 credit hours) in STEAM education since 2019, purposing to prepare students with an ability to develop the ethos of lifelong learning in their personal and professional contexts. However, many basic, secondary, and university-level teachers do not have theoretical knowledge of STEAM and its implementation in curriculum development, learning resources development, and classroom teaching learning. Similar to the observation of Affouneh et al. (2020), "there is a lack of high-quality STEAM teachers, as an obstacle to implementing STEAM education in our classroom at the national level" (p. 3). The local government officers responsible for implementing STEAM teaching and learning in school education were unfamiliar with it. However, it focuses on lived experiences of underrepresented people, which challenges the traditional scientific knowledge paradigms established by the dominant culture (Miriti, 2019). Miriti (2019) added that empirical, objective and non-cultural discipline-based curriculum development is challenging to implement STEM education in Nepal.

In this context, developing basic level teachers' knowledge, skills and attitudes towards STEAM education and integrating it formal education system is

challenging because shifting to an interdisciplinary project-based and problem-solving-based curriculum is challenging for Nepalese teachers (Affouneh et al., 2020). As a resource person, the workshop realized such a challenge in a workshop for basic and secondary level headteachers at Gorkha Municipality. The headteachers considered professional development training as a mean for teachers' knowledge and skills development. However, "insufficient access to resources, lack of instructional support, lack of development opportunities, and lack of confidence could negatively influence STEM teaching" (Affouneh et al., 2020, p. 3) in the context of the Nepalese school system.

Policy and Constraints of its Implementation in the Context of Nepal

In the context of Nepal, most of the teachers are not aware of cultural knowledge. They have a problem implementing cultural knowledge in multicultural classrooms because of the lack of contextual and situational knowledge in science teaching (Shizha, 2008, 2011). National Education Policy 2076 BS, National Curriculum Framework of School Education 2076 BS and National Science Technology and Innovation Policy 2076 attempted to connect the western epistemology and pedagogy as a predetermined (Shizha, 2008) science curriculum with socio-cultural practices in a hybridized (Shizha, 2012) form with STEAM education to some extent. The content that emerged in the literature seems to be in the grey area for the acculturation of knowledge in the present education system in Nepal. However, most of the government's education policies, curricular designing, textbook writing process, and teaching and learning were "grounded in a western modernist epistemology with the notion of the superiority of western science and the inferiority of Ethno knowledge of indigenous peoples and local communities" (Jacobs, 2015, p. 37).

An indigenized school curriculum emphasizing traditional knowledge will enhance students' success, cognitive development and academic achievements (Shizha, 2014). Suppose the government of Nepal is ready to implement indigenous/ Ethno knowledge in the school science curriculum; in that case, it should be mandatory at a policy level, as South Africa advocated and implemented Ethno knowledge (EK) in their education system (Jacobs, 2015). The curricula of western science and Ethno knowledge are seen nearly similar, however, the problem arises in the teacher's textbook writing and pedagogical strategies selection (Shizha, 2014).

In this vein, a curriculum officer of the Curriculum Development Centre (CDC) informed me that the main problem of implementing Ethnoscience in school curricula is finding valid scientific proof sources. His argument is that "*we have implemented Ethnoknowledge as project work but not in the direct content matter*". The reason indicated that curriculum designers prioritize colonizing perspectives in curriculum writing process. Contextual teaching approach could be supported for the decolonization process (Shizha, 2014); however, it was not found in the Nepali curriculum, textbooks, and teaching approaches. Teachers are not seen as ready to include indigenous methodologies to incorporate within the school environment.

Curriculum Review

Nepal has implemented grades 1-8 curriculum in the 2068 BS in General, Sanskrit, Gurukul, and Gonpa/Bihar education. The general curriculum was implemented in all public and private schools. Sanskrit, Gurukul, and Gonpa/Bihar schools are allowed to make some changes to suit their school contexts. Yet, science education is an exception to it. Science Education consists of physics, chemistry, biology, geology, astronomy, and environmental education. Physics includes measurement, force and velocity, simple machine, pressure, work, power and energy,

heat, light, sound, magnet, and electricity. The chemistry portion includes matter, mixture, metals and non-metals, acid, base and salt, and some valuable chemicals. The biology portion includes animals, cells and tissue, and life processes. The geology and astronomy portion includes earth structure, weather and monsoon, earth and sky. The environment portion has season and climate, environment and balance, environmental degradation and conservation, and environment and sustainable development. The business portion includes contents such as vegetable farming, fruit farming, dry vegetables and fruits, food materials, flower farming, herbal plants, local technology, etc. The list of the contents of these curricula is given in appendix 7.

I reviewed the recently revised curriculum 2077 BS for grades 6-8 because it was my focus. The revised curriculum, which will be implemented in the next year (2080 BS) contains a small portion of herbal medicine. It has included biodiversity-related content, but the agriculture-related content is completely removed. In the words of a curriculum designer, "*the agricultural contents are the areas of the local curriculum"*. If every local level educational institute can prepare a local curriculum considering the local agricultural knowledge, it ultimately recognises the local knowledge and supports the decolonizing views of science teaching. However, the irony is that many local governments have not yet prepared local curricula. Secondly, there is no guarantee that they can introduce these contents in their curriculum. So if we can link the contextual knowledge with the school science curriculum prescribed as in appendix 7 we can decolonize the present science curriculum (Shizha, 2014).

Chapter VII
Modern, Vedic and Ethno Science in Curriculum from School to Teacher Education Program

Introduction

This chapter presents the science curriculum of grades 5, 8, 10, 12, Bachelor, and Master in education comparing with review literature emerged Ethno-agriculture, Ethnoecology, and Ethnomedicine. I chose only the final grades of each level because it represents that level's curricular structure; but comparing each class is difficult in this study. The curriculum analysis shows that Grade 5 has science with the environment. In Grade 8, science has content related to the environment, health and physical, profession, skills, and entrepreneurship. In Grades 9 and 10, the science curriculum has science and environment. In Grade 12, chemistry, geography, environmental science, biology, and technology are taught under science curricula. Similarly, in B.Ed program of Tribhuvan University has physics, plant, and animal science. In M.Ed fourth semester, there is a course in Ethnobiology. In the tree diagrams, one side represents the reviewed literature that emerged (from chapters III, IV and V), and another side is curricular prescribed contents, methods, and evaluation relating to three areas: Ethnoagriculture, Ethnoecology, and Ethnomedicine (up to grade 12 compared based on above three areas but not for bachelor and master level). The two branches show the possibility of connection under the limitation of the time, contents load, and student learning activities.

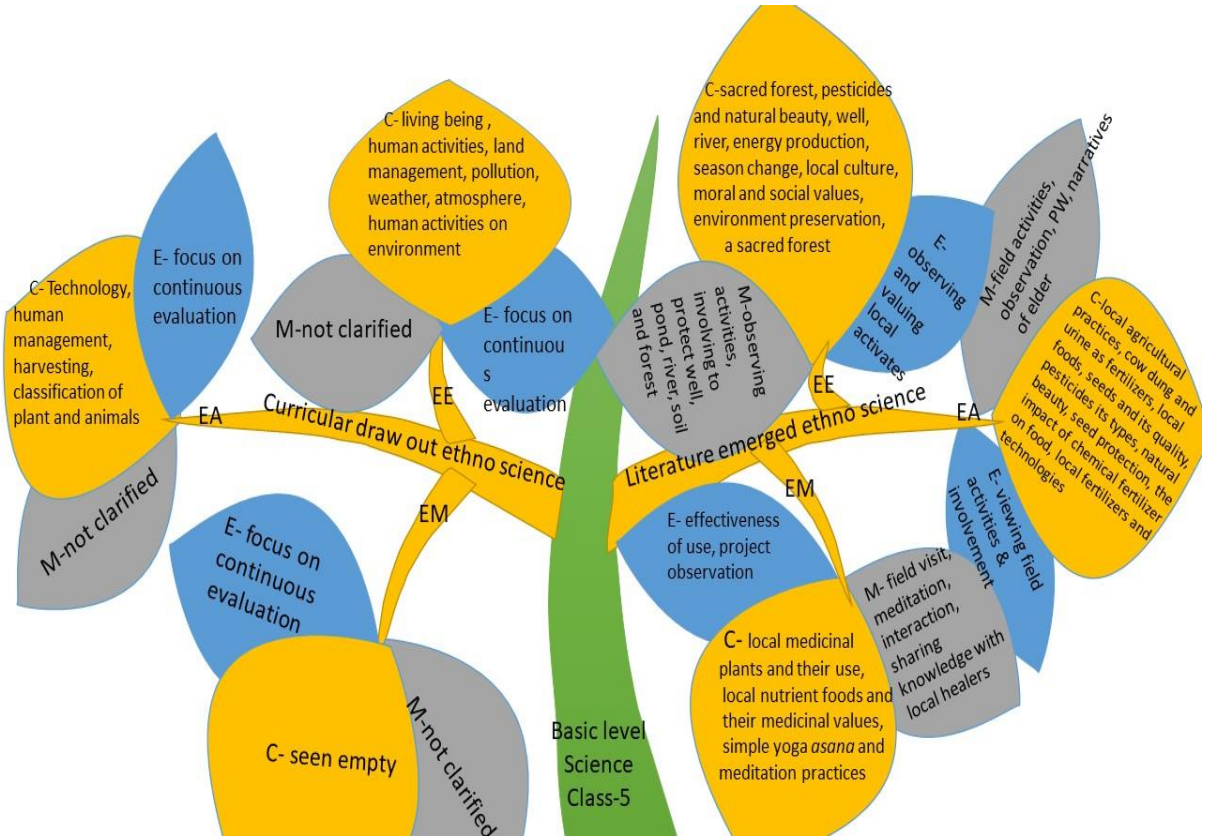
Gradation of Literature Emerged and Curricular Listed Contents, Methods and Evaluation

In this chapter, I have drawn the basic level (class 5) curricular and literature-related contents, methods and evaluation relating to only Ethnoecology, Ethno agriculture and Ethnomedicine (hereafter called E-EAM) and put them on the two

sides of the tree diagram in comparative form. Figure 12 represents the basic level curricular contents, methods, and evaluation on one side of the tree diagram and literature-based content, methods, and evaluation on another side in a comparative form. It shows that curricular contents of the basic level are mostly related to Ethnoecology and Ethnoagriculture, but the Ethnomedicinal contents are embedded in Ethnoecological contents: they are not explicitly spelt out. However, the literature lists Ethnoscience as having the clearest concepts of E-EAM related contents, methods and evaluation system for the Basic level (class-5).

Figure 12 *Basic Level (class 5) Tree Diagram of Curricular and Literature emerged Contents, Methods and Evaluation*

Basic level class 5 tree diagram of curricular and literature content, methods and evaluation.xps



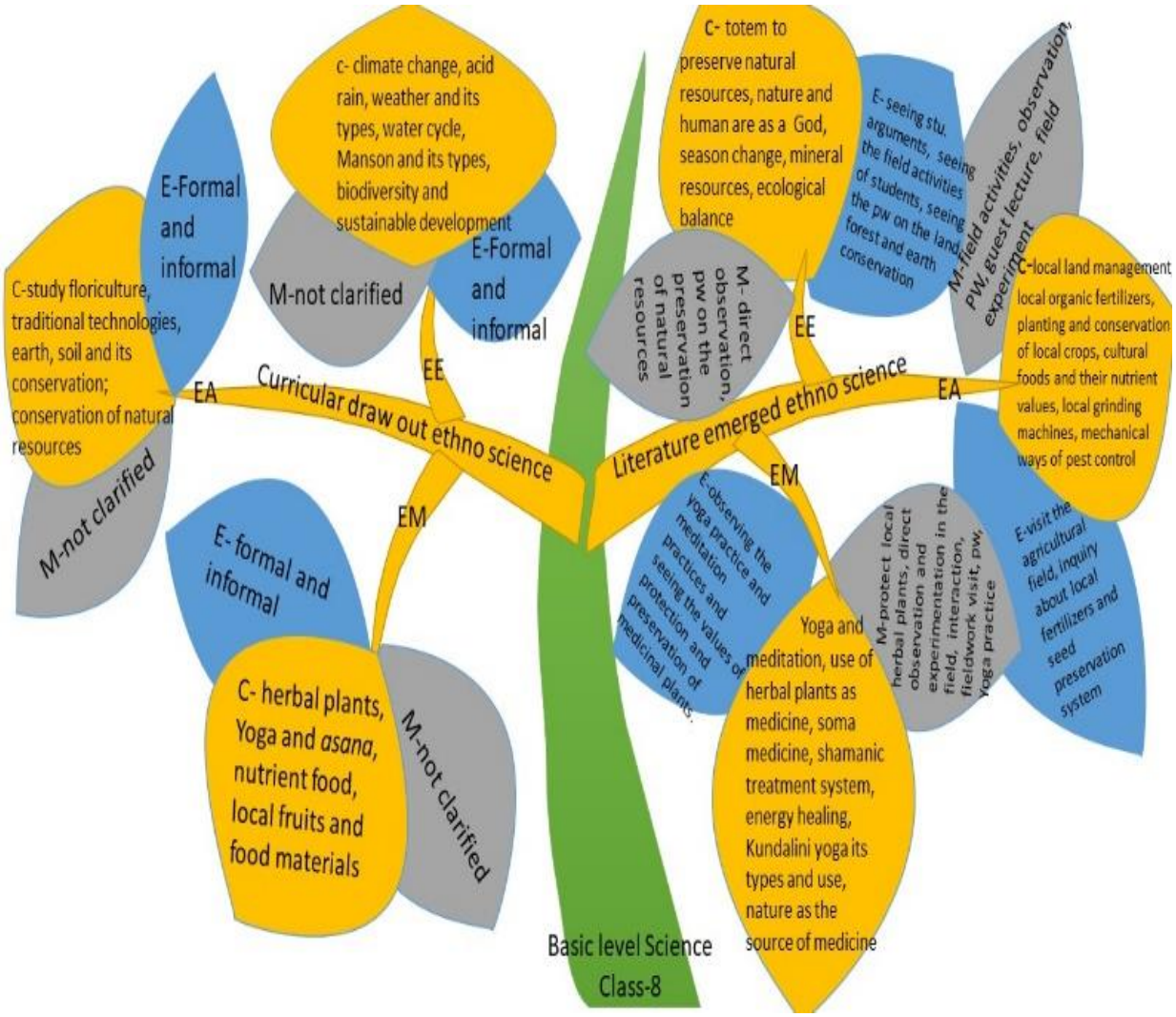
The prescribed methods of teaching at this level are storytelling, role-playing, discussion, question answer, research and inquiry, creative work, problem-solving, experiment, demonstration, field trips, and interaction. The specific methods related to Ethnoscience were not indicated in the curriculum. However, the literature suggested that science teaching methods are more or less similar in different levels of curricula in Nepal. The literature-based methods are supportive of social-cultural reality of learning. Participation in cultural activities, field observation, interaction with the cultural expert, observing the local worship events, and involving the preservation practices of the forest, well, pond, and river with their parents are the main methods. The other methods are observation and participation in local agricultural practices with their family and neighbors, interaction with local farmers, discussion about the values of local seeds, participation in local seed protection processes, farmers experiences sharing practices with the students and teachers, and field observation of medicinal plants could be some of the ways of connecting the modern school science with sociocultural context.

The curricular evaluation system recommended at this level is continuous, curative and formative assessment through portfolio, checklist, cumulative record; classwork, homework and project work. The literature also focuses on continuous field observation for assessment, such as discussions about the local value of herbal plants, field observation/involvement, project work, experiences sharing, and valuing local food and medicine. These methods are similar to the evaluation prescribed in curricula.

The contents, methods and evaluation for Grade 8 science in Nepal, drawn from curriculum and literature are presented in the figure.

Figure 13 *Basic Level (class 8) Tree Diagram of Curricular and Literature Contents, Methods and Evaluation*

Basic level class 8 tree diagram of curricular and literature content, methods and evaluation.xps



The analysis of the curricula and literature show that literature has mostly focused on the natural phenomenon as a god, local agricultural practices, preservation of local well, rivers, pond, forest; cultural and moral values; local crops, food preservation practices, preparation of local fertilizers and pesticides; Yoga, Asana, Pranayama, meditation, and shamanic treatment system etc.

The indicated methods of teaching related to Ethnoscience were not found in the class 8 curriculum but the literature prescribed separate teaching methods for E-EAM based on the learning contexts. Moreover, literature has tried to use discourse based on field and local knowledge connecting with school science practices. The comparison between the two is clarified in the tree diagram given above.

The curricular assessment system is based on 60% formative evaluation through project work, paper presentation, workshop, materials construction, and documentation, and 40% summative evaluation. However, the literature shows other evaluation systems that could be better tools for holistic evaluation. These could include student reasoning, fieldwork observation, project work on the land, forest and earth conservation, farm visit, inquiry about local fertilizers and seed preservation system, observation of yoga and meditation practices, and assessment of the values they place on the protection and preservation of medicinal plants.

It indicates that literature on Ethnoscience suggests fieldwork-based evaluation rather than paper-pencil tests are better indicators of learning and decolonizing science assessment. In other words, it focuses on continuous evaluation by observation of the interaction with elders, fieldwork, habit, and knowledge acquisition processes rather than final examination.

The curriculum and literature listed contents, methods and evaluation system prescribed for secondary level (class 10 and 12) related to E-EAM are presented in figure 14.

Figure 14 Tree Diagram (class 10 &12) of Curricular and Literature Contents, Methods and Evaluation

Class 10&12 curricular and literature based on content, methods and evaluation.xps

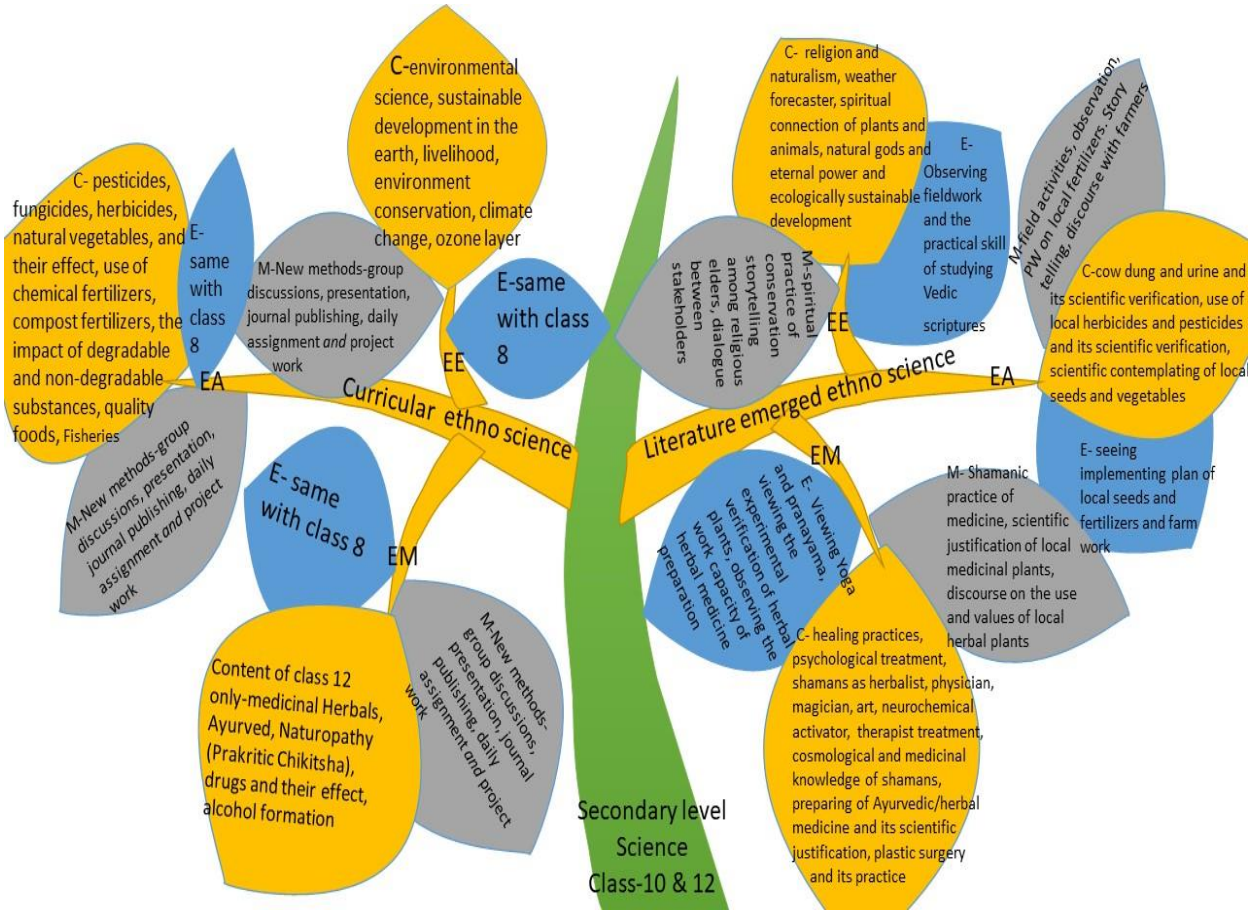


Figure 14 presents the curricular content of Garde10 and 12 as prescribed in the curriculum and shown in the above tree diagram. It indicates the newly implemented curriculum of Grade 12 has more socio-cultural or Ethno practices related topics than curriculum of Grade10. However, literature review shows that secondary level curriculum includes more spiritual and cultural knowledge. Figure 15 also presents methods and evaluation systems related to E- EAM.

Literature has more extensive coverage of content knowledge related to philosophical and scientific sectors, which are not listed in the figure as E- EAM. The

literature has included the concept in the Upanishad; expansion, creation and destruction of the universe; gravitational forces, electromagnetic force, relativity, Sunya vada of Buddha, thermodynamics of Buddha, Jyotish and Nakshatra vidya, cosmological knowledge of stars, and heliocentric and gravitational force in Surya Siddhanta.

The literature review presented in chapter V presents a diversified and holistic dimension of Ethnoscience and the Vedic knowledge, which included cosmological, astronomical, and spiritual social values for secondary level science curriculum (both for Garde 10 and 12). However, analysis of curricular content shows that they are not systematically ordered, but randomly spread out from lower to a higher level of school education system, despite National Education Policy's (2076) recommendation of a systematic multidisciplinary STEAM education within the secondary level science curriculum to cover holistic view of knowledge.

The teaching methodologies prescribed in the curriculum of Grade 10 are lecture, question answer, demonstration, experimental, discussion, field study, project work, satellite method, critical thinking, collaborative learning, and situated learning. The teaching methodologies included in Grade 12 are lecture, interaction, question answer, demonstrations, ICT-based instructions, cooperative learning, group discussions, presentation, journal publishing, daily assignment, and project work.

However, the literature suggests different teaching methodologies at the secondary level, such as sharing the spiritual practice of conservation, involving students in worship programs, spiritual practices on the natural force, involving them in generating knowledge from natural objects, storytelling among religious elders, dialogue between stakeholders, organizing discourses among the students, teachers and farmers; discourse among science teachers and religious leaders; collecting

narrative of elders and participating in local worship programs; observing the direct involving at field practice, doing project work on the use of local fertilizers and pesticides preparation procedure, meditation, sharing knowledge with shamans and practice of spiritual healing, scientific verification of shamanic practice and its impact on human health, scientific justification of local medicinal plants, and discoursing on the use and values of local herbal plants. These methods seem to be more appropriate to connect sociocultural knowledge with modern school science teaching.

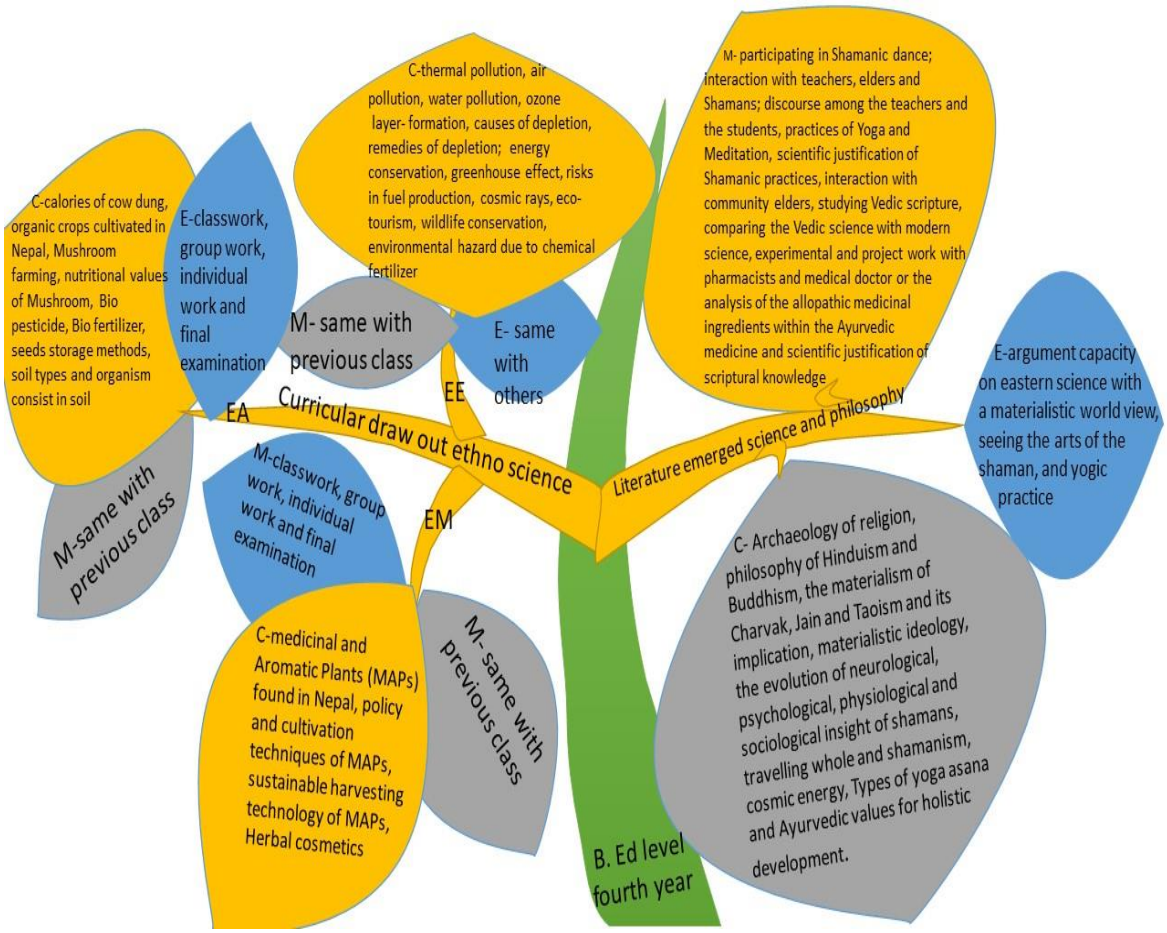
The evaluation system prescribed in the secondary level secondary level curriculum and Grade 8 is similar. However, the literature suggests general assessment techniques rather than curricular techniques. The primary evaluation methods found in the literature are arguments and counter-argument about eastern philosophy in terms of modern scientific practices, observation of fieldwork and the practical skills of studying the Vedic scriptures, observation of the practical activities and project work on local seeds and fertilizers, viewing Yoga and pranayama, conducting the experimental verification of herbal plants, inspecting the work capacity of herbal medicine preparation.

Analysis of the evaluation system listed in the literature indicates that a research-based and practically field-oriented evaluation system is more appropriate for the evaluation than a traditional paper-pencil-based examination system.

The Bachelor level science curriculum is mainly focused on WSK. However, some types of Ethno knowledge are prescribed in physics and biology curriculum of B.Ed fourth year. Figure 15 presents curricular contents, methods and evaluation related to E-EAM; philosophical and scientific contents, methods, and evaluation.

Figure 15 B. Ed Level Tree Diagram of Curricular and Literature Contents, Methods and Evaluation

B.Ed level curricular and literature based content, methods and evaluation.xps



However, the content specified in the literature are more scientific, abstract and philosophical. For example, the existing curriculum does not mention the archaeology of social development, the philosophy of Hinduism and Buddhism, the materialism of Charvak, Jain and Taoism and its implication, materialistic ideology, the evolution of neurological, psychological, physiological and sociological insight of shamans, travelling whole and shamanism, cosmic energy, types of yoga asana and Ayurvedic values for holistic medicine.

It indicates that the contents are not ordered vertically in Ethnoscience from a lower level to a higher level in the curriculum. The analysis found that the E-EAM knowledge, which can be fundamental at the lower level, is lacking in the curriculum. The systematic arrangement of content knowledge of Ethnoscience from the basic level to the higher teaching institution is not visible. Practically E-EAM related understanding is better implemented at the school level, and abstract and philosophical knowledge could be relevant at the university level. Such arrangements were not found in the curricula.

It was found that literature knowledge embedded more spiritual and philosophical knowledge than the curricula at the school and university levels. It can be argued that the literature listed knowledge could be more appropriate to implement in the current science curriculum at the Bachelor level.

Curricular prescribed teaching approaches are lecture, discussion, demonstration, collaborative, problem solving, experimental, internet search, report writing, and project method.

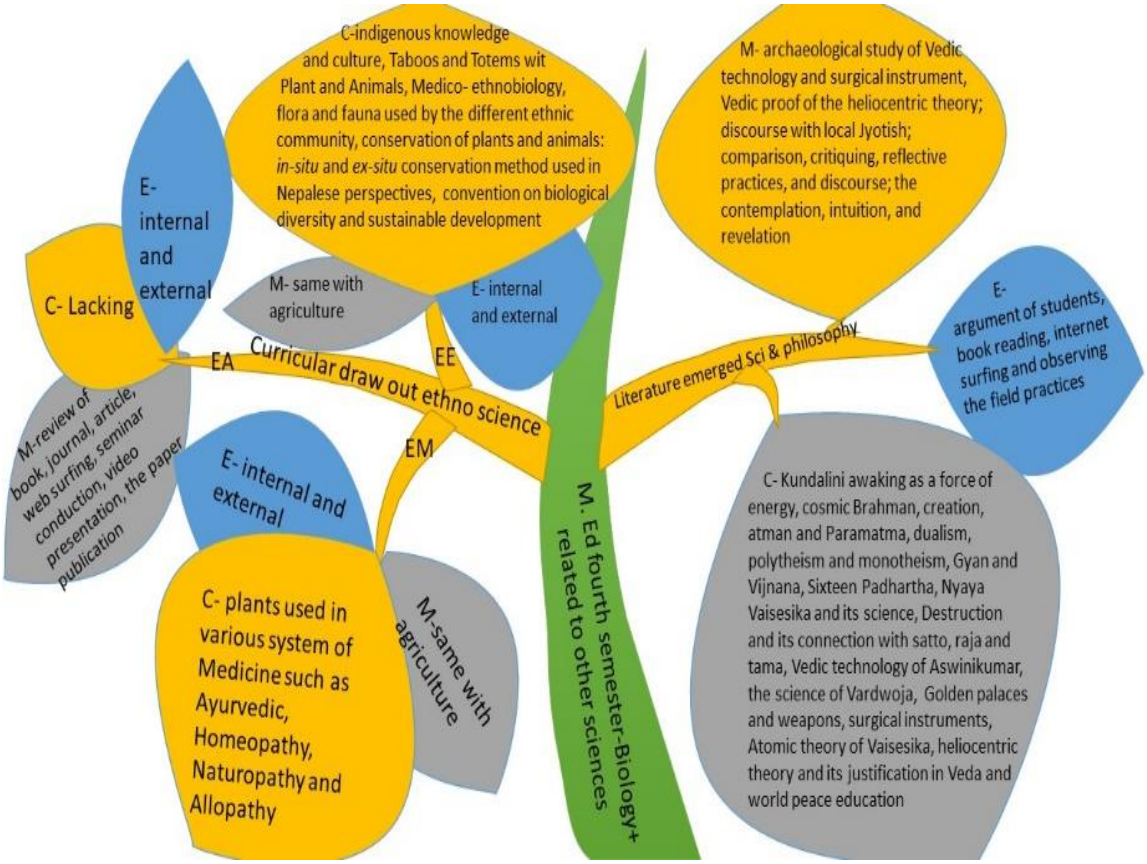
But the literature emerged approaches of obtaining knowledge are participating in Shamanic dance; interaction with teachers, elders and Shamans; discourse among the teachers and the students, practices of Yoga and Meditation, scientific justification of Shamanic practices, interaction with community elders, studying the Vedic scriptures, comparing the Vedic science with modern science, experimental and project work with pharmacists and medical doctor or the analysis of the allopathic medicinal ingredients within the Ayurvedic medicine and scientific justification of scriptural knowledge. In other words, the holistic epistemological learning approach is prescribed in the literature-based teaching methods.

The assessment system prescribed in the science curriculum are classwork, group work, individual work, and final examination, but the literature prescribed assessment process are argument capacity on eastern science with a materialistic worldview, seeing the arts of the Shamans, and yogic practice. It indicates that the metacognitive evaluation system is more relevant at a higher assessment level.

The M.Ed fourth-semester Ethnobiology curriculum prescribed the curricular contents, methods, and evaluation related to E-EAM, and scientific and philosophical contents, methods and evaluation system. The relationship between curricular content and literature is presented in figure 16.

Figure 16 M.Ed Level Literature and Curricular Comparison on Contents, Methods and Evaluation

M.Ed level literature and curricular contents, methods and evaluation.xps



The common contents are indigenous knowledge and culture, taboos and totems with plants and animals, Medico- ethnobiology, flora and fauna used by the different ethnic communities, conservation of plants and animals: *in-situ* and *ex-situ* conservation method used in Nepalese perspectives, convention on biological diversity and sustainable development, plants used in various system of Medicine such as Ayurvedic, Homeopathy, Naturopathy and Allopathy. Figure 16 shows that the Ethno-agricultural content is missing in the science curriculum.

The literature lists Kundalini awaking as a force of energy, cosmic Brahman, creation, atman and Paramatma, dualism, polytheism and monotheism, Gyan and Vijnana, Sixteen Padhartha, Nyaya Vaisesika and its science, destruction and its connection with satto, raja and tama, Vedic technology of Aswinikumar, the science of Vardwoja, Golden palaces and weapons, surgical instruments, Atomic theory of Vaisesika, heliocentric theory and its justification in Veda and world peace education.

It also found Ethno content without connecting lower levels in curricular content. However, the literature focuses on eastern philosophical content and its scientific justification for the Master level. Similar to the B.Ed level, the Ethnosciences found in the literature is missing in the M.Ed level curriculum.

The teaching-learning methods at this level are similar to methods prescribed at the bachelor level. However, it has added the review of book, journal, article, web surfing, seminar conduction, video presentation, the paper publication for teaching sciences at Master level.

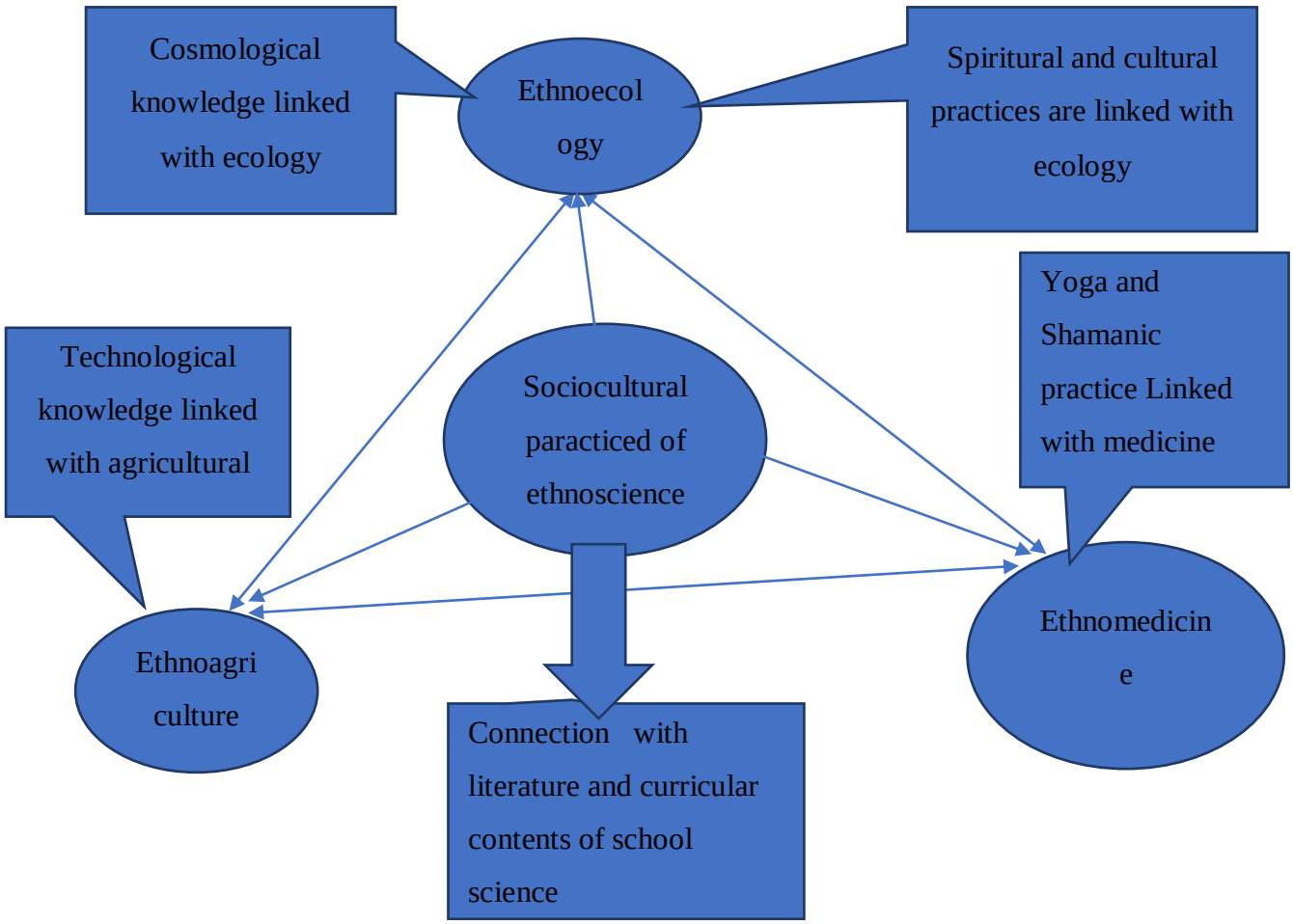
The teaching methods found in the literature are the archaeological study of the Vedic technology and surgical instrument, the Vedic proof of the heliocentric theory; discourse with local *Jyotish*; comparison, critiquing, reflective practices, and discourse; the contemplation, intuition, and revelation are the contemplating method of searching new knowledge. The literature has primarily focused on philosophical and scientific argument process for knowledge generation

The evaluation system prescribed in the curriculum is internal assignment and external examination. However, the literature-based assessment system emphasizes the students' reasoning, book reading, internet surfing, and observation of the field practices. The evaluation systems prescribed in the formal curriculum and literature were not found to have significant differences.

The review of the entire curriculum found that the curriculum has listed content knowledge related to E-EAM, which is not found vertically arranged from the basic level to the master level. The knowledge transfer was also not systematically set from the basic to Master level.

The link of three sciences with socio-cultural and literature knowledge is presented in figure 17 below:

Figure 17 The Relationship of Three Science with Socio-Cultural Science and Literature Knowledge



The above figure 17 indicates that socio-culturally practised science is at the centre of E-EAM. The E-EAM was also found to be linked with other branches of Ethno science. The figure indicates that holistic knowledge could be better applied in school and teacher education program related science curricula rather than specific disciplinary areas. The in-depth interaction between stakeholders, teachers, students and parents could be the better way to select content matter and choose the appropriate method to teach three sciences at the school level. The STEAM approach could be the better method to connect the holistic indigenous peoples and local communities IK with school science teaching to explore community learners' knowledge.

Chapter VIII

Sciences in Relation

Introduction

Students learn and practice science in school and on-campus/college. Do the teachers teach science by relating to students' knowledge of science at home and in school? Do the students relationally learn sciences? Did the curriculum designers and the textbook writers pay attention to this relation? Did the teacher trainers prepare teachers to establish the community's connections between practised science with the science taught in school/college? This chapter attempts to answer these questions by unveiling the relation (yes/no) between the people who practised science at home and the school/college-taught science. The answer to these questions addresses my research question, i.e., what can be the appropriate curricular connection for teaching the Vedic, Ethno, and school science together? And what could curricular co-exist among the Vedic, Ethno, and school science in the field of E-EAM? I did analysis and interpretation based on Ethnoecological, Ethnoagricultural, and Ethnomedicinal science of the community and its connection with the school/college science education system.

Ethnoecological Practice

The Ethnoecological practice of community people is discussed under the following heading.

Socio-Ecological Practices to Preserve the Universe (Sarbe Bhabantu Sukhina….)

Socio-ecological practices support the ecological balance of the universe. It supported the preservation of natural resources and made a strong relationship between living beings and nature. Bliss and tranquillity to all were the ecological expectations of the Vedic ancestors. People in my research site practised this kind of

Ethnoecological science in various ways. They performed Y*ajna,* where they burn fire, put *charu* in it, and chant Mantras to create a natural cycle of oxygen and carbon dioxide, help to protect the environment and sustain the earth for a long time (Dvivedi, 2004; RV, 10.90.6 & YV, 31.14). They retained this knowledge that came from the Vedas. They worshipped Peepal in the form of Bishnu (BG, 10.26; 15.1) that they knew from Bishnupuran. We can see the Vedas and Bishnupuran intend to protect the environment through rituals. Studies show that Yajnya helps control air pollution by absorbing the pollutants (Carbon-dioxide) from the atmosphere and providing a huge amount of oxygen. Yajna also helps " minimise air pollution by increasing crop yield, protecting plants from diseases, and providing a disease-free, pure and energized environment for all, offering peace and happiness of mind" (Tiwari, 2016, p. 166). Peepal generates a huge amount of oxygen and serves as Ayurvedic medicinal plants (AV, 5.4.3; Kumar, 2008). Allopathic doctors advise their patients to sit near a tree, which provides ample oxygen to save them from decreasing oxygen levels in the body these days.

Local ecological practitioners Nim Prasad Dhakal and Yam Bahadur Adhikari viewed that: "*Tulashi and Peepal provide oxygen. Therefore, they keep the dying person near the Tulshai tree, hoping that s/he will get a high oxygen flow"*. These informants did not learn these ideas in school. They knew it from their spiritual practice and listening to the elders. However, so much research justified that Peepal and Tulashi consist of H_2O_2, which produces water and oxygen during the day and at night. At night, Tulashi and Peepal have stomata open, and with the help of crassulacean acid metabolism (CAM), they prepare malate-like sugar in photosynthesis and give oxygen at night. It is difficult to calculate the total amount of oxygen exhaled by a tree in a day; however, one estimates that a 100-foot tree, 18 inches in diameter at its base, produces 6,000 pounds of oxygen (https://www.thoughtco.com/how-much-oxygen-does-one-tree-produce-606785).

Studies at Maharishi Mahesh International University in the US showed that Yajnya supports the peace of consciousness and mantra pronounced at Yajna helps to produce world peace (Hagelin, 1989). However, it was found that the Vedic mantra mentioned peace of the sky, peace of mid-region, peace of earth, peace of waters, peace of plants, peace of trees, peace of all-gods, peace of Brahman, peace of universe, peace of peace; may also that peace comes to me! (AV, 19.9.14 & YV, 36.16). My participants said that "*these universal peace Mantras also support the protection of the natural environment forever because it carries energy as medicine, water, wind, and foods and ultimately helps the people of the whole nation*". It is claimed that when we chant the Vedic mantra properly at sunrise time, saying *Suryaya Svaha and Prajapataya Svaha* and in sunset time, saying *Agneyaya Svaha, Prajapataya Svaha* with mixing charu and ghee from cow, that mantra extends as the sound energy and attract the universal electric energy which kills the germs and bacteria and keeps the environment clean (Abhang & Pathade, 2017). After their experiment, Berk and Sharma (2015) concluded that Agnihotra energy purified contaminated water and reduced air pollution.

In the Yajna the Soma plant is also used, however, there is inadequate knowledge about what is the Vedic Soma? Where is it found? According to Shah (2015), botanist Wasson claimed one type of red mushroom (*Amanita muscaria*) as a Soma. Some scholars agreed with his finding. However, the other researchers disagreed with Wasson's claim. For example, Smith, a professor of Sanskrit at the University of Cambridge, disagreed with Wasson's claim. It indicates that more exploration is needed about the Vedic Soma from which new knowledge can be explored about its use in the present context. The Yajna fire is believed to generate high temperatures ranging from hundreds to thousands of degrees Celsius. The

vapours and particles spread into the atmosphere, reduce global warming, reduce microbial growth in the air, increase plant growth and purify the surrounding air producing quality rain (Chaganti & Cheruvu, 2021). They further claimed that Yajna reduces air and water pollution.

Review of the literature, participants' saying, folk understanding of my parents and the school science show the connection of the Vedic wisdom. However, the curricular designers have taken it as superstition; teachers only taught what is written in the science curriculum and textbooks, and students never asked questions about socio-spiritual practices. The science curriculum mentioned the ecological problem. However, they failed to provide scientific proof to reduce the ecological problem involving community knowledge.

Suppose people burn a mixture of unpolished rice, cow dung, and cow ghee in the inverted pyramidal shape of a copper pot, chanting Surya and Agni mantras at sunset and sunrise. In that case, they can find infrared radiation of sunlight resonates with the Agnihotra, which produces a massive amount of vital helpful energy for the life process (Abhang & Pathade, 2017). Cow dung contains a diverse group of microorganisms such as "*Acinetobacter*, *Bacillus*, *Pseudomonas*, *Serratia* and *Alcaligenes*, which makes them suitable for microbial degradation of pollutants" (Gupta et al., 2016, p. 4). Moreover, Cowdung slurry maintained in the ratio of 1:10 or 1:25 can degrade rural, urban, and hospital wastes, reduces the petroleum hydrocarbon contamination by 81% in the soil, and reduced hazardous cancer-causing radiotoxic heavy metal strontium 5-90% (Gupta et al., 2016).

From the above discussion, we find that mantras chanted during the period of Homadi are helpful for the sustainable life process of the whole universe. It is also supported by a verse from the Gita, 3.14

(अन्नाद्भवन्तिभूतानिपर्जन्यादन्नसम्भवः।यज्ञाद्भवन्तिपर्जन्योयज्ञःकर्मसमुद्भवः). It means that living beings are born from food, food is produced by rain, and rain comes by performing Yajna. The Yajna is performed by doing Karma. The Atharva Veda and the Bishnu Purana indicate the universe is made of the Pancha maha bhuta, which includes five significant elements, that are Akash (Ether), Vayu (Air), Agni (Fire), Jala (Water) and Prithibi (Earth) (Dey, 2020). Yajna supports the connection of all these Pancha maha bhuta, which Modern science has also supported. It can claim that the universe is made of five basic elements, and the earth is the center point of all the activities as the mother. The Sukla Yajur Veda-Saṁhita 18;1;2 -6 mentioned the detailed account of the various benefits of a sacrifice's performance (*yajñena kalpantām*). Among such benefits are "abundance of food (*vāja*), wealth (*prasava*), efficiency in work (*prayati*), mental acuity (*dhiti*), enlightenment (*jyoti*), physical vigour (*ojas*), longevity (*dirghāyu*), health (*anāmaya*), tranquility(s*arma*), fearlessness (*abhaya*), friendship (*anamitram*), and sound sleep (*sukham śayanam*) " (Ramajunacari, 2013, p. 4).

According to Hagelin (1989), Maharishi Yogic practices also reduces crime, violence, hostility, and war in recalcitrant areas where political and negotiated settlements have historically demonstrated their inability to do so. Professor of Maharishi International University (MIU) Chandler (n. d) added that Maharishi technology of pronunciation of Mantra as the form of Transcendental meditation (TM) supports eliminating war, poverty, and violence and supports maintaining world peace and happiness.

The above argument provides the relational values of Yajna and mantra and supports creating world peace in the whole universe as said by Vedic experts.

However, the irony was that both students and teachers came from the community where they had undergone the Yajna rituals, planted the Peepal and Tulasi trees, never talked about these practices in science class, and never questioned their teachers about its further scientific investigation. A science teacher said, "*I only know that mantra which is chanted at Yajna, but I am unclear about its ecological value"*. Students could not answer it. It indicates that connecting socio-cultural knowledge with the school science curriculum is challenging.

Ecological Values of Trees

The Brihadaranyaka Upanishad, 3.9.28 expressed that the God who exists in the universe lives in air, water, fire, and in trees and herbs, and men should have reverence for them. Dey (2020) indicates that trees are a form of God worship in a Yajna and support to protect the whole universe. My parents said trees are gods and goddesses and taught me to take care of them. According to the Vastu sastra, thorny plants should not be planted near the house because they absorb negative energy and cannot provide peace and prosperity at home. He opined that: "*Tulashi, Bell, Sami, Asoganda, Amala, Ashoka, Aakh, Neem, Coconut, Banana, Bamboos and other powerful plants are recommended in and nearby house to provide peace and prosperity at the house"*. According to Hindu myth, most of them are considered the residence of God and Goddess. However, bigger plants are not recommended in the east and south directions because they disturb the direct sun rays and make a shadow on the house. Banyan, Bamboo, and Peepal are recommended to be planted far away from the home because their roots and branches can destroy its structure (Shastri, 2076 BS). Culturally we have to chant a mantra before planting trees. It supports to control of the overuse of trees in residential areas. In this context, one participant said:

> *In our village, there is a sacred place in a different location. The place is preserved as sacred; people fear cutting plants and still consist of big trees.*

Due to big trees, drinking water sources are still found, and we are drinking water, but so many other water resources are destroying these days.

The above argument indicates that local people having spiritual knowledge of plants supported the conservation of natural resources, ultimately saving the earth and other living beings.

From the Varah Puran we came to know that, if a person planted a Peepal (*Ficus religiosa*), a Neem (*Azadirachta indica*), a Banyan (*Ficus benghalensis*), two Pomegranates (*Punica granatum*), two Oranges (*Citrus X sinensis*), five Mango trees (*Mangifera indica*), and ten flowering plants, then s/he never goes to the hell (Dey, 2020). The above mythological saying consists of scientific justification for providing a considerable amount of oxygen and bringing peace and harmony to the residential area and removing the negativities and bitterness. Moreover, modern science proved that these plants work as antiseptics and save air pollution nearby the house.

The principles of the Vaastu that cultural people practise were formulated based on the cosmic influence of the sun, its light and heat, and the direction of the wind. These principles result in a climate-responsive, contextual and user-friendly design. By default, the Vastu Shastra consists of eco-sensitivity, understanding of the users' requirements, understanding of building materials, knowledge of aesthetics, and the comprehension of energy fields. Incorporating knowledge of energy fields in building design can add a sense of support for well-being, peace, tranquility or other desired qualities to the atmosphere (Jain, 2001).

Going through the above arguments, I realized that my father has scientific arguments when he says, "*if we cut the construction wood on full moon days (purnya pakxya) and rainy season, the wood will be attacked by insects (dhulyaha lagxa)*". So, he taught me to cut construction wood on *aausi pakxya* i.e. waning moon days and in the winter season. He reiterated that woods remain strong for a long time without

any fungal attack. This ritualistic concept consists of experience and practical wisdom. Zurther (1999) said that plants absorb more water on new moon days than on full moon days. In these days, the tree decreases the resistance capacity and hence decays. In *aausi pakxya* (waning moon days) the tree absorbs less water, which makes them more durable for construction.

However, the teachers and students at school; curriculum designers, textbook writers, and trainers did not relate these rituals, the scientific causes behind these rituals, mantra for planting trees and rituals for preserving trees. They believed that these practices were superstitious and non-scientific.

Mythological Understanding of Nagadevata and its Ecological Value

My parents used to worship the snakes as the Nagadevata mainly near the water resources and plantation field area saying:

> *Nagadevata (snake) lives in water resources, so we should never urinate near water resources. If we do that Nagadevata will be angry with us. We never cut the Peepal of the water source and elsewhere because it is the form of Bishnu. We never cut the trees of Devithan (sacred place) because there consists the Devi. Under the local trees, we the villagers worship Kshetrapal devata (called Gaddess). In our cultivating field, Bhume devata protects our crops and landslide.*

My parents' arguments arouse me questions: How Nagadevea protects the environment? How the Devi lives in the tree? What science consists of within it? What is the understanding of teachers and students about it? Why did they not mention such knowledge in the science curriculum? To understand scientific causes, I asked a question with two school science teachers. They said, "*Snakes absorb the Ultraviolet rays of the sun so that it makes the environment less harmful as well as keep the natural ecosystem balance forever".*

Students also viewed snakes found in the Terai region as more poisonous than in the Hilly and Himalayan regions. There are direct sun rays, which are more harmful than in the Hilly and Himalayan regions. Snakes absorb the poison created by harmful rays mixing with different plants. The snake specialists counter-argued that "*snakes do not directly absorb the poison from the environment; however, they support the ecological balance in the natural earth"*. Jacobes (2015) viewed that pseudoscience might rationalise strongly held beliefs but does not bother to investigate and find out what's going on or to test various possibilities. It means the teachers need to know which myth is science, which is non-science and which is pseudo-science. My participants' pseudoscience-related argument also ultimately supported preserving natural resources and the world's ecosystem.

Sound Nurtures Ecological Balance

The Veda has several Mantras (sounds) that can get rain, collect clouds, bow trees etc (RV. 5.32.1-2; YV.12.8,14,18 & 20). My parents exemplified this by saying:

> *The Vedic sound we pronounce expands in the sky and helps clear the air around us. The Vadaik mantra such as Prithivi santi, Akash, santi, Antariksya santi, Apa santi, Banaspataya santi, Dehu Santi! Santi!! Santi!!!…supports for the Bishwo (world) peace (discussion with my father at different times).*

My parent's argument was based on the folk understanding that keeps the environment clean. It was confirmed by the Pundit Govind Regmi who said " *Yajna support for rainfall*". He added, "*Vedic mantras pronounced in Yajna help minimise air pollution, increase crop yield, protect plants from disease and provide us a disease-free, pure and energized environment".* According to Prasad (2010), Vedic sound consists of Naada and Shabda which could not be translated to the human audible range. He further argues that Vedic shabda Brahma destructive spread from

self (Atman) as energy burn Akasha (space); from akasha, the air; from the air the fire; from fire the water; from water the earth; from earth the plants; from plants the food. It indicates that sound nurtures the ecological balance which is also justified in the Bishnu Purana. I noted that my father's understanding, Pundit's confirmation, Prasad's claim, and modern science agree that air is a carrier of sound waves. It says that the air is essential for sound waves to propagate.

Maharshi Mahesh International University also found the connection of OM sound between what it calls the unified field of consciousness (soul in Vedic understanding) and the quantum form of cosmic energy (Hagelin, 1989). However, the school teachers, students, textbook writers, and curriculum designers had different thoughts about these mantras. Here is the excerpt I noted at different times during my fieldwork.

One basic level science teacher argued that "*when we chant the Vedic sound on the Yajna practice consisted truth, it impacted on psychological and physiological relief to me as well as support to kill the virus consisted in our surrounding but I cannot say how it happened with materialist proof. I felt relief and peace due to Vedic sound, but how can I connect with school science teaching is difficult for me*".

Another ethnic minority teacher said that: *" either Hindu or Christian chanting mantras support for peace and prosperity in the society. Still, we could not say whether there was scientific proof or not*". Another secondary-level science teacher was positivist on the teaching science approach. His counter-argument was that "*we should teach scientific truth as the scientific principles and theory. The Vedic sound is ritual and myth-base. There is not any scientific proof of how [the]Vaidic sound supports the maintenance of ecology. What we are teaching in the science curriculum is only realistic knowledge*". The above argument indicates that teachers'

socio-cultural status, motivation and understanding play important roles in decision-making on connecting the school science curriculum with Vedic knowledge.

Another spiritual and non-science background teacher argued that "*the mantra chanted homadhi Yajna connects the universal energy with physical energy. When we chant the mantra with proper sound, it passes through Muladhara (root) chakra to Sahasrara (crown) chakra, then Ajana chakra(the third eye) becomes active, the mind consists of the conscious mind, which provides peace and prosperity eliminating the disease from the body. The Vedic OM sound expanded on the universe, which supports Kundalini activation as well as support for the ecological purification*."

Students knew the cultural practice knowledge. However, they did not know what was behind those practices. They believed what their teachers taught them. Most of my participant students were aware of the ecological patterns of biodiversity conservation, but they were not interested in the Vedic sound and its impact on ecology.

Curriculum experts saw the obstacles to implementing that knowledge in the science curriculum. He did not show interest in a particular topic but focused on the eastern spiritual and philosophical part that could be implemented in the school science curriculum. The science curriculum experts said, "*We should change the thought system at the university-level study to implement eastern philosophy at the school level. The politicians are unclear about what is right and wrong about curricular content. The understanding level of politicians should be developed about what types of education could be better in Nepal for biodiversity conservation. The spiritual institution should be actively involved in the curriculum development process and could play an interventive role in implementing spiritual wisdom in the science curriculum. The Vedic knowledge should be proved with scientific justification, which*

supports the minimizing gap seen between the different cultural groups of Nepal. We have started some chapters at the secondary level connecting science with eastern philosophy".

His argument indicated that science experts are trying to understand eastern philosophy but searching for scientific justification for spiritual and cultural practices. Policy-level understanding is needed to implement cultural knowledge. Spiritual organizations should try to justify their value in the present context. Similarly, different factors influence the textbook writing process. According to a basic-level curriculum writer, several factors influence curriculum writing. He argued that "*Donors, higher policy level as well as local interest group try to influence for writing our textbook contents. Through child rights and equality perspectives, donors somehow influence our curriculum and the textbook writing process. Preparing a culturally friendly textbook is more challenging in the multicultural context of Nepal*."

The excerpt above shows that teachers have indigenous and cultural knowledge. Science teachers are only guided by their prior scientific knowledge. Students are involved in local cultural practices, but they only believe what their teachers taught them. The prescribed guidelines bound both curriculum designers and textbook writers. They did not attempt to explore the underlying science behind cultural knowledge and practices.

The school teachers, students, textbook writers, and curriculum designers had different opinions. Here is the excerpt I noted at a different time during my fieldwork.

> Teacher*: Vedic sound makes me relax; affirms that this sound kills germs; gives relief from the tensions which I generate from material lusts. But I don't know the scientific reasons embedded in it. Chanting the mantra I heard that it*

passes through Muladhara (root) chakra to Sahasrara (crown) chakra, then Ajana chakra (the third eye) to make me active, and conscious. I also heard that OM sound activates Kundalini and also does ecological purification

Student: *I believe on what the teacher says*

Curriculum designer: *Donors, higher policy levels, and local interest groups try to influence us. So, we do not have such a practice. This approach is appropriate for the higher education curriculum only.*

Textbook writer: *Preparing a culturally friendly textbook is more challenging in the multicultural context of Nepal. Therefore, we avoid such contents to make the book homogeneous.*

A couple of observations can be made from these excerpts. One, the teacher practices cultural science but does not know its relation to the Western Modern Science contents. They did not get more opportunities to study the indigenous peoples and local communities' knowledge to incorporate into school science teaching. Students don't bother to ask questions but believe in what is taught in the class. Curriculum designers see the encroachment of the donors. Textbook writers find difficulties addressing sciences practised in multicultural societies because of the different values of the diverse community.

Local Agricultural Epistemic of Knowledge Construction

People have been practising Ethno-scientific knowledge and skills in their everyday life. They have been transferring them from one generation to another. For example, Vedic seers gave the knowledge to use fertilizers for increased food production in agricultural land (RV, 3. 8.7). They suggested the selection of appropriate seeds in an appropriate season and controlling rain and drought for rain and drought crop production (AV, 7.18.1-2). The Yajur Veda.3.14. 1-3 mentioned

cow shed, its preservation, its milk and ghee as nutrients, and cow dung for good fertilizer. The knowledge of what Vedic seers practised is still relevant in agriculture. Agricultural knowledge like this has been preserved culturally with or without the role of the school. The succeeding paragraphs present these.

Agricultural Ingredients in Ashuro, Khirro and Titepati

My father used *Justicia adhatoda* (Ashuro), *Artemisia indica* (Titepati) and *Wrightia arborea* (Khirro) to increase the productivity of crops through pest control. Acharya et al. (2020) claimed that "*Justicia adhatoda* (Ashuro), *Artemisia indica* (Titepati), *Agave americana* (Hattibar/Ketuke*), Acoruscalamus* (Bhojo), *Xanthoxylum armatum* (Timur*), Meliaazedarach (*Bakaino), others tobacco liquid, mustard cake (Pina), cow urine, etc. for controlling different diseases and pests of crops" (p. 148). Wormwood, neem, persian lilac, chilli, garlic, onion skins, marigold leaves, cow dung, ash, oil seed cake, khirro, *Adhatoda vasica*, and tobacco are examples of plants that can be used to make an agro- pesticides and fertilizer

My father used Titepati in bathing instead of soap and said it cures skin disease. Titepapati and Khirro are used for covering the seedbed.

Nahid et al. (2017) conducted a study and found that the plants and herbs used by the farmers above consisted of antibacterial and antioxidant properties due to the presence of the compound Phenol and flavonoid. They are used as organic manure because these plants and herbs contain nitrogenous compounds (Nahid et al., 2017). The oil that plants and herbs have works as a repellent, insecticidal agent or antifeedant and control field pests (Nahid et al., 2017). Chhetri and Burpee (n. d) also reported that these plants and herbs consisted of insecticidal, fungicidal, and herbicidal properties that control the weeds in a rice paddy. They consist of Alkoloid Vasicine, which works as poison for ants, mosquitoes, and fish but not for human

beings (Chhetri & Burpee, n.d). Top Bahadur Kumal's shared his experience as he said, "*we live on the edge of the river and go fishing in the Daraudi river. We use Khirro to kill the fish*". His experiences resonate with the understanding of modern scientists.

The aforesaid plants and herbs are rich in potassium nitrate, nitrogen, potassium, and phosphorus to supplement chemical fertilizers (Chhetri & Burpee, n.d). However, Timsina (2018) and Gupta et al. (2016) counter-argued that applying nutrients from inorganic and organic sources at a 75:25 ratio is sufficient to increase crop yields and achieve food security. An experienced agricultural practitioner also agreed with the above scientific proof. He said:

> *Farmers do not know how to mix the different types of chemical fertilizers and the proper use time. Suppose we correctly use the mixture of potash, nitrogen and phosphorus. In that case, it increases fertility and absorbs the whole fertilizers by the plants so that extra fertilizer is not collected in the soil and the soil texture would not be damaged.*

Another farmer with 70 years of agricultural experience viewed nearly the same idea. He mentioned:

> *In the past, we used Val pani (flood) in our Besi bari (plain land) because it carried fertilizer from the jungles and Pakha bari. So, we did not need any fertilizers for Besi bari (plain area). But nowadays, people have stopped keeping cows; flood carries only mud, sand and small stones. So nowadays, I do not use Val pani anymore. Instead, I use cows' and buffalos' dung and chemical fertilizers to increase production and save the soil from being hard.*

The above arguments indicate that both the scientists and the farmers came to a similar understanding of the usefulness of conventional herb and chemical fertilizers equally essential for agricultural land.

Contrary to the above findings the school teachers, students, curriculum designers, and textbook writers had a different view. Their views are mentioned in the following paragraph.

> Teacher*: We know that all green plants work as fertilizers and pesticides. But the Science curriculum and the textbooks do not mention their detailed use. So, we did not teach students about using green plants as manure and pesticides. But they know it at home.*
>
> Students: *I know from elders that Titepati, Khirro and Ashuro work as fertilizer and pesticides, but I do not know how it supports for agriculture. We never studied it in the textbook. Teachers used to teach us little about the general uses of compost fertilizer, but they did not teach more about these practices.*
>
> Curriculum designer: *The teacher can ask students to do project work on locally available plants for manure and pesticides. We have included only the scientifically justified content in the curriculum.*
>
> Textbook writer: *We include local knowledge in the textbook. But the reviewers change them later. We do not know why they do so.*

The excerpts above show that (a) the teachers know and practice the Ethno-science at home to some extent but they do not encourage students to do project work on it; (b) students also know this knowledge, but they do not get the opportunity to connect their ancestral learning with school science curriculum; (c) curriculum designers hesitate to incorporate this knowledge because it is not scientifically proven; and (d) textbook writers include such content which the moderators and reviewers remove from the textbook because they do not know the local knowledge and have limited knowledge about the diversity of local community knowledge. This shows a lack of coordination among the teachers, teacher trainers, textbook writers,

botanists, and curriculum designers. As a result, students are deprived of scientifically knowing the use of local plants. As said National Education Policy (2067), if a National science school is established in each Palika, it could support the indigenous and local communities voices of traditional knowledge in science teaching.

Use of Cow Dung and Urine as Manure and Pesticides

Cow dung and urine consist of high-quality organic fertilizer, insecticide and pesticide. Gupta et al. (2016) found that a mixture of dung and urine in the ratio of 3:1 consists of lignin, cellulose, and hemicelluloses. It also contains 24 minerals like nitrogen, potassium, and trace amounts of sulphur, iron, magnesium, copper, cobalt and manganese, which are required for higher crop yield.

They further explored that the cow's dung also contains more calcium, phosphorus, zinc, and copper than the cross-bred cow (Gupta et al., 2016). They also found the combination of cow dung with NPK (15:15:15) in the concentration of 3 ton/hector and 100 kg/hector, respectively, showed a marked increase of 8.9 t/ha in the yield of potato in comparison to the control that yielded only 1.8 t/ha (Gupta et al., 2016). Top Bahadur Kumal, a farmer with long experience in agriculture, observed that organic fertilizers such as cow dung, poultry fertilizers and goat fertilizers consist of a huge amount of nitrogenous substance compared to buffalo fertilizers. He said, "*we can properly use human, cow and buffaloes urine as a form of fertilizers and pesticides*". He added:

> *If we collect the cows, buffaloes and human urine in an airtight pot and put it for about twenty days, then mixed with water in one to six ratios, it works as organic fertilizers. Its spray can remove the pest from the agricultural farm. One year's buffalo urine works near about one quintal of chemical fertilizers (Urea).*

The farmers' ideas aroused some questions: Why are they not called as agricultural scientists? Why were their idea not implemented in science teaching? Why do we not include them as our guest lectures at the school and university levels? With these questions in mind, I reviewed the literature. The literature showed that organic manure significantly increases the soil pH and the concentrations of nitrogen, available phosphorus, exchangeable potassium, calcium, and magnesium. In contrast, the NPK chemical fertilizers decrease the soil pH and exchangeable calcium concentration, do not affect the soil concentrations of nitrogen and magnesium and increase the concentrations of available phosphorus and exchangeable potassium (Han et al., 2016).

The study also shows that organic farming maintains the microorganism population in the soil and decomposes organic substrate aerobically into carbon dioxide, water, and minerals, stabilizes organic matter and shows a natural ability to increase soil fertility through phosphate solubilization, improves nutrient and water-holding capacity of the soil (Han et al., 2016). Studies further mentioned that cow dung is high in organic material and rich in nutrients. It contains about 3 % Nitrogen, 2 % Phosphorus, and 1 % Potassium (3-2-1 NPK), and improves soil fertility. Dung increased pH, total Nitrogen, organic Carbon, loss of ignition, and exchangeable Magnesium and Calcium favoured nitrification, resulting in the rapid conversion of ammonium-nitrogen to nitrate-nitrogen. Vermicomposting of cow dung improves nutrient cycling and helps to convert unavailable nitrogen in available forms to plants (Raj et al., 2014) which was experimentally proven by Han et al. (2016). The local agricultural farmers had gained this experimentally. Participants related to school education had different views on it. For example,

Teachers: *We know about using cow dung and urine as agro-insecticides and pesticides. But the detail is not given in the textbooks. We just share our experience with students because it is not prescribed in the textbook.*

Students: *We know cow dung and ash work as fertilizers and protect soil quality, but we cannot say how cow dung, ash and urine work as pesticides and insecticides. Our teachers teach only the contents written in science textbooks.*

Curriculum designers: *Scientific justification is needed to include such content in the curriculum. Once we get scientific evidence, we can include them in the curriculum.*

Textbook writers: *We cannot go outside the curriculum guidelines. So, we just suggested project work.*

The above excerpt indicates that the curriculum guides textbook writers; curriculum designers are looking for scientific evidence; teachers are looking for these contents in the textbooks; students hardly ask teachers about the science embedded in the local wisdom on the use of cow dung and ash. All the informants had "the logic of practice" (Bourdieu, 1990). But this practice needs a way to break the chain of blaming each other.

Pesticides and Seeds Preservation Practice

My mother used different local herbicides to preserve the seeds for a long time. She used to preserve the different types of beans by mixing with the Kharani (ash), Bhojo, leave of Bakaino, Timur and paste of oil and Turmeric. She also used Ash (Kharani) to protect the seed for a long time. I realized that what my mother did was the scientific process of protecting seeds from weeds. It was proved experimentally by Abhang and Pathade (2017). They found Agnihotra ash supports the germination of seeds preserved at home; plants become disease-free, grow fast

and ultimately increase the productivity of seeds. The agnihotra ash contains carbohydrate, amino acid and protein contents. These contents help increase the size and weight of mushrooms. It supports to increase in organic carbon, phosphorus, copper, manganese, iron, zinc, total protein, and oil content in plants (Abhang & Pathade, 2017).

Moreover, Nitrogen-fixing and phosphate-solubilizing bacteria increase with the addition of *Agnihotra* ash into the soil. It also kills fungal pathogens, directly affecting the yield and productivity of crops growing in the field. One of the participants of this study, Keshari Prasad Dhakal said,

> *We, the farmers, devalued agnihotri ash and started using malathion, including other poisons (bis), as pesticides were banned in the developed countries. This means we neglected the local pesticides such as Ashura, Khirro, Titepathi, Nimpatta, Bojho, Tulashi and Timmur that never harm us and protect seeds and our environment.*

Farmers can also follow the Top Bahadur Kumal approach of mixing the bark of Kaphal (*Myrica esculenta*), garlic, onion, the dust of local tobacco and chilies with water to make a pesticide. We can use it to preserve seeds and remove the pest in the field. Similarly, putting Sishnu (*Stinging nettles*) in water for about 14/15 hours and spraying in the field removes the pests from the crops.

Agricultural scientists' argument indicates that local people have developed ideas from perceptions, observations and experiences. However, our school education system never attempted to practically explore their thoughts and involve them in teaching-learning activities with school students. The following discussion is a testimony of my arguments about the school's doings:

> Teachers: *Farmers are easy going these days. They buy chemicals, pesticides and seeds directly from the market. They do not bother to preserve the seed*

conventionally. So is their habit of using green plants for manure. Due to the mutation, local pesticides cannot show their effect on pest control. Besides, we do not have more ideas about the local pesticides and insecticides.

Curriculum designers: *Curriculum guidelines direct us on what types of knowledge can be included in the school's science curriculum. We cannot go beyond it.*

Textbook writers: *We cannot go outside the curriculum in the textbook writing process.*

The talks I came across with my participants indicated that teachers know about organic pesticides and insecticides but are reluctant to use them. Students also understood the use of local pesticides and insecticides by their elders and community people. However, they did not get the opportunity to study them in detail at school. Curriculum designers cannot include local pesticides and insecticides in the science curriculum because they have to follow the curriculum development guidelines. Textbook writers cannot go outside of the formal system of textbook writing. Each participant had limitations, and none of them attempted to go beyond that limitation. This made the students unable to learn local science and relate it with school science.

Medicinal Knowledge

Our ancestors identified milk, ghee, and honey's nutritional and medicinal value. They figured out soma as Yajna material and the material to prolong the life of human beings and the gods' lives (YV, 21.33). So, they called Soma the king of the world (RV. 8.48.4, 9.96.10; 9.97.24). The Vedic seers also identified cow milk, ghee, yoghurt, dung, urine, and herbal plants (see detail Vedic herbs and plants mentioned in Atharvaveda in appendix 4) for medicines (Gupta et al., 2016; Prasad, 2000). Cow milk and ghee are essential to energize human life, eradicate disease and provide

happiness for all, for which the ancestors credited God and said that god resides in the cow body (RV. 3.30.14, 6. 28 6, 8). Dairy products from cows such as milk, yoghurt, ghee, dung, and urine were named Panchagavya/ Panchgavya Chikitsa or Cowpathy medicine to treat Tridosa (Batha, Kapa and Pitta) (Raut & Vaidya, 2018). Keeping this in mind, I have tried to search the medicinal practices of the community people and place them in school science.

Science in Panchyagavya Treatment

Panchagavya is used as a sacred substance in Hindu rituals. It is used in Yajna as a divine substance, but modern science verified it as a disinfectant, antiseptic, and immunity booster as well as (Raut & Vaidya, 2018). In the Vedas, the use of cow-derived products has been mentioned for treating three types of health problems (Bath, Pith and Capa). These five items possess medicinal properties that are used alone or combined with other herbs against many human and animal diseases (Raut & Vaidya, 2018). The Padma Purana also mentioned the medicinal use of Panchagavya mixture with dubo. My father also used to mix barley, sesame, kush and dubo in Panchagavya during the Yajna period and sprinkle it everywhere. It is used for the treatment of diseases like flu, allergies, colds, cough, asthma, renal disorders, gastrointestinal tract disorders, acidity, ulcer, wound healing, heart diseases, skin infections, tuberculosis, chickenpox, hepatitis, leprosy and several other bacterial and viral infections (Gupta et al., 2016). It is also reported to be beneficial for cancer, acquired immune deficiency syndrome (AIDS) and diabetes (Gupta et al., 2016).

Panchagavya is rich in nutrition, amino acids, proteins, vitamins and minerals, and they are boosters of the immune system. N, K, Mg and Zn, the contents of Panchagavya help activate the body's metabolism; microbial and biochemical substances are highly present in them (Chakraborty & Indrajit Sarkar, 2019).

Panchagavya gritha also consists of calcium, sodium, phosphorus, potassium, lactose, oligosaccharides, and chorine. They are effective in schizophrenia, depression, attention deficit, hyperactivity disorder, types of epilepsies, post-traumatic dementia, etc. (Jithesh, 2013).

Panchagabya products are rich in minerals and vitamins. The mixture of cow urine and Agnihotra ash is a good disinfectant and antiseptic antifungal agent (Abang & Pathade, 2017). Pandey and Pawar (2016) proved that Panchgavya ghrita is used as an antiepileptic, anti-depressant, nootropic activities, brain activates and treatment of mental illness. They further argued that a mixture of Panchagavya ghrita consisted of antioxidant, antibacterial, anticarcinogenic and wound-healing activities. According to Pande and Pawar (2016), the Charak Samhita mentioned that the mixture of Panchagavya with other herbal medicine was scientifically verified as an adjuvant with modern antiepileptic, nootropic, antipsychotic or antidepressant drugs. These findings indicate what our Vedic ancestors found and used as sacred substances consisted of scientific reasons.

As we know, Panchagavya is also considered an Ayurvedic medicine. One Ayurvedic element of Panchagavya is cow ghee, which improves digestive fire, memory, intelligence, voice, lustre, skin softness, immunity, lifespan, and eye strength (Ramaiah, n. d). As he mentioned, the Ayurvedic Pharmacopeia of India proved the medicinal value of all the elements of cow products for better health and disease control. Mixing herbal drugs into Panchagavya makes a more potent drug that functions more effectively than allopathic medicine (Pandey & Pawar., 2016). Panchagavya has both preventive and curative aspects of Ayurvedic medicine.

An Ayurvedic doctor, a participant in this study, claimed that Panchagavya consists of complete medicinal properties.

If we mix Panchagavya with other herbs, it provides a good body metabolism, controls bath and sugar in the body, works as antiseptic and energies in the Yajna period, the mind makes creative and Sattoic thought is developed in the human mind.

Thus Ayurvedic doctors supported that Panchagavya mixed with herbal plants has Ayurvedic medicinal properties. This medicine works as preventive and curative work through the activation of the endocrine gland associated with seven chakras in the body (Nair, 2016; Raut & Vaidya, 2018). Not only that, it treats the diseases like headaches, migraines, mental dullness, intellectual deficiencies, depression, insomnia, intemperance, epilepsy and schizophrenia (Nair, 2016). However, the analysis of field data showed that teachers, curriculum experts and textbook writers do not see the importance of science practised by the people based on ancestors' knowledge. The students did not get the opportunity to study about it in the school science curriculum. They never got an opportunity to listen to the medicinal values of Panchagavya in the Yajna program in their house. Teachers never involved them in scientific justification on panchagavya and homadi materials that consist of or do not have therapeutic value. Local, provincial and federal governments still did not establish the research and innovation centre for its scientific justification and to provide the patent right; however, it has been mentioned in the National Education Policy 2076 and National Science, Technology and Innovation Policy 2076.

The above arguments show that teachers, curricular writers and textbook writers know the value of Yajna and Yajna Samagri as spiritual and sacred forms. However, they never contemplated its scientific justification. Students never got an opportunity to study about it.

Medicinal Science in the Daily Food

Daily food items my participants ate in the village consisted of medicinal ingredients suggested by the Vedic seers. People use *shad rasa* (six tastes) related foods every day, knowing that our body is made of shad rasa, which supports to balance tri-dosha of the human body. By *shad rasa* they mean salty, sweet, bitter, astringent, sour and pungent. To make sure the inclusion of the shad rasa, they eat different types of food in their daily meal. Modern science also found shown their concern for local foods. However, their validation process lacks locally available foods. Table 4 shows their food item.

Table 2 *Daily Meal of the Community People*

Morning	Afternoon	Evening
Rice, dhido, wheat, milk, achar, rayo, karkallo, lude saag, Beth, mustard, ginger, garlic, radish, onion, lemon, honey, potato, bhatmas, radish,timur, tomato, ghee, curd, bitter guard, black pepper, fish, meat and other seasonal foods that are found around them	Corn, the bread of corn and millet, bhatmas, achar, banana, guava, orange, amala, sugarcane, cucumber and other seasonal fruits that are found there.	Rice, dhido, milk, achar, wheat, rayo, karkallo, ludesag, banvhade saag, timur, potato, tomato, ghee, curd, mustard, ginger, garlic, radish

Table 2 shows that indigenous peoples and local communities take different foods with high calories of carbohydrates, vitamins, proteins and fat without measuring it. They ate what food was available seasonally, including herbal substances.

These food items make our body strong and develop an immune system to save us from bacteria and viruses. In this context, a local herbalist with a long experience in using it expressed the medicinal values of local foods eaten daily.

> *Usually, people eat Kurilo, Nihuro, Banvhade, Gittha, Vyakur, Sisnu, Karkalo, and Thotne saag (like pumpkin's leave but having more nutrients), Lude Saag for vegetables; wheat for grains; milk for drinks.*

I attempted to see the phytochemical verification of some locally eaten vegetable plants. The scientific study found that Kurilo (*Asparagus racemosus)* is used as a refrigerant, demulcent, diuretic, aphrodisiac, antispasmodic, antidiarrhoea, galactagogue and in rheumatism (IUCN, 2000). It consists of an essential component of food supplements in animal diets because of their higher availability of nutrients. Crude protein, crude fibre, ether extract, nitrogen-free extract, and ash contents are found in this herb. It is a nitrogen-free extract with minerals like Ca, Mg, Fe, Cu, and Zn. It works as an antioxidant and improves breast milk production (Aryal et al., 2017). Ministry of Soil and Forest Conservation [MSFC] (2013) mentioned that Kurilo exhibits "anticancer, astringent, tonic, laxative, aphrodisiac, diuretic, demulcent, antiseptic, alterative, appetite-inducing, antispasmodic and cardiac stimulant activity. It is used against leprosy, dyspepsia, gonorrhoea, epilepsy and throat complaints in modern medication" (p. 4).

Another common plant consumed by the informants was Nihuro (*Matteuccia struthioreris*). Study shows that it has a high amount of minerals. Table 3 shows the percentage of minerals that consist of Nihuro.

Table 3 *Mineral Consist of Local Plant Nihuro*

Minerals	*Amount*	*% Dv*
Calcium, Ca	*32mg*	*3.20%*
Iron, Fe	*1.31mg*	*16.38%*
Magnesium, Mg	*34mg*	*8.10%*
Phosphorus, P	*101mg*	*14.43%*
Potassium, K	*370mg*	*7.87%*
Sodium, Na	*1mg*	*0.07%*
Zinc, Zn	*8.33mg*	*7.55%*
Copper, Cu	*0.32mg*	*35.56%*
Manganese, Mn	*0.51mg*	*22.17%*

Sources: https://www.healthbenefitstimes.com/fiddlehead-fern/

Table 5 indicates that Nihuro consists of a high amount of Fe and Cu, which are required for active human body metabolism and oxygenation of red blood cells. Nihuro has been verified by modern allopathic science, which recommends iron pills for pregnant women. It also contains a high amount of vitamin A, vitamins B1, B2, B3, vitamin C, protein, ash, energy, and a low amount of carbohydrates and fats required for the human body activation. (https://www.healthbenefitstimes.com/fiddlehead-fern/). It also consists of anti-cholesterol, anticancer, anti-inflammatory activity, enhances immune capacity, treats eye ailments and bones disorder, and treats anaemia due to the presence of iron and vitamins B2. It also consists of Riboflavin, which treats headaches and migraine attacks. Riboflavin is useful to treat body pain. Phosphorus supports the digestion and balance of acids and bases in the human body. Nearly the same quality and ingredients are found in Karkalo/ Pidalu (*Colocasiaesculenta*) that my participants

consumed in daily life called. Ezeabara et al.'s study (2015) concluded that Vitamins B1, B2 and B3 were present in Karkalo/ Pidalu in small quantities but iron, calcium, phosphorus, magnesium, sodium and potassium were found large amount in them.

The elemental analysis in milligrams per100 grams of the dry grain of Lude jhar (*Amaranthus retroflexus*) shows that my participants get calcium (78.3 to 1004.6), iron (3.61 to 22.51), magnesium (44.31 to 97.38), potassium (267.8 to 473.6) and zinc (0.53 to 1.20) (Kachiguma et al., 2015). The leaf consists of protein ranging from 13.37 to 23.27%; ash (14.08 to 19.95%) and Vitamin C (30.3 to 117.79 mg/100 g) while the mean mineral leaf analyses in mg/100 grams ranged from 14.84 to 31.17 for iron, 1.03 to 3.46 for zinc, 1512 to 2381 for calcium, 1320 to 1677 for potassium and 383.4 to 513.9 for magnesium (Kachiguma et al., 2015). It indicates that Karkalo/ Pidalu consists of a high amount of nutrients, minerals and vitamins which work as medicine and daily use of it supports to save people from the pandemics as well (Kachiguma et al., 2015).

Akubugwo et al (2007) reported that leaves of *Amaranthus hybridus L*. contained sodium (7.43), potassium (54.20), calcium (44.15), Magnesium (231.22), Iron (13.58), Zinc (3.80) and phosphorus (34.91). The vitamin composition of the leaves in mg/100 g (DW) was carotene (3.29), thiamine (2.75), riboflavin (4.24), niacin (1.54), pyridoxine (2.33), ascorbic acids (25.40) and tocopherol (0.50). Seventeen amino acids were also found in it. It also consists of alkaloid, flavonoid, saponin, tannins, phenols, hydrocyanic acid, and phytic acid. The results reveal that the leaves contain an appreciable amount of nutrients, minerals, vitamins, amino acids and phytochemicals, and low levels of toxicants (Kachiguma et al., 2015). This suggests that the leaves that the community people eat are directly related to medicinal properties.

In this context, another herbal practitioner also prioritises medicinal foods. He said:

> *Jauko (Barley) jamara laga bhaneko hoina khaa bhaneko ho babu (Babu, jamara of barley is for eating but not for wearing in the head). Before eating, we used to pests the Besar (Turmeric) on the outer surface of meat; it kills skin disease and makes the meat eatable. If we paste the Ghee of local cows, it makes the body strong, and if we daily eat the cows' ghee, it provides energy and we live longer without eating any type of medicine*

Besides food, the community people use sheep's ghee to treat the fire burn. They use the hen's fat and the egg's inner membrane to treat the fire burn. In an interview, a rural student who was studying now in district headquarters added:

> *Mero amale garmi huda kerako(root of banana) jara kutera khuhaunuhuntyo ra pet fulida ra apach huda timmur, kharani pani ra lasun khana dinu huntyo ra yesle thik pani garthyo tara bazarma ta medical ausadhi nai prayog garinxa*. (When I was sick at home, my mother fed me banana roots to treat hotness. She used to feed us timmur, kharani pani and garlic for abdomen pain and swelling, which gave me relief, but nowadays, we use allopathic medicine bought from the market)

All the experiences of indigenous peoples, local communities, and students indicate that they applied for locally available medicines as traditional knowledge. However, teachers, curriculum experts and the textbook writer did not value such community knowledge. They never attempted to see the scientific justification of the food substances of the people and teach them accordingly. Schools never tried to research indigenous peoples and local communities' traditional knowledge, skills and practice for scientific explanation through research and innovation mentioned in

National and international treaties, conventions and agreements. As mentioned in the Constitution of Nepal 2015, the local government should forward scientific research and innovation to preserve such cultural and community knowledge by collaborating with national-level research institutions such as Research Center for Applied Science and Technology.

Medicinal Science in Herbal Use

The Atharvaveda mentioned more than 125 herbal plants for preventing and curing the disease of the human body (Prasad, 2000). Out of them, local people, students, and teachers used some herbal plants as medicine. The table below shows the list of the medicinal plants that the people used for treatment in the study locations:

Table 4 *Herbs Used by the Local People for Medicinal Purposes*

The common namees of herbal plants used by participants	Scientific names with families	Local use for medicine	Pharmacological/phytochemical analysis of the local herbs		
			antifungal	antiseptic	antibiotics
Tulasi	*Ocimum tenuiflorum* Lamiaceae	common cold and Asthma, control the sperm	antifungal	antiseptic	antibiotic
Tejpatta Tejapatra/Teja pat	*Cinnamomum tamala* Lauraceae	Common cold	antifungal	antiseptic	antibiotic
Kaphal Katphala	*Myrica esculenla* Myricaceae	To treat the ragatmasi(Aam arakta/ आउँ वा रगतमासी), stomach pain		bark is antiseptic	antibiotic

Akshbeli आकाशवल्ली, आकाशबेली, अमरलता, अमरबेली	*Ictens/Dodders cuscuta reflexa* Convolvulaceae	For treatment of jundice/ पित्तनाशक कफनाशक आमविकारनाशक Astringent, Carminative, Anthelmintic			antibiotic
Dubo दुर्वा	*Cynodon dactylon* Poaceae	Cancer cure, reduce depression Haemorrhage, Haematuria. DropsyBurning sensation वीर्यवर्द्धक, सन्तानकारक		antiseptic	antibiotic
Panni amala भुइँअमला, भूम्यामलकी	*Nephrolepis cordifolia* *Nephrolepidaceae*	Jundish/Jaundice			antibiotic
Guava अमृतफलम् बीजपुरम्	*Psidium guajava* Myrtaceae	Inflammation, diabetes, hypertension, diarrhoea, pain relief		antiseptic	antibiotic
Khirro/ कुटज	*Falconeria insignis* Euphorbiaceae	khil palteko, pilo		antiseptic	antibiotic
Siudi / स्नुही	*Euphorbia royleana* Euphorbiaceae	Khil palteko and abdomin pain	antifungal	antiseptic	antibiotic
Tatelo/ श्योनाक	*Oroxylum indicum* Bignoniaceae	Mussles joint	antifungal		
Bark of Chilaune सुरपुन्नाग	*Schima wallichii* *Theaceae*	Wound treatment, fever	antifungal		
Ashuro/Asuro वासा	*Justacia adhatoda* Acanthaceae	Relief cough, fever,		antiseptic	

Chilli/ कटुवीरा	*Capsicum frutescens* Solanaceae	Khil palteko, pillo	antifungal		
Ranisinka	*Aleuritopteris bicolor* Pteridaceae	as ayurbedic herbs			antibiotic
Belpatra/ बिल्वपत्र	*Aegle marmelos* Rutaceae	Treatmet of khoki	antifungal	antiseptic	
Bhang/ भंगा	*Cannabis sativa* Cannabaceae	Abdomen pain, energiter	antifungal		antibiotic
Tanki/ काञ्चनार	*Bauhinia purpurea* Fabaceae	Asthama, abdomen pain			antibiotic
Aakh/ अर्क	*Calotropis gigantean* Apocynaceae	Bath disease		antiseptic	antibiotic
Kabhro/ अश्मन्तक	*Ficus lacor* Moraceae	Ulcer, gargle in Salivation	antifungal	antiseptic	
Dumri/उदुम्बर	*Ficus racemosa Moraceae*	Abdomen pain			antibiotic
Bar /बर	*Ficus Bengalensis Moraceae*	diabetes, vomiting		antiseptic	
Pipaal/अश्वत्थ	*Ficus religiosa Moraceae*	skin diseases,	antifungal	antiseptic	
Nimaro	*Ficus roxburghii Moraceae*	Body burning			

Byadulo	*Ficus sarmentosa Moraceae*	As medicine			
Nirmasi	*Delphinium denudatum* Ranunculaceae	Digest food		antiseptic	antibiotic
Okhar/ अक्षोट	*Juglans regia* Juglandaceae	wound treatment	antifungal		
Barrow/Barro विभीतक	*Terminalia bellirica* Combretaceae	To treat the khoki		antiseptic	antibiotic
Titepati/ सुरपर्ण	*Artemisia vulgaris* Asteraceae	Bathing, allergy treatment		antiseptic	antibiotic
Neem/ निम्ब	*Azadirachta indica* Meliaceae	Common cold, Ashama	antifungal		antibiotic
Gurjo/ गुडूची	*Tinospora sinensis* Menispermaceae	Digestion			antibiotic
Lude/ तण्डुलीयक	*Amaranthus retroflexus* Amaranthaceae	Urine clear,	antifungal		
Ginger/ शृंगवेर	*Zingiber officinale* Zingiberaceae	Asthma, common cold, cough, tuberculosis	antifungal		antibiotic
Gheukumari कुमारी, गेहकन्या	*Aloe barbadensis* Liliacea	To treat the pain, bubbles and pimples of the body		antiseptic	antibiotic
Ban lasun	*Lilium nepalense* Liliacea	To kill Juka			antibiotic

Timur/ तुम्बुरु	*Zanthoxylum armatum* Rutaceae	Abdomen pain, chronic diseases	antifungal	antiseptic	antibiotic
Chari amilo/ चांगेरी	*Oxalis corniculate* Oxalidaceae	Fever	antifungal	Antiseptic	
Chillo Batulpate पाठा, अम्वष्ठा गुदेरगानो,गुजर गानो	*Cissampelos pareira* Menispermaceae	Khoki			antibiotic
Amala आमलकी	*Phyllanthus emblica* Euphorbeaceae	To treat the khoki		antiseptic	antibiotic
Turmeric/ हरिद्रा	*Curcuma anguslifolia* Zingiberaceae	Kill the skin diseases, common cold,	antifungal	antiseptic	antibiotic
Alaichi बृहदेला, एला	*Amomum subulatum* Zingiberaceae	Food digest, treat the pirro		Antiseptic	antibiotic
Nirmasi/ निर्मसी(विष) निर्विषी(नीलो विष)	*Delphinium denundatum* Ranunculaceae	Begar and food poison	antifungal	antiseptic	
Ghodtapre मण्डूकपर्णी	*Centella asiatica* Umbelliferae	To treat the khoki of fatty substances			antibiotic
Goban /Gogan गोगन	*Saurauia nepaensis/napaulensis* Actinidiaceae	To remove the body burning			
Yaiselu मांसरोहिणी	*Rubus elipticus* Rosaceae	Khoki, bodi burning		antiseptic	
Satuwa सेतो फुल्ने वचा श्वेतवचा, हैमवती	*Paris polyphylla* Melanthiaceae	Treat the wound		antiseptic	

Pachaule/पञ्चाङ्गुल सालमपञ्जा, हत्ता	*Dactylorhiza hatagirea* Orchidaceae	Burn of fire and tret the cut place	Antiseptic	
Harsul/ अस्थिसंहारी हडचूर, हडजोड	*Cissus quadrangularis* Vitaceae	To treat the broken part of the body	Antiseptic	
Dhaturo/ धत्तूर	*Dhatura stramonium* Solanaceae	Use both headache and abdomen pain	Antibiotic	
Yarsagumba	*Ophiocordyceps sinensis* Ophiocordycipitaceae	Use as the energy source		
Lemon/ निम्बुक	*Citrus limon* Rutaceae	Gastric treatment	antiseptic	antibiotic
Harrow/Harro हरीतकी	*Terminalia chebula Chebulic myrobalan* Combretaceae	To treat the khoki	antiseptic	

Source: Field data and IUCN (2000)

My participants used these herbal medicines for their treatment at the local level. Phytochemical analysis of locally available plants showed that most of them were antifungal, antiseptic and antibiotic characteristics (the detail is given in appendix 5). It was proved by the two Ethnobotanists Cox and Balick (1994). They argued that most of the Ethnobotanical plants consist of antiviral, antifungal antiflammatory activity and anticancer properties that need in the pharmaceutical arsenal (Cox & Balick, 1994). More research is needed about the study of these herbal medicines at the school and university level to explore the inherent knowledge of local herbalists, Vaidhya, and students.

In this context, I explored herbal medicinal practices among local people and students. A local herbalist Bir Bahadur Gurung said:

> *During cold, we suggest to drink the juice of Tulasi and Tejpatta mixed with honey for the betterment of common cold and asthma. If blood is seen in stool (ie ragatmasi parda) we suggest drinking the juice of Kaphal bark in a fixed quantity considering the patient's age. If someone has a mouth wound and cuts any part of the body, we suggest eating fidkiri(locally available salt) as medicine which kills the fungus and stops the flow of blood. Aksashbeli is another important medicine we suggest to treat Jaundice (icterus). Bark and root of Goban, Root and Munta of Yaiselu, Ashuroko Munta and Rani Sinka/Damkane are also recommended to treat many diseases such as khoki, abdomen pain and treat body burning. Like that Satuwa is used to treat the wound and Pachaule is used to treat the burn of fire and help join cut places.*

All the medicinal plants used by local practitioners consist of antibiotics, antiseptic, and antifungal characters, which is listed in table 6. However, teachers, curricular specialists, and textbook writers were not serious about incorporating this knowledge into the text and their pedagogical process by transforming into new generation. However, as said by Cox and Balick (1994), this knowledge is disappeared whenever the knowledge holders have died. In this context, a local herbal practitioner, Krishna Dhakal mentioned his experience in the following ways:

> *We used to join the breakdown of human bodies using the local materials eg Anati chamalko pitho and Harsul mixed and cooked, and then it is pasted on the broken part with covering clothes then covered with the bamboos stick considering the area of the body part. One month later, it came in its previous condition.*

Another local agriculturalist and herbalist named Lok Prasad Amgai, having inhabitant Barpak- Suliko-4, Saurpani, also expressed his experience with the use of herbal medicine. He said:

> *Dubo (Cynodon dactylon) is found around us if we used to drink the juice of Dubo regularly; it clears the blood, reduces depression of people and cures cancer also. Another famous medicine in wetland areas is Pani- Amala (Nephrolepis cordifolia), a useful and chief local medicine for the treatment of Jundish. If we drank two spoonfuls of Tulashi juice daily, we would not need family planning.*

Krishna Prasad Dhakal further added that

> *We can use locally found Guava (Psidium guajava) leaves and bark to treat many diseases such as inflammation, diabetes, hypertension, wounds, pain relief, fever, diarrhoea, lung diseases, and ulcer. If we paste the Tatala, it helps join muscles of the cut part. Khoto of Chilaune (prepared by cooking the bark of Chilaune) and Juice of Citrus (called Chook Amilo) are used to treat the body's wounds. The milk of Khirro and Sihudi are used to treat the Khil Palteko. Sihudiko Gudi is used to feed abdomen pain which makes relief recently. Chilli and the milk of Ban khirro are also used to treat the Pilo. Like that bark of Belauti(Guava) for Gano, Bark of Bohori, Ranisinka, Belpatra and Tanki can use to treat the Asthama and abdomen pain. The Ganja (Cannabis Sativa) is used to treat fever including abdomen pain in men. It kills the abdomen disease and removes the cold (chiso hatauna) of cows, goats and buffaloes. A small quantity of Bhang and Dhaturo also can be used as medicine. The milk of Aak (Calotropis gigantea) is used to treat the bath disease. Like that, if we cook the mixture of the bark of nonflowering (but*

having fruits) plants such as Kapro, Dumri, Bar, Pipaal, Swami, Nimaro, Byadulo… are used to treat whole body diseases.

The experience above shows that local people know to use herbal medicine. However, school teachers never use these people as resource persons. As said by Cox and Balick (1994), they can use as colleagues, guides and teachers in our learning institution.

I found that school students knew local herbal medicinal knowledge, which they learned from their elders, observing their daily practices of treating different diseases. But there is lacking intellectual property rights for this knowledge who have used it in their everyday life. In this context, a rural student Rajan Gurung studying at the district headquarters school said:

My grandmother used to feed us Nirmasi in abdomen pain which helped us to digest food and kill the bacteria. She used the cover of Okhar[walnut](Juglans regia) when there was a wound in our mouth. She mixed Fidkiri and Turmeric into hot water and used it to treat the wound on the mouth and neck. Like that leaves of Neem, Guava, Titepati and Ashuro were boiled and given to us to treat diseases such as common cold, Asmatha and reduce the pressure. Not only that she used Gurjo to develop digestive power and to make the body healthy. If we could not urinate well, she would feed us roots of Lude saag (Amaranthus spinosus) to clear it.

In this context, I found that the scientific value of herbal plants Ashuro and Titepati aroused issues among the students. They used the whole plant of Ashuro as an ingredient for numerous popular formulations including cough syrup used incombination with Ginger (*Zingiber officinale*) and Tulsi (*Ocimum sanctum*) and these things act as expectorant and antispasmodic (Dhankar et al, 2011). It is a

primary herb of the ayurvedic system used in the treatment of cough, bronchitis, asthma and symptoms of common cold, or treats cold, cough, asthma and tuberculosis (Dhankar et al., 2011). A wide range of phytochemical constituents has been isolated from *J. adhatoda (*Ashuro*)* which possesses properties like antitussive, abortifacient, antimicrobial, cardiovascular protection, anticholinesterase, anti-inflammatory and other important activities. This plant has medicinal value because of the presence of small doses of active compounds which produce physiological actions in the human and animal body (Dhankar et al., 2011). It also consists of minerals necessary for the human body's metabolic activation. Essential oil of *A.indica (*Titepati*)* has shown anticancer activity in human cell lines of breast cancer, hepatocarcinoma, lung cancer and colon cancer. Moreover, it consists of Antidiabetic, anti-inflammatory and anti-helminthic properties (Nahid et al., 2017). It also consists of minerals that are required for the human body.

I conducted a group discussion/sharing with the students of Mahendra Secondary School Kundur studying in grades eight and ten. Three students from grades eight and four from class ten participated in the discussion. In class eight, students represented different geographical areas and cultural groups. In the discussion, I noticed that students were more aware of the use of herbal medicine than their teachers. During the focus group discussion, the students said:

> *Gheukumari (Aloe vera) and tomato are used to treat the fire pain, save the body to be hot and delete the bubble of the face, Ashura and Neem are used to treat the Khoki(caugh), Yarsagumba provides us energy, Gurgos an antibiotic, Leaves of Amba (guava) are used to treat the abdomen pain, Ban Lasun (wild garlic)is used to treat/kill the Juka (roundworm) of our abdomen, Timmur for saving the seeds from disease and Alaichi is also used to treat the chronic disease.*

They also added:

> *Chari amilo is used to treat fever, Alovera is used to treat the effect of the body burning (garmi niko parna), poleko (burning) and to remove the pimples (gatha guthi and dag of bady parts), kharani pani and juice of Leamon are used to treat the abdomen pain (gastric), damkaneko pat, belpatra and ghodtapre are used to treat the khoki; harrow, barrow and amala are used to treat the different types of disease. Chillo batulpate is used to treat the khoki(caugh) due to the use of the fatty substance.*

Students' knowledge of herbal medicine aroused some questions: why do we not teach such medicinal content in the school science curriculum? Why do the school not use such knowledgeable people as the resource person for science teaching at school and college? Why do we not do scientific verification of the indigenous/locally used medicine and encourage students? How can we transfer the local medicinal knowledge to the new generations?

To search for the answers to the above questions, I discussed with the teachers, curriculum designer, and textbook writer. The information that I received from them is given in their own words:

> Teachers: *Homeopathy and Ayurvedic treatment systems are better to implement in the school science curriculum, but it is difficult for teachers and students to teach the use of herbs for medicinal purposes. In fact, we do not know the details. But we expect to include local herbal medicine's general introduction and use.*
>
> Curriculum designers: *We have included some medicinal plants in the science curriculum. The Ayurvedic treatment system is included in the health curriculum of class six as indicated by the government of Nepal. We can include local science in the curriculum if it is proven as science by NAST and the Botanical society.*

Textbook writers: *Local Ayurvedic medicines can be used to protect and treat diseases, but donor agencies decide most of the contents in the curriculum approval process. We include in textbooks only the contents mentioned in the curriculum. We can just mention such concepts as project work for students.*

From the focused group discussion/ sharing with the participants, I came up with the knowledge that teachers know about the value of local Ayurvedic medicine and treatment systems but were unable to use in the textbooks or use them while teaching, connecting with the present school science curriculum. They neither invite the local healers/ knowledge holder into their classroom nor informal discus with them about their use. I also noted that textbook writers knew the importance of Panchagavya medicine and local food, but they could not go outside the formal system of textbook writing. Local government and schools could not find organizing the research work and innovation on the indigenous peoples and local communities' practice for sustainable use of natural resources.

Medicinal Ingredients in HomaYajna Materials

The Charu (mixture of different ingredients), which is used in Homadi Yajna, produces fumes and shows antimicrobial activities (Deogade, 2020). Deogade further argued that various materials used as Homadi Yajna, like cow dung cake, rice, ghee, and medicinal plants either as a Charu, firewood, or Samidha, support the prevention and control of various communicable diseases. If Homa (Agnihotra) is regularly performed, it creates a clean, nutritional, and medicinal atmosphere which is helpful for the reduction of physical/mental diseases. Therefore, it is applied in Ayurveda for therapeutic purposes and is also known as Homa therapy (Deogade, 2020). Regarding the number of medicinal plants used in Homadi Yajna, Kumar et al. (2015) and Deogade (2020) mentioned 26 types. These plants are presented in Table 7.

Table 5 *Medicinal Plants Used in Homadi Yajna*

The community used medicinal plants for Homadi Yajna	Kumar et al.,'s version	Deogade's version
Sal, Tulashi, Pines, Bel, Chap, Aapa, Palas, Champa, Dhaturo, Sunakhari and Dhupi, Rice, Til, Barley, Kush, Local smelling flowers	Indian mallow, Babul, Khair, Aamarga, Lebbeck/ flea tree, Akar-kara, Palash, Amaltas, Coffee senna, Tun, Himalayan Cedar/Deodar, Bharngi, Lasoda, Gular, Peepal, Mulahathi, Chemali, Aam, Bakul, Night-flowering Jasmine, Zaitun, Miswak, Harad, Giloe, Bitterleaf and Nugundi	Udumbara, Agaru, Khadir, Ashwattha, Gguggulu, Nyagrodha, Chandana, Aamra, Ark, Haridra, Nyagrodha, Narikela, Palash, Plaksh, Bilva, Doorva, Apamarga, Deodaru, Haritaki, Shami, Darbha, Bakul, Babul, Parijat, Nirgundi, Aragwadha

The physio-chemical analysis of these medicinal plants used in Homadi Yajna gives a clue that Homadi Yajna uses Atomic Absorption Spectroscopy (AAS) and Flame Photometry (FP) for quantitative estimation of calcium (Ca), phosphorus (P), potassium (K), magnesium (Mg), iron (Fe), manganese (Mn), zinc (Zn) and nickel (Ni) in plants ash. This ash is a necessary inorganic substance for the body to be strong and healthy. Hydrogen sulphide (H_2S) and nitric oxide (NO) are released due to cows' dung and ghee (hump-backed Indian cow) during the *Yajnya* process (Abhang & Pathade, 2017). Both H_2S and NO act as bio-signaler and are involved in the growth of new blood vessels, control of Alzheimer's disease, etc. Cow ghee provides all fat-soluble vitamins like A, D, E and K (Abhang & Pathade, 2017).

According to Abhang and Pathade (2017), the ash of Homadi Yajna works is an anti-ageing, antioxidant agent that improves immunity, secretes biliary lipids, and controls cholesterol levels in the blood. Agnihotra ash also contains a high amount of Zn, which works as the curative effect of skin infection and protects from ultraviolet radiation (Abhang & Pathade, 2017). Similarly, they consist of high amount of Mg and Ca, which work as binding agents of ribosomal particles where protein synthesis takes place; support blood coagulation, neuromuscular transmission, and muscle contraction (Kumar et al., 2015). They consist of a high amount of Fe that helps transport of oxygen to the tissues (haemoglobin) and involves cellular respiration processes (Kumar et al., 2015).

The presence of manganese is essential for the normal functioning of the nervous system and bone metabolism. Agnihotra ash shows good antimicrobial and antifungal activity. Apart from this, ash provides the necessary trace elements and metals required in different stages of the wound healing process (Abhang & Pathade, 2017). Agnihotra renews the cells, tissues, and organs and has wholesome effects on circulatory, pulmonary, and nervous systems (Abhang & Pathade, 2017). The antimicrobial nanoparticles which are released during the burning of Agnihotra materials, act as fumigants and herbal drugs.

Another study conducted by Chaube et al. (2020) concluded that medicinal smoke significantly removes human pathogenic microbes. The vaporization and sublimation of ingredients of Hawansamagri deliver a vast amount of therapeutic and environmental benefits. The chemical of the herbal/ plant medicinal preparations in burning in Yajna leads to the release of medicinal phytochemicals, which affect many endogenous chemicals including the hormonal axis (Chaube et al., 2020). They further claimed that these plants' fumes help purify the air and have anti-epileptic,

antipyretic, anti-fungal, antibacterial, anti-microbial, anti-ulcer, antispasmodic, immunostimulant, antioxidant, anticancer, anticonvulsant action, immune booster and anti-inflammatory action (Chaube et al., 2020). Regular chanting of hymns helps in purifying the mind. Improvement has been found in digestion, hypertension, mental agitation, and sleeping after chanting the Mantras (Chaube et al., 2020).

It indicates that people practice Homadi Yajna's knowledge in society as the local medicine. However, the frequency of Yajna is decreasing. These days, several questions remain unanswered, such as (a) how many science teachers are knowledgeable about it? (b) even if they are knowledgeable, how often do they share it with students? This study shows that none of the teachers were aware of it. Hence they were not teaching this to the students.

The above scenario indicates medicinal knowledge in Homadi Yajna, but many people are unaware of it. The following excerpts of the informants illustrate the situation.

> Teachers: *We used Homadi ash as an antiseptic and used to eat as a base for neutralizing the acidity of the body system. Used as medicine to kill pesticides in the agricultural field, but we do not know their chemical composition, what it consists of, and how it functions. It is used as a cultural practice but not included in the science curriculum. Including it in the science curriculum could be better to teach it to our students for more information.*
>
> Students: *We never got opportunities to study Homadi Yajna's use and medicinal ingredients.*
>
> Curriculum designers: *We see the national and international demands and curriculum guidelines in curriculum writing. I am positive about including such knowledge doing scientific research, but my single decision cannot be*

final in the curriculum writing and finalizing process. If authentic resources are found, we can discuss them in the curriculum writing and approval process.

Textbook writers: *We do not have validated knowledge about Homadi Yajna and its medicinal ingredients, so we cannot go outside the curriculum in textbook writing.*

The views of my participants indicated that teachers know about medicinal values consisting of fumes and ash of Homadi Yajna and used to treat different diseases without knowing its scientific justification. Students did not get the opportunity to understand Homadi Yajna's use and its ash's medicinal value to study them in detail. Curriculum designers cannot decide what content can include in the science curriculum because they have to follow proven content in Western Modern Science. Textbook writers do not adequately know the medicinal ingredients of Homadi Samagri and the ash of Homa Yajna. The excerpts above could pave the road that could be motivating to teachers and students to make them scientifically inquisitive through problem-posing questions, project work, search engines, or experiments to gain knowledge of this cultural ritual. To do that, the research centre could be established in each Palika as indicated by National Education Policy 2076 and National Science, Technology and Innovation Polity 2076 for more validation and to provide the patent rights of panchagavya.

Chapter IX

Findings and Discussions

Introduction

This chapter draws findings based on philosophical, spiritual and scientific justification of the Vedic and Ethno science, their connections with school-level curriculum, and interpretation of participants' arguments with modern scientific justification guided by the study's research questions. Then it discusses these findings connecting with referent theories and other relevant literature based on the braiding design and decolonizing research paradigm.

Findings of the Study

Based on the analysis and interpretation of scientific proof of cultural people in Ethnoecology, Ethnoagriculture and Ethnomedicine, I have derived some findings. The field observation and scientific proof indicated that our ancestors' Vedic and cultural practices were passed on to society members and are found to be a form of folk science. The field knowledge related to Ethno science has tried to verify the modern scientific worldview relating to a community's Vedic and cultural knowledge. The findings of my study are presented below.

Socio-Ecological Practices and Their Scientific Justification

I found that the Vedic literature asserts that peace of the universe means not only peace in the sky, earth, trees, gods, human beings and water; there should be rational peace in the universe. For this, the Vedic seers did the Yajna and chanted the Vedic mantra, which expanded the whole universe through the subtle vibration of the sound. They use *charu* (a mixture of ghee, jau, til). If put in the pinewood fire, this mixture reduces the pollutants, supports rainfall, and clears the environment (Hagelin, 1989). Maharshi Mahesh University's research shows that it reduces global warming,

reduces microbial growth in air, helps vanish the Malaria parasite and Pathogenic Bacteria, increases plant growth, and purifies the surrounding air producing quality rain (Hagelin, 1989).

The burning of cow ghee with homaYajna Samagrai produces propylene oxide, supporting the rainfall and the maintenance of the ecology around us (Dvivedi, 2004). Ethylene oxide and formaldehyde support to kill unwanted bacterial fungi and viruses in the environment (Dvivedi, 2004). It indicates that homa Yajna samagri and pure cow ghee consisted of medicinal and ecological value. Knowledge like this to be linked with the topics on food, shelter, and herbal plants under the chapters environment and its balance (chapter 22) and environment degradation and its conservation (chapter 23) of SE subject.

Hindu rituals consider Tulashi, Bell, Sami, Asoganda, Amala, Ashoka, Aakh, Neem, Coconut, Banana, Bamboos other flowering plants to consist of God and Godness. The Bastusastra recommended that they plant trees near a house to provide peace and prosperity. Scientific justification shows that they provide a huge amount of oxygen, working as an antiseptic, reducing pollutants nearby houses, bringing peace and harmony to the residential area, and removing the negativities and bitterness. However, more research and innovation are required on these ritual materials at the local levels.

Like that, the spiritual worship of Nagadevata, Bhume devata and Vayu devata ultimately supported the preservation of the earth, water and wind and their purification. This knowledge supports ecological balance and sustainable development in the world. The Vedic sound pronounced in the Yajna period supported minimizing air pollution, protecting plants from diseases, increasing seeds germination, providing high crop yield and supports for ecological balance. So it

could be the discursive area within the school science curriculum. Teachers can forward research work on the impact of the Yajna program on pollution control and biodiversity conservation.

From the above finding, I can conclude that the cultural practices are based on socio-ecological justice-based transformative eco-pedagogy and knowingly or unknowingly being supportive of the preservation of our natural world as well as maintaining world peace which was justified by modern science. But science teachers and students could not become aware of these traditional practices to sustain ecological balance; neither they try to see the connections of it nor challenge this finding in school science learning. Even the curriculum designers and the textbook writers were skeptical to accept and search for the knowledge, as mentioned earlier as science to maintain ecological balance using transformative eco-pedagogy.

Sustainable Agriculture Practice of Local People

This study found that Vedic sounds and modern science comply with each other for better output in agriculture. The Vedic and cultural practice of local people shows that their knowledge supports to save soil, the environment and their health. Research of Chivukula and Ramaswamy (2014) showed that plants grow faster, give good products when the Vedic sounds are chanted. This finding is related to the Yajurvedic hymns which mention that solar energy provides longevity, health, and prosperity to human beings, including all the living beings in the universe (YV, 36.24). This suggests that the Vedic sound is to be linked while teaching the chapter about environmental degradation and its preservation and minimizing the climate change effect on the earth. Moreover, it to be connected to food preparation under the OBT subject.

Scientific study shows that cow dung contains microorganisms such as *Acinetobacter*, *Bacillus*, *Pseudomonas*, *Serratia* and *Alcaligenes* spp. (Gupta et al.,

2016). These microorganisms make the land fertile, provide nutrients to the plants and trees. These contents help plants and trees nutrients to grow and give more fruits and grains. At the same time, it helps reduce microbial degradation of pollutants and also reduces hazardous cancer-causing radiotoxic heavy metal strontium. Scientifically proved that cow dung and urine consisted of high-quality organic fertilizer, insecticide and pesticide and its mixture (lignocellulosic biomass) consists of lignin (energy storage as well as attract the carbon dioxide), cellulose and hemicelluloses, which work as the supportive for fertilizer. The most important lignin in cow dung and urine consists of ethylene, propylene and butadiene, which is to be worked as protective of the plant by absorbing the hazardous heavy metals and organic pollutants from land due to the presence of functional groups -OH and -COOH (Jazi et al., 2019). Scientific research and innovation is to be conducted by the local government and school level on the locally available cow dung and urine and tried to take the patent right for its validation and international standardization.

Modern science found different types of chemical fertilizers such as Ammonium Nitrate (NH4NO3), Ammonium Sulfate (NH4)2SO4), Calcium Ammonium Nitrate (5Ca(NO3)2-NH4NO3*10H2O), Magnesium Nitrate (Mg(NO3)2), Magnesium Sulfate (MgSO4), Mono Ammonium Phosphate (MAP)(NH4H2PO4), Mono Potassium Phosphate (MKP)**(**KH2PO4), Potassium Nitrate (KNO3), Potassium Sulfate (K2SO4), Urea (CO(NH2)2), Potassium Chloride **(**KCl), Copper Sulfate (CuSO4*5H2O) and Zinc Sulfate (ZnSO4*7H2O).

The discussion above shows that cow dung and urine contain more nutrient substances than chemical fertilizers. The scientific research found that it consists of 24 different minerals like Nitrogen, Potassium, and trace amounts of Sulphur, Iron,

Magnesium, Calcium, Copper, Cobalt and Manganese, which are required for higher crop yield. They work as fertilizers and pesticides, increasing soil pH, water holding capacity, and crop and vegetable yield.

People utilized *Justicia adhatoda* (Ashuro), *Artemisia indica* (Titepati) and *Wrightia arborea* (Khirro) to increase the productivity of crops as well as pest control as traditional methods. They believed these plants support the reduction of chemical fertilizer and prevent the soil as prayed as Prithivi shanti. It is scientifically proven that these plants and herbs work as repellents, insecticidal agents, antifeedants, and pest controllers. They consist of insect repellent, anti-insecticidal, microbial antifungal, skin ailment, antifeedant, anti-bacterial, anti-inflammatory, anti-cancer and anti-oxidant. They provide nutrients required for plants, such as Nitrogen, Potash, Phosphorus, Sulpher, and Calcium to increase the productivity of the soil without harming health, soil texture and ecology.

Participants in the study area realized that chemical fertilizers were gradually destroying the soil of their lands, ecology and human health. The scientific study also shows that it is still questionable that Green manure, cow dung and urine consist of only 24 minerals or more than that to preserve the soil. So above mentioned green manures and cow dung and urine are used as organic fertilizers and work as medicine, insecticides and fungicides and support sustainable farming as mentioned by the secretariat of the Convention of Biological Diversity (2005). Knowledge like this is to be linked with both environment related as well as the medicine and agriculture chapter of SE, and OBT subjects. But the teachers were not found doing so even when they were talking about the STEAM approach to teaching.

I found that teachers, students, textbook writers, and curriculum designers were attracted to organic farming for better human health and biodiversity

maintenance using transformative agro pedagogy. However, they were not asking students to relate the traditional farming in the community with the school science by showing the resemblance between organic manure (Ashuro, Khirro and Titepati), cow dung and urine, and chemical fertilizer's property for soil preservation.

Local Epistemology on Use of Medicinal Ingredients

This study found that ancient people were protecting plants to generate more oxygen. They believed that Tulasi, Pudina, Bell, Sami, Asoganda, Amala, Ashoka, Aakh, Neem, Coconut, Banana, Bamboos, Pipal and other plants and trees are part of divine banaspati (plant) and used for medicinal purposes. They plant these vegetation around their homes. I also found that scientific study shows that these plants and trees absorb solar and lunar rays, conserve energy, and have medicinal characteristics (Shastri, 2076 BS). They make their surroundings full of oxygen, work as antiseptic, reduce pollutants nearby houses, bring peace and harmony to the residential area, remove the negativities and bitterness, and support creating to be healthy for us. Local people have planted Tulashi, Bar, Neem and Peepal plants nearby their houses, preserved and used for spiritual and local medicinal purposes.

Shatri (2076 BS) mentioned that the Atharvaveda had listed 125 herbal plants. These plants have been used for the prevention and cure of human health. Medicinal studies of the aforementioned plants and trees show they are antitoxic, nutritive, digestive, and many more (Shatri, 2076 BS). Out of these plants and herbs, I found that people in the research site have used 55 local herbs, vegetables and fruits (see appendix 5) for antiseptic, antifungal, antibiotic and antioxidant agromedicine. Local vegetables Nihuro, Karkalo, lude sag including local foods til, jau, fapar that they use consist of medicinal value for healthier human life. But these things were not discussed in the classroom or mentioned in the curriculum and the textbooks. The

people in my field were found using these plants and herbs in the form of what Hagelin (1989) said, "quantum unified field" as agro medicine to reduce tri-dosha (baat, pitta, and cough).

The Vedic seers identified cow milk, ghee, yoghurt, dung, and urine as Panchagavya. They used it as spiritual material to purify their surroundings. Local people used it as vitamin and energy booster. Scientific analysis shows that milk consists of fats, proteins, lactose, carbohydrates, minerals; ghee consists of free fatty acids, phospholipids, sterol esters, fat-soluble vitamins, casein, phosphorus, iron, etc; yoghurt consists of lactic acid and free fatty acid instead of protein with that found in cow milk; dung consists of minerals, proteins, enzymes, microorganisms and pollutant absorber hydroxyl group (e.g. lignin); and urine consists of urea, minerals, 24 types of mineral salts, hormones and enzymes required for both plants and human beings. However, there could not be scientific research and innovation on the mentioned medicinal materials at the local and school levels.

Science (Gupta et al., 2016) shows that panchagavya with a mixture of Jautil, Kush and Dubo are beneficial for human beings due to the presence of minerals, nutrition, amino acids, proteins, vitamins and hormones as essential substances (immunity booster). It is used for the treatment of diseases like flu, allergies, colds, cough, asthma, renal disorders, gastrointestinal tract disorders, acidity, ulcer, wound healing, heart diseases, skin infections, tuberculosis, chickenpox, and several other bacterial and viral infections (Gupta et al., 2016). Moreover, they function as an antiepileptic, anti-depressant, and nootropic activity and the brain activates and treatment of mental illness (Gupta et al., 2016). The above scientific arguments indicate that Panchagavya mixed with other substances is to be applied as a medicine to treat several diseases, keep the environment clean, and work as an antiseptic and

insecticide. So local people used them spiritually as sacred substances; however, modern science justified that it has consisted of medicinal properties.

Moreover, the Ash of Homadi Yajna works as an anti-ageing, antioxidant agent that improves immunity, transport of oxygen in body tissues, activates bond metabolism, removes human pathogenic microbes, secretes biliary lipids and controls the levels of cholesterol in the blood (Abhang & Pathade., 2017; Chaube et al., 2020). The study also shows that completely burned fumes of Homadi materials support the purifying of the air and have anti-epileptic, antipyretic, anti-fungal, antibacterial, anti-microbial, anti-ulcer, antispasmodic, immune stimulant, antioxidant, anticancer, anticonvulsant action, immune booster and anti-inflammatory action. Different scientific justification shows that Homa Yajna samagri and its ash consist of ecological, medicinal, and agricultural value. The locally applied materials consist of interdisciplinary knowledge. It can link with STEAM, which is mentioned in the National Education Policy, 2076 BS.

The review of the textbooks and curriculum showed that the contents mentioned above were not included. Even the science teachers, textbook writers and curriculum designers showed reluctance in relating indigenous peoples and ancestral knowledge to the curriculum, textbooks, teacher training materials, and classroom instructions. Students use different medicinal plants at home as agro medicine but do not question their application in science learning by analyzing their scientific practices. The teacher himself did not involve and did not provide research opportunities to the students on the knowledge as mentioned earlier.

Pedagogical Connection of Three Sciences

The review of the literature showed that Vedic and Ethno science and field practices related to E- EAM are "complementary and co-existent" (McGregor, 2012). The table below shows them in an indicative way.

Table 6 *Potential Connection of Vedic and Ethno Science with School Science Curriculum of Grade 8*

Vedic science	Ethno science	School science
Vedic ecology= Content: Nature and human as gods, Peace hymn, sarve bhabantu sukhina….for biodiversity preservation, water cycle, carbon cycle, Vedic Yajna and homadi samagries as sustainable ecology; preservation of water, air, prithivi and universe; protective layer, Vedic mantra Methods: Sraban, Manan and Nididyasana Evaluation: Project work and observation of activities Vedic agriculture= Vedic foods, Vedic ploughing system, Vedic irrigation, Vedic sound for good production, use of local plants as fertilizers, Vedic agricultural tools, focus on seasonal foods and fruits Methods: Sraban and Nididyasana Evaluation: Seeing the application of knowledge Vedic medicine= Rig Vedic hymn, Yajur Vedic hymn and Athrvedic hymn, Charak Shamita, Susrupta Shamita, Soma	Ethno ecology= Content: Nagadevata for biodiversity conservation, Plantation of the tree nearby house, Deveta consist in water, land and forest; Panchagavya, Vedic mantra and its ecological impact, impact of homadi Yajna in ecology, the practice of Vedic mantra for sustainable development Methods: Involve in preservation practice of natural environment Evaluation: Observation of day-to-day events, project development on the preservation of the local environment Ethno agriculture= Local herbal plants for agricultural use, local seed preservation practice, use of cow dung and urine as agricultural purpose, Homadi ash as pesticides and as a fertilizer, seeds preservation using local pesticides, the local procedure of weeds control by burning ghaseta Methods: Fieldwork,	Ecology= Acid rain, climate change, weather and its types, water cycle, monsoon and its type, environment and biodiversity conservation, sustainable development, conservation of natural resources, greenhouse effect Methods: Not clearly identified for these contents Evaluation: project work, field observation, field experiment, formative and summative evaluation. Agriculture= study floriculture, traditional technologies, soil and natural resources conservation, animal keeping, local food preservation, production and conservation of local foods and fruits, seeds preservation, pest control, use of organic fertilizer, Methods: Not clearly identified for these contents Evaluation: Same as previous Medicine= Herbal plants,

plant, energy healing, shamanic treatment, Kundalini Yoga, treatment of Bath, Pita and Kafa; Milk, Ghee, Honey as medicine, Ayurveda, Naturopathy, Mudra chikitsa and Yog asanaMethods: Srabanan, Manan and Nididhyasana Evaluation: Observing the day-to-day activities and fieldwork	project work of agricultural practice and local manure production, observation of local field of manure construction and seeds preservation Evaluation: Field and project observation Ethno medicine= use of local 52 herbal plants, fooding plants as medicine, healing system, Yoga practice, meditation, Homadi ash, Homadi materials as medicine Methods: Involvement of herbal plant production, use of local vegetables and herbal plants as medicine, field experiment,	Yoga and aasana, local and nutrient foods and local fruits Methods: Not clearly identified for these contents Evaluation: Same as previous

From Believing to Questioning and Envisioning Pedagogy

This study found that there are sciences, non-sciences, pseudosciences, and sciences to be figured out in the religious texts and peoples' practices. This finding demands challenging questions from the students to the teachers; project work to answer these "good questions" through research, reflection, and many other ways. Additionally some efforts are needed in a well-equipped labs to test the untested religious text's saying and cultural practices of the people. A group of the logical scientists could explore the recurring procedures embedded in peoples' practices. An integrated STEAM-based research and teacher training is to be imparted for teachers support to link the Vedic, Ethno, and school science while teaching in the class.

Discussion of the Findings

Some of my findings comply with the literature, others challenge them, and some others open new avenues for further discussion. With this broad realization, I attempted to see the connections of my findings with the literature I discussed in the review chapter and with the conceptual, theoretical, and philosophical framework that I mentioned in different chapters. The discussion of my findings is organized into different topics below.

Braiding the Eastern Spiritual Knowledge, Philosophy and Daily Life with School Science

My findings show that science is everywhere, although they are disconnected. For example, Tulashi and Peepal are prayed as Devata (god) in the Vedic literature, but they are worshipped as idols in culture. On the other hand, science justified ecological and medicinal values in them, but school science devaluated them as non-science and pseudoscience. The logical argument supports that it can be braided with school science curriculum (Koirala, 2022, McGragor et al. 2018) and institutionalized in decolonization process (Chilisa, 2012) through teaching. Here, I see the importance of Comte's three stages theory to support my findings that the Vedic, Ethno and school sciences can be taught together by enabling students to see their connections, disconnections, and future connections through research and lab testing. The relational theory (Datta, 2018) that I used for data interpretation demands a pedagogical orientation to bridge these scattered sciences. My relation-seeking conceptual framework supports it.

Categorically speaking, my finding complied with Aikehhead (2006); Battiste (1986); Cajete (2000); Jegede (1995), and Seehawer (2018) for connecting the socioculturally emerged knowledge with school science curriculum. These

researchers argued that science teaching requires relational pedagogy to braid the Vedic, Ethno, and school science through collateral learning (Cajete, 2012; Jegede, 995). Comte's three stages theory that I discussed in chapters III and IV paves the way to relate eastern spirituality, the Vedic and the Upanishadic philosophy, and school science in a relational way. For example, the Vedic word jyoti (light) is considered as daivic (devine); philosophically it is viewed as the aapah (water), agni (fire), aaditya (sun) and baidyuta (thunder); and in school, we can teach it in the form of energy in school science. It also indicates that the Vedic practice (ontology) can be understood in the relational form (Comte, 2009).

This finding also supports the notion of decolonizing Western thought and indigenizing the present school science teaching (Held, 2019; Shizha, 2008, 11, 14; Smith, 2012) by using relational epistemology (Datta, 2017, 2018; Held, 2019) and braiding theory (McGregor et al., 2018; Seehawer, 2018). We can use the idea of Hatcher et al. (2009), who said, science cannot be taught in isolation: there can be the importance of the indigenous research paradigm (Chilisa, 2012; Held, 2019). In each step, we can connect/integrate school science curriculum with the sociocultural understanding of the people (Bang et al., 2016; Koirala, 2022; Mashoko, 2022; Seehawer & Breidlid, 2021) collaterally (Jegede, 1995) to let students know that sciences are there in religious literature, culture, and day to day life (Goldman et al., 2020).

Opportunity for Decolonizing Teaching and Learning Together

This study found that the Vedic and Ethno knowledge is not just spiritual and religious; they carry knowledge of agriculture, ecology, medicine, and many more. For example, pure cow product panchgavya mixed with til, kush, jau, dubo; and the burning of homa Yajana samagri provide the ecological, medicinal and agricultural

benefits and support the preservation of animate and inanimate substances of the universe. I see Comte's argument of scientific knowledge can be taken as proof here. But what we need is further research on culturally embedded science. As STEAM, we can think of VESC to teach the interconnected sciences. V stands for Vedic science, E stands for Ethnoscience, and SC stands for school science together. Research like this unveils socio-culturally generated science and provides the opportunity for the students' to learn science in a holistic way (Datta, 2017; Higgins, 2016, 2019; Snively & Corsiglia, 2000). It works in a two-prong process. The first prong connects the scattered sciences, and the second decolonizes education (Battiste, 2013).

Apart from it, decolonization prepares students and teachers for postcolonial ways of knowing and being in being and reshaping place-based relational learning (Higgins, 2016). Two folds (see Hatcher et al., 2009) curriculum design and teaching that I mentioned in the findings support decolonizing, indigenizing, enculturation and minimizing the "cognitive imperialism" (Battiste, 1986, 2010; Higgins, 2019) in learning. We can decolonise the science teaching and learning processes if we apply the epistemologically diverse and pedagogically pluralistic (Higgins, 2016) learning situation together.

A Time for Stopping the Scientific Clashes

Chapter VII discussed the relational science that emerged from the Vedic scripture, culture, and curricular contents. These contents were presented to show the clashes. Such clashes occurred (Higgins, 2016; Khupe, 2014) because they were standing side by side in the classroom. For example, the Vedic and cultural practices argued that the Vedic mantras pronounced in Homadi Yajna generate rainfall, grow seeds, and keep the environment clean. The curricular designers and textbook writers

can refer to the research carried out so far. If they are not sure of it, they can encourage students and teachers to debate whether it is science, non-science or pseudo-science. In other words, these sciences can be framed in the science curriculum (Battiste, 2013; Higgins, 2016) through dialogue, respect for pluralities, multiplicities, and diversities, thereby transferring cultural knowledge to the next generation (Datta, 2017). As this is a global concern, it requires synergized initiatives (Snively & Corsiglia, 2000) to connect different knowledge systems thematically and pedagogically to create a new wave in science.

Application of Scientifically Justified Cultural Knowledge in School Science Curriculum

The areas of the Vedic and Ethno sciences and their scientific justification have been discussed in chapter VIII. This discussion indicates that the knowledge transferred from the the Vedic period has been culturally preserved. Thus preserved knowledge can be added to the school science curriculum. For example, Titepati, Ashuro and Khiro are used locally as green manure, which consists of medicinal, organic manure, and insecticide properties. Similarly, Karkalo, Nihuro and Lude sag also consists of medicinal substances such as vegetables. Contents like this can be incorporated into teacher training, curriculum, and textbooks to relate school science with homegrown sociocultural content and the contents that came from religious texts.

It also demands teachers deliberately share the learnings from the local agricultural practitioners, ecological practitioners and medicinal practitioners in the class. The local people could share their experiences and encourage teachers to teach students by linking these sciences under what I call VESC approach. The following approach can be the invitation of the aforementioned practitioners and appreciation for their knowledge as guest teachers (Aikenhead & Elliott, 2010; Upadhyay et al.,

2021). Project work to seek culturally embedded science can be the third approach to relating students with bookish and community sciences. This requires the orientation of the teachers using relational epistemology (Datta, 2017, 2018) to value the cultural and school science curriculum together. To do so, local government, in collaboration with teacher training institutions, can reorient teachers to braid science and science-like content into the culture.

Introducing Indigenizing Methodologies in Science Teaching

There are many ways of indigenizing the present science teaching in the school. The first one is Photovoice (Higgins, 2016). Photovoice is a participatory method to capture people's life experiences and relate them to school science. The second is to include cultural knowledge in the curriculum, teaching manuals, textbooks, and teachers' professional development manuals. The third one is open listening to the people at school. The fourth one is the brainstorming session between the students and teachers.

To transfer the indigenous knowledge of local agricultural practitioners, local spiritual practitioners, local herbalists, and local shamans/ healers, the schools can invite these experts and share their culturally transformed knowledge in science class (Koirala, 2022). For example, the school can request local agricultural practitioners to share how cow, buffaloes, goats, and chicken manure can be used as fertilizers; and Titepati, Khirro, and Ashuro as pesticides and fertilizers together. Following their sharings, students will question how such manure (use of both organic and inorganic) supports the protection of the earth, environment, and human health. If we can do so, it helps to decolonize, and indigenize knowledge in a participatory way. This helps develop students' curiosity for school science by connecting it with local knowledge.

If we do so local people, students, and teachers can be developed as co-researchers (Datta, 2018). They will begin to value each others' learning in a relational way (Chilisa, 2012); it also simultaneously ensures localization, contextualization and indigenization of the education system (Wilson, 2008). Besides, it nurtures “post-critical pedagogy” (Hodgson et al., 2018) and culturally responsive science pedagogy (CRSP) (Upadhyay, 2022) in classroom teaching. In other words, teachers begin to accept local wisdom; students begin to appreciate community knowledge and automatically become critical of their science books.

Chapter X

Reflection, Conclusion and Implication

Introduction

From the analysis and interpretation of the study; and findings and discussion, I have drawn the following reflection, conclusion, and implications of this study.

Reflection

Recapitulating Chapter Organization

I used the thematic approach in my chapter organization. In chapter III, I attempted to dig out scientific notions consisting of eastern scriptures, content, methods, and evaluation that could be implemented in the school science curriculum. In chapter IV, I dug out the science-related contents, methods, and evaluation from the Vedic and eastern philosophies. In chapter V, I dug out the scientific contents relating to astronomy, cosmology, ecology, agriculture, medicine, architecture, technology and yoga, along with methods of teaching and evaluation process. In chapter VI, I searched the policy-related support for the implication of Ethno practice, Vedic knowledge, and school science curriculum together. In chapter VII, reviewing the literature, I categorized contents, methods and evaluation from the basic level to master level and compared them with the ongoing curriculum based on E-EAM. In chapter VIII, I attempted to explore the field realities of the three sciences E-EAM. I collected teachers, students, and community members' views; analyzed them from a science teaching worldview; and attempted to see their connection to the school science curriculum. In chapter IX, I drew out the findings of all chapters based on research questions and tried to connect them with the school science curriculum of grade 8. Then I presented the discussion based on Comte's three stages theory, reviewed literature, and emerged braiding design and decolonizing research paradigm.

I used Comte's three stages theory, cultural theory and collateral theory as referent theory for guiding my study. I selected those theories neither for justification nor falsification but for understanding the field from different perspectives. Based on the referent theories, I came up with the braiding design, which could be used as the theory to connect the Vedic and Ethnoscience with the school science curriculum**.**

Reflection on Epistemological Practice

When I first met my supervisor, he asked me what the area of interest for the research. I explained my tentative areas and concepts about multicultural science teaching. My supervisor suggested that if I was interested in studying the Vedic science and its cultural transformation in society and relating it to science teaching in school, it would be a better area for study. He said that it would contribute to curriculum design as well. First, he suggested I collect the books on the four Vedas and have a deeper study of those books. After reading the Vedic books of the Nepali version of the four Vedas, I became more curious about my western mindset about Vedic knowledge. Then I studied Hindi and English translations of these books. This made me realize that what I learned from school to the university level did not give the broader scientific knowledge. After studying them, I knew that major scientific knowledge was embedded within the Vedic scriptures and that it had been practised by the people in my community from immemorial time.

Based on this reflection, I drew educational themes like contents, methods and evaluation systems from the Vedic and culturally practised knowledge which was later compared with the ongoing school science curriculum. I found that science that emerged from the literature review seemed more relevant to exploring socially constructed knowledge than the current practised science curriculum.

Realizing the above context, I started my dissertation writing by questioning the contextual knowledge of my simply literate father and no literate mother’s

spiritual understanding. My query with them was how they obtained their knowledge and why their knowledge is spiritual and science I studied in school and university. Then a question arose in my mind: why community people's knowledge, use of technology and skill transformation practices were not valued as the knowledge of modern scientists? Then I studied details about the Vedic and spiritual scriptures, related books and published articles written by both easterners and westerners. I generated more ideas from them and attempted to see the science embedded within the Vedic scriptures and people in my community. Then I revised my research questions to see the connection between the Vedic science mentioned in the literature, the culturally sustained Ethnoscience of the people in my community and the present school science curriculum. In other words, my focus was to seek relational sciences regarding content, method, and evaluation.

In this context, I reviewed the literature related to different areas and drew out the science from them. My main focus was on E-EAM. After studying them, I realized that a lot of scientific knowledge was embedded within the Vedic scripture and cultural practice. Then I drew relevant contents, methods and evaluation systems from the Vedic and culturally practised knowledge. This comparative picture is presented in Figures 12 to 16 in Chapter VII.

Initially, I was guided by the constructivist/ interpretivism research paradigm, theoretical framework and phenomenological research design of the qualitative research approach. I had planned to use the semi-structural pre-design tools for data collection and fixed pre-determined tools for data collection and made the plan to analyze the data using the transcendental phenomenology approach. However, later on, I changed to post/qualitative research, decolonizing research paradigm, relational epistemology, and belief in interrelated science teaching. When I studied the Vedic

scripture, I realized that Sravana, Manana, and Nididhyasana (listen, recite, and act) are their knowledge construction process. These processes have continued in the form of cultural practices and rituals. This understanding ultimately helped me think of decolonizing current pedagogical practices.

Field Reflection

When I reached the field with semi-structured tools such as interview schedules, observation and FGI with my participants, I did not get the data I expected. Then I consulted with my supervisor and changed my strategies for the data collection process. I had changed the research paradigm I had carried in my preset mind. After studying more literature, I decided to use the decolonizing research paradigm for data collection. By decolonization, I mean reciprocity and relation-seeking tools for data generation. I developed a relational and reciprocal relationship with my participants to implement these tools, considering them as co-researchers/ knowledge developers. I used multi-paradigmatic transformative and indigenizing approaches as the methodology for information collection and analysis.

I used a hermeneutic approach to find out the scientific justification of the Vedic scripture, which supported me in identifying scientific notions that consisted of them (Crotty, 1998). I used the study's post/ qualitative and braiding design to connect with the school science curriculum and analyzed the research process's information (Denzin, 2018; McGrager et al., 2018).

Data sensing was done using the rhizomatic approach of Higgins (2014). I did not use structured tools for information collection. In other words, I collected whatever information I could with an open mind. Out of these collections, I used the required information from the participants to justify/ falsify the scientific arguments. An iterative and relational process was used for the information collection and

analysis. I never felt difficulty with participants in the process of information collection. The school and the community environments supported me in the information collection process (detail is given in the methodology section). I contacted each participant face to face. When I could not contact them in a face-to-face mode, I contacted them by using other means of communication to get more information and validate them during the data analysis process.

The information I collected from the participants was judged against the present school science curriculum and other literature. I also developed trustworthiness by using the abductive analysis approach where the Ethno practitioners' views about E-EAM were scientifically justified in the research literature, and its implementation practice was observed against the opinion of the teachers, students, curriculum experts and textbook writers. I tried to show critical reflectivity during the research process to reach multiple realities of lived experiences.

Reflection While Writing

The chapter writing of my dissertation was theme-based. I did not feel much difficulty writing up chapter VII. I started my chapter writing from the Vague area of spiritual knowledge, the Vedic philosophy and science embedded in the Vedic and Ethno practices in the area of ecology, agriculture, medicine, technology, Yoga, cosmology, astronomy, and shamanism. I dug out the content, methods and evaluation of these vast areas and compared them with school science curricula. However, when I started to write analysis and interpretation in chapter VIII, I was limited to only E-EAM. After collecting some information, in the beginning, I was motivated towards the interpretive research paradigm and transcendental phenomenology design and its data analysis procedure. When I read the known phenomenology-related books of Mostaskas (1994), People (2021), Vagle (2018), Van Manen (2017) and others, I realized that the data that I collected from my

participants are exploratory types. These data did not support a transcendental phenological study. My study was designed to explore community knowledge and examine it with a scientific eye to draw implications for the current school science curriculum. Then I realized that the above methodology did not support my data analysis process.

After that, I rethought my research paradigm and started to study some books, journal articles, and a thesis related to indigenizing and decolonizing research methodologies. I reviewed books and journal articles such as Chilisa (2012), Held (2019), Smith (2012), Wilson (2008) and others. The recently published article by Held (2019) motivated me, and I thought it would be appropriate for my study. So, I used the decolonizing research paradigm and transformative research methodology, which appreciate both communities and western-based science knowledge in classroom teaching and support the knowledge transformation process. I found it was focused on relational, reciprocal, and accountability of ontology, epistemology, methodology, and axiology between known and knower.

Then I studied the article that supported me for the information analysis. I studied other articles. Out of them, Higgins (2014) was one. I found his Rhizomatic indigenizing data analysis approaches appropriate for me. I learned how it supports the theme generation of the indigenizing and decolonizing study. This approach supported me in finding out the common nodal point of what most participants said and considered it the central theme of information. It also helped me analyze the field by connecting the participants' arguments with scientific verification. Therefore, I followed Higgins' approach and analyzed and interpreted the information that I generated from the participants.

My information collection and analysis process was iterative and cyclic. As I already mentioned, I collected information physically, digitally, and orally. I had

regular contact with my participants. I bounded by empirical study area within E-EAM. I generated four main themes related to ecology, three to agriculture, and four to medicine. In the analysis process, I saw the Vedic proof of E-EAM, and collected participants' cultural ideas, knowledge, and practice (methods) about the Vedic proof. Then I attempted to find the scientific connection between the community members' knowledge and practices in their daily life, especially in agriculture, medicine and ecology. After that, I attempted to find how it was understood by students, teachers, curriculum, and textbook writers. It supported me in triangulating knowledge developed by the Ethno-practitioners.

I felt somehow challenged to draw out the finding of my research. First of all, I drew the findings from all the chapters based on the research questions. My supervisor challenged me to make it more metaphoric, contemplating and representing field and literature analysis. This made me think differently. I did not draw out finding based on the research question in linear form. I attempted to see Vedic proof, participants' views, literature-based justification, and my experience implementing the study context in each finding. This process led me to follow an iterative and circular approach to answer all my research questions.

This study was based on the decolonizing research paradigm. My discussion was mainly based on the transformative, decolonizing, and indigenizing theory and methodologies. I used Comte's theory as a referent theory only for the scientific justification of spiritual knowledge. In the other context, I was not a carrier of fixed theories. However, I was guided by collateral theory, crossing over, acculturation and observation because my objective was to show the connections between the Vedic and cultural /community knowledge as science and relate it with the current school science curriculum. The aforementioned theories and literature supported my discussion to braid cultural/ community emerged science with school science

curriculum. As Mashoko (2022) mentioned, the connection between the three sciences is given in the conclusion section.

Reflection While Finalizing the Write-up

A memorable event was my first meeting with my supervisor at his home. He asked me: why did you select me as a supervisor? Are you selecting me as Koirala to get more support? I am harder than you have imagined.

I listened to my supervisor, learned about him, and took some of his classes, but I was not close to him. When I contacted my supervisor, I never struggled with knowledge generation, chapter writing, and communication. He always provided freedom for my idea generation and supported me studying a broad spectrum of texts. He never pushed me toward the formal guidelines of dissertation writing, which made me accessible for chapter generation. We exchanged more than 80 Emails within these last three years periods. He used to read the mail and reply within that day or the following day with constructive feedback and clear direction to proceed in writing. When I was convinced, I used to complete the chapter writing in thematic form. We had long telephone discussions during the writing process. He never felt bored with my calls. If he could not take the call, he used to call back later. If he found some unclarity in my writing, he used to call me for clarification. He behaved like a scholarly peer and always encouraged me to generate new ideas to contribute to research, knowledge generation, and writing. However, he strictly suggested that I be serious and follow rigorous research and writing. Sometimes I need deep contemplation to obtain new ideas.

Finally, I came to the end of my writing over reflection. My conclusive reflection is that I am transformed: transformed in the sense that I will always see connections between the Vedic science, community-practiced science, and school science while teaching. The Vedic is symbolic for me as it can be Mundum of Kirat;

Keyn of Gurung; Dhammapad and Tripitak of Buddhist; and any other sacred texts of the believers.

Reflection While Teaching Science

Now I realize that teachers like me need to relate religious texts, cultural practices, and school science to help students learn from non-literate peoples, ancestors, and western scientists. I realized that these sciences could be relational but factually unestablished truths; they can be a science like understandings, but they might need further research and innovation at the local, national, and international levels; they might be a part of logical and/or social sciences if figured out their scientific processes; they can be the contents for the science fictions to explore science in them, and they can be the cultural myths for the journey of exploring the presence of alien-like science.

Conclusion

From the above findings, discussion and reflection, I have found science embedded within the Vedic and spiritual scripture. It is there in non-literate peoples' practices as well. I also realized that school science could not be better without knowledge of traditionally practiced science (see Upadhyay, 2022). It means we have to braid the Vedic science, community-practiced cultural science and school science together while designing curriculum and teaching. In other words, I have completely changed my previous mindset and now realize that scientific worldview and western verified knowledge are not only science: there are sciences around us; in the Vedic literature, and cultural practices (see Upadhyay, 2022). I understand that Vedic scripture, spiritual practice and community people have unknowingly applied science. We could do more scientific contemplation on such knowledge nationally and locally and teach students to connect sciences. We can incorporate indigenous peoples' knowledge and culturally practised science in the curriculum preparation process and the training modules for teachers at Palika (local government) and national levels. The

potential ways of connection that can appear in my study in relational ways of Vedic and community science with the school SE and OBT curriculum of class 8 based on E-EAM is given in figure 18

Figure 18 *The Potential Connection of Vedic, Community and Curricular science of class 8 Based on E-EAM*

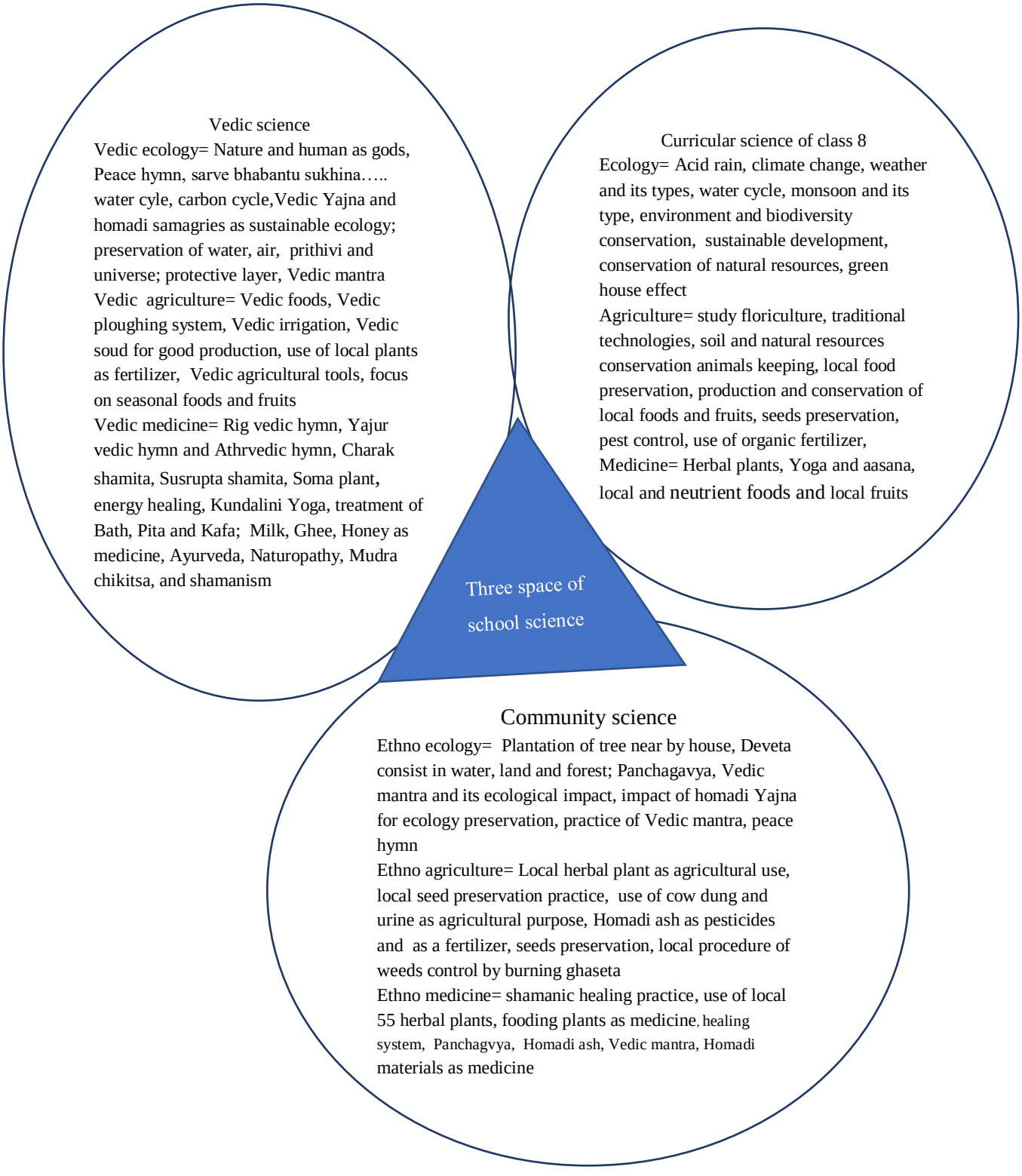


Figure 18 shows that scattered Vedic and community knowledge needs to be connected with school science thematically. It shows that the class 8 SE curriculum focused mainly on ecology in detail and, to some extent, on herbal plants and local foods. The science-related knowledge such as agriculture, herbal plants related to Ayurveda is given detailed on occupation, business and technology (OBT) education. Figure 18 also indicates many areas of Vedic and Ethno- medicine related contents are connected with school curriculum which can be taught collaterally. However, some contents are not seen included in both subjects i.e. SE and OBT of Garde 8. For example, the ecology section of the course has covered local ways of preserving the natural environment. However, both subjects of the school curriculum have not included Vedic and community-practiced ecological knowledge. It can say that the community-emerged agricultural practice can be highly applicable and environment-friendly in the present context. Unfortunately, these techniques are not described in both subjects as well the newly prescribed science and technology curriculum. So, such types of content needs to be added to the present science curriculum.

Both people of Vedic civilization used cow dung and urine as fertilizers; used Panchagavya for multipurpose use; used homadi materials as universal peace, medicinal values and agricultural purpose; shamanic treatment system; used homadi ash for medicinal and agricultural purposes; used Vedic sound for good agricultural product, antifungal and physio- psychological treatment; burned pure cow ghee to protect the environment; used of local plants as medicine, local pesticides and agricultural practice. Many of these practices are performed by present generation of the people as cultural practices. Some of these contents are found to be connected with the school science curriculum. But they are yet to be mainstreamed.

The general methodologies are prescribed at the end of the science curriculum without specific explanation. The details of the prescribed practical work with 50%

field study and project work in the subject OBT are given. It indicates that there could be more focus on local knowledge implementation practice in science teaching.

Regarding the teaching methodology, Vedic practice followed Shravan, Manan, and Nididhyasan. In the Vedic practice of learning, the first practice is listening to elders/ knowledge holders (Shravana), then analysing their views on how they could be implemented in the field (Manana) and practice for experiential learning from the heard knowledge (Nididhyasana). Similarly, the traditional learning process in the community is entirely based on learning by doing, such as learning by observing, learning by field practice, observing the cultural events, observing the effect of the local treatment system and agricultural practice, contemplation on their ancestors' ideas, doing the experience of the local treatment system, seeing the ecological impact and agricultural practice; and transformation of this knowledge into a new generation.

For evaluation, 20% and 50% weightage is allocated for practical activities like project work. However, in reality, teachers used paper-pencil (summative, somehow formative but not metacognitive type) tests. But both Vedic and community evaluation systems are to be seen based on the actual transformation of knowledge and skill into learners/ followers. Field practice observation is their way of evaluation, which is to be relevant in the present context. Both Vedic and field practice are appropriate to teach the prescribed content of the school science curriculum collaterally. If we do so, as mentioned above, methodologically and pedagogically, we can decolonize the present science contents and teaching. To do such curricular designers, textbook writers, teachers and training package designers should be trained accordingly.

Implication

The implication of this study is drawn from the above findings; reflection and conclusion are given below:

Theoretical Implications

I can say that the use of the theory to understand the field makes people determinist. The deterministic outlook cannot describe the field reality in a multicultural society like ours. This made me realize that we have to prepare students to see things from a multi-perspective; generate meanings that way; and come up with a list of solutions; and encourage students, teachers, and community people as per their value system. This study implies that (a) school teachers can be asked to study their textbooks and curriculum (b) they can be asked to find out the ways to relate their bookish analysis with the culturally practised Ethno-science and the Vedic scriptures (c) they can be encouraged to develop relational materials to teach science (d) these materials can be collected in the Palika (Municipality) website for comments, suggestions, and implications with necessary modification to suit with the school and the community cultures that the teachers work.

Pedagogical Implications

My study can say that local people practice science, but they do not recognize science in it; teachers teach science but they do not know how to link the taught science of the school with the science practiced at home; and this mismatch can be corrected through pedagogical changes in classroom teaching (Ballard et al. 2021) who claimed that community people distrust science. The historical lack of exclusion of multiple voices and perspectives in decision-making around scientific issues cause such monolithic practices. They also lack scientific understanding, transparency of scientific process. They also do not know whose knowledge counts and who benefits

from it. They also do not know how or why communities may or may not engage in science and/or the scientific enterprise. At the school level science teachers do not believe that science is embedded in their everyday practice.

Consequently, a significant gap exists between the scientific community and the members of local communities. Scientists on the other hand do not necessarily understand the needs, interests, and knowledge of people and communities, nor have they typically been educated or encouraged to support community engagement as part of their scientific efforts. Besides, the community people trust or engage with the scientific enterprise, for historicized and self-protecting reasons.

This means that cultural knowledge is ignored by the scientific community in dehumanizing and harmful ways (Ballard et al., 2021). It is where I see the role of teachers to use transformative pedagogical discourse among the community people and school science teachers. By doing so, we can link the epistemic practice of the community people with the science teaching. This helps connect cultural knowledge with the bookish knowledge about what they practised, understand, and transfer to the new generation.

The knowledge that exists in the community as cultural practice can be called as “community-driven science” or “community science” which works as an umbrella form (Ballard et al., 2021). It attempts to connect both types of sciences. It may be helpful to the teachers to meet the educational requirements of the 21st century i.e. teaching-learning activities through creativity, critical thinking, collaboration, communication, and constructivism (5C). In other words, community-driven science can be the agenda for pre-service and in-service teacher training programs (Ballard et al., 2021) in our universities and training centres.

This study concludes that community-based science can be implemented as a STEAM approach to education to connect students and science teachers for reciprocal

learning from the community. I realized that science learning requires Sravana, Manana and Nidhidhyasana. This notion of the Gurukul teaching system equates to what Paulo Freire (2000) called praxis which can be applied in schools to teach and learn science from the members of the local community.

Political/Policy Level Implications

This study revealed that a huge amount of indigenous scientific knowledge has been unrecognized. If explored and connected with school science, this unrecognised science can provide social justice and equity for all (Ballard et al., 2021; Morales-Doyle, 2017). It can be implemented by including this knowledge in School Improvement Plan at the school level; the training manual at the provincial level; and the national curriculum at the federal level.

This study tried to find that Vedic literatures and community knowledge contain science. It implies that national policy can be developed to explore science from the Vedic literatures and the knowledge of local people. School teachers, scientists of the universities, Curriculum Development Centre [CDC], Educational Review Office [ERO], Research Centre for Educational Innovation and Development [CERID], National Examinations Board [NEB], NAST and RECAST can investigate the authenticity of the existence of science behind these practices. It can be implemented by national-level policy developers, teacher trainers, as well as curriculum designers through the study of Vedic scripture and the inclusion of culturally practiced science in the curriculum, training package, and textbooks.

In the context of Nepal, the political and bureaucratic mid-set did not give adequate attention to Vedic and Ethno science. Political leaders and policymakers are oriented toward the western science schooling/ knowledge system. However, after studying this dissertation, they will realize that Vedic scripture and cultural

knowledge are not only ritual and spiritual. Huge science can be seen embedded within them and it could apply to the sustainable knowledge development of Nepalese people.

Sociocultural Implications

My study found that researchers are everywhere in the community. In order to collect their experiential oral research, teachers and students are the perennial and reliable sources. This implies that teachers and students need to be reoriented. Palika's (local government) Education Department and Teachers' Confederation can lead such implementation. They need to prepare teachers, parents and students to connect their teaching and learning with life related place-based/ cultural/ community science. Teachers can apply social justice-centered science pedagogy for individual and social transformation (Morales-Doyle, 2017). Theoretically, such social justice-centered pedagogy generates critical and culturally relevant science pedagogy (Upadhyay, 2022) at the school level. It also enables teachers and students to explore culturally embedded scientific knowledge. This can be termed as 'community-based design research' (Bang et al., 2016) or 'socio-political consciousness of learning science' (Upadhyay et al., 2020) and/or equity-related and justice-related science for the well-being of the community and their member (Ballard et al., 2021). If we can disseminate this study finding correctly with new generations of different cultural people, they could understand science embedded within the Vedic scripture and their cultural practice. They will try to see every phenomenon/event of cultural practice with a scientific eye and preserve it themselves.

Research Implications

The present study can say that science is everywhere in society. It is embedded in cultural practices in ecology, spirituality, astronomy, cosmology,

agriculture, architecture, technology, Ayurveda, and Yoga. This implies that school teachers can work with Palika (local government) to establish a research centre and well-equipped lab to search for science behind the cultural practices of the community members. Once the teachers, students, and parents claim the science, the school can request CDC, ERO, CERID, NEB, NAST or RECAST for its authenticity and implication practice. Culturally relevant science pedagogy (Upadhyay, 2022) like this will help unveil diverse knowledge and connect with the school curriculum (Hodgson, 2018; Morales-Doyle, 2017) to ensure academic success, cultural competence and socio-cultural consciousness (Ladson Billings, 1995). It supports the application of new research philosophy as a new approach to the research paradigm, new methods of methodology, and dissemination of knowledge in the broader context of academic research in the Vedic thoughts and theories.

Potential Areas for Further Study

I have tried to show the connections of the Vedic, Ethno, and school sciences while teaching. However, I realized that this single study is not adequate to do so. Therefore, I delimited my study in three areas of E-EAM. Even in these three areas, I cannot claim that I went deeper. Further scientific studies are required to gain a deeper understanding of these fields. It is where I identified the following content-specific areas for further study. I suggest some areas for future studies with the hope that other scholars and myself will help push the boundaries of science education. Furthermore, I hope this also encourages scholars to connect indigenous people and local communities' cultural knowledge and practices with scientific verification through the use of technology and innovation (Mashoko, 2022) by questioning the current nature of science teaching and learning. It also enables intellectuals to explore

the sciences of various Nepali indigenous and local communities. Herein below are the broad areas for further research.

1. Krishi (agricultural) Veda, community practice and school science curriculum
2. Vedic science and School science: possibilities for connection in school science teaching
3. Agroecology for the preservation of the natural world
4. Connection of the Vedic and Ethno knowledge for preservation biodiversity
5. Ayurvedic plants, locally used plants, and plants taught in the school curriculum for medicinal purpose
6. Engagement of local government on the scientific justification of Indigenous people and local communities' interdisciplinary science

Many more areas also need comparative study of the Vedic, Ethno, and school sciences. They might be in Botany, Zoology, Geology, Physics, and Chemistry depending on the interests of the researchers. If we do so, I believe we can link the Vedic, local, and modern knowledge for sustained and harmonious living on earth. Finally, I completed the exploration of scientific knowledge generated from the Vedic/ Sacred scriptures and empirical field study and tried to connect them with present school science teaching. As I already mentioned, the oriental and western researchers' job is to dig out the Vedic and Ethno knowledge as science hidden in the community and schools. Here, as an eastern researcher, I attempted to dig out the Vedic and Ethnoscience in a limited area and tried to connect it with a modern scientific worldview. Therefore, I am satisfied with this academic research from which I have changed my mindset and attained considerable expertise and experience in this long educational journey. I know this academic finding is like a drop in the ocean. There are so many areas of further research which I could continuously explore

through scholarly publications and book writing and to keep myself updated as an academic researcher. I will continue to work on other areas of the Vedic, Ethno, and eastern knowledge, explore science from indigenous peoples and local communities through research and innovation and implement them in the school science curriculum.

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Note: The Rig Veda, Yajur Veda and Atharva Veda related hymns were taken from the Nepali translation of Tilak Luitel, published by Vidyarthi Pustak Bhandar, Kathmandu.

Appendices

Apendix 1: Fourteen Dharmasthanas

Four Vedas such as Rig Veda, Yajur Veda, Sama Veda and Atharva Veda; six Angas (Vedangas) are Siksha (pronunciation), Vyakaran (grammar), Chhandas (Metre), Nirukta (explanation of words), Jyotish (Astronomy), and Kalpa (Ceremonial) and four Upangas are Mimamsa, Purana, Nyaya and Dharmasastra. Branches of Veda as Vidyasthanas (Abodes of knowledge) are Ayurveda, Arthasastra, Dhanurveda, and Gandharvaveda (Saraswoti Swami, 1995, p. 181; Muller, 1860, p. 113).

Apendix 2: 108 Upanishads

1. Isa 2. Kena 3. Katha 4. Prasna 5. Munda 6. Mandukya 7. Taittiri 8. Aitareya 9. Chandogya 10. Brihadaranyaka 11. Brahma 12. Kaivalya 13. Jabala 14. Svetasva 15. Hamsa 16. Aruni 17. Garbha 18. Narayana 19. Paramahamsa 20. Amritabindu 21. Amritanada 22. Atahrvasirah 23. Atharvasikha 24. Maitrayini 25. Kaushitakibrahmana 26. Brihajjabala 27. Nrisimhatapini 28. Kalagnirudra 29. Maitreya 30. Subala 31. Kshurika 32. Mantrika 33. Sarvasara 34. Niralamba 35. Sukarahasya 36. Vajrasuchika 37. Tejobindu 38. Nadabindu 39. Dhyanabindu 40. Brahmavidya 41. Yogatattva 42. Atmabodha 43. Naradaparivrajaka 44. Trisikhi 45. Sita 46. Yogachudamani 47. Nirvana 48. Mandalabrahmana 49. Dakshinamurti 50. Sarabha 51. Skanda 52. Tripadvibhuti-Mahanarayana 53. Advayataraka 54. Ramarahasya 55. Ramatapani 56. Vasudeva 57. Mudgala 58. Sandilya 59. Paingala 60. Bhiksu 61. Mahat 62. Sariraka 63. Yogasikha 64. Turiyatita 65. Sannyasa 66. Paramahamsaparivrajaka 67. Akshamalika 68. Avyakta 69. Ekakshara 70. Annapurna 71. Surya 72. Akshi 73. Adhyatma 74. Kundika 75. Savitri 76. Atma 77. Pasupata 78. Parabrahma 79. Avadhutaka 80. Tripuratapini 81. Devi 82. Tripura 83. Katharudra 84. Bhavana 85. Rudrahridaya 86. Yoga-kundali 87. Bhasma 88. Rudraksha 89. Ganapati 90. Darsana 91. Tarasara 92. Mahavakya 93. Panchabrahma 94. Pranagnihotra 95. Gopalatapini 96. Krishna 97. Yajnavalkya 98. Varaha 99. Satyayani 100. Hayagriva 101. Dattatreya 102. Garuda 103. Kalisamtarana 104. Jabali 105. Saubhagyalakshmi 106. Sarasvatirahasya 107. Bahvricha 108. Muktik (By Swami Nirmalananda Giri, source https://gita-society.com/wp-content/uploads/PDF/108upanishads.pdf)

Apendix 3: Sixty Four Arts

1. Itihas-History 2. Aagam - Rituals 3. Kavya -Poetry 4. Alankar- Grammar of poetry 5. Natak- Dramatics 6. Gayaktva – Singing 7. kavitva – Composition of poems 8. Kamashastra – Sex 9. Durohar / Dyuta – Gambling 10. Deshbhasha Lipidynan - Knowledge of scripts and languages of different countries. 11. Lipikarma -Script deciphering 12. Vachan -Reading 13. GaNak - Computation 14. Vyavahar – Behavioral etiquette 15. Swardynana -Phonetics 16. Shakun -Knowledge of Auspicious time and events 17. Samudrik - Palmistry 18. Ratnashastra - Gemology 19. GajaAshvaratha Kaushalya - Horse/Elephant riding 20. Mallashastra- Wrestling 21. Soopakarma -Cookery 22. Bhuhdohad -Gardening 23. Gandhavada- Perfumery 24. Dhatuvad -Metal purification 25. Rasasambandha –Khanivad-Chemical mining 26. Bilwad 27. Agni Sanstambha-Fire control 28. Jala Sanstambha-Water control 29. Vachahstambhan- voice control 30. Vayahstambhan-Age control 31. VashikaraN-Hypnotism 32. AakarshaN - Attraction 33. Mohan – 34. Viddveshan – 35. Uchattan - Extraction (thorn) 36. MaraN - Killing 37. Kalavanjan- 38. unknown 39. Parakayapravesh-To enter into another person's body 40. Padukasidhhi – 41. Vaksidhhi -Oretory 42. Gutikasidhhi43. Endrajalik 44. Anjan - Ointment making 45. Pardrushtivanjan – 46. Swaraivanjan 47. Manimantra Aushadik Sidhhi 48. Chorkarm -Theft/ Stealing 49. Chitrakriya- Drawing 50. Lohakriya- Iron smithy 51. Ashmakriya- Stone working 52. Mrutkriya - Soil conditioning 53. Darukriya- Wood working 54. Venukriya- Bamboo works 55. Charmakriya- Leather works 56. Ambarkriya -Umbrella making 57. Addrushyakara N -Vanishing things 58. DantikaraN – 59. Mrugayavidhi -Animal hunting 60. Vanijya - Commerce 61. Pashupalya- Animal keeping 62. Krushi- Agriculture 63. Asavkarma - Distillation 64.

Lavkukkutameshadiyudhakarak kaushalya - Bird/Animal fighting (Nene, n.d, form https://shekharsk.files.wordpress.com/2016/02/64-arts-of-ancient-india.pdf)

Apendix 4: Herbal Plants Mentioned in the Atharvaveda

1. Ajasringi (Vishani) *(Gymnemasylvestra* R.Br.)
2. Ala
3. Apamarga*(Achyranthesaspera* Linn.)
4. Aghata,
5. Amoola
6. Abhrikhata.
7. Arka*(Calotropisgiganteaiprocera* R.Br. ex Ait.B.Br.)
8. Arjuna*(Terminalia arjuna* W. & A.)
9. Arani (7 *Premnaintegrefolia* Roxb.)
10. Arundhati.
11. Avayu
12. Ashwatha*(Ficusreligiosa* Linn.)
13. Avakolva.
14. Ashwara
15. Asikin
16. Aukshagandhi,
17. Asuri (7 *Brassicajuncea*(Linn.) Ezemcoss)
18. Anjana.
19. Arataki.
20. Alabu*(LagenariaSiceraria*(mol) StandI.)
21. Apaskambha.
22. Audumbara*(Ficusglomerata* Roxb.)
23. Aparajita*(Clitoriaternatea* Linn.)
24. Aralu*(Ailanthus excelsa* Roxb.)
25. Baja,
26. Bilva*(Aegle marmelos* Corr.)
27. Bisa
28. Bhanga*(Cannabis sativa,* Linn.)
29. Badhaka
30. Balvaja (? *Imperataarundinacea* Cyrill.)
31. Chipudru
32. Darbha*(Desmostachysbipinnata* Stapf.)
33. DashaVriksh
34. Dhana (? *Coriandrumsativum* Linn.)
35. Dhanya*(Oryza sativa* Linn.)36. Dhava*(Anogeissuslatifolia* Wall.)
37. Durva*(Cynodondactylon* (Linn. Pers.)
38. Guggulu*(Commiphoramukul)* (Hook ex-Stocks)
39. Ita.
40. Ishika*(Saccharummunja* (Roxb.)
41. Jeevanthi*(Leptadeniareticulata* W. & A.)

42 Jangida
43. KanakanakaX.4.22
44. Kushtha*(Saussurealappa* (C.B. Clarke)
45. Krityadushani
46. Karkari
47. Kyambu
48. Kumuda*(Nymphaea alba* Linn.)
49. Krishna *(Piper nigrum*Linn.)?
50. KesabrimhaniXVIII.4.34; V1.21.3
51. Khadira*(Acacia catechu* Willd.)
52. Kudhya
53. Kairatika (Kumarika)
54. Madhavathi
55. Madhuga
56. Masha *(Phaseolus mungo* Linn.)
57. Madhula
58. Munja*(Saccharummunja* Roxb.)
59. Mulali
60. Naladi (Jatamansi) *(Nardostachysjatamansi, DC.)*
61. Narachi*(Ipomoea turpethum* Wat.)?
62. Nitatni
63. Nyagrotha*(Ficusbengalensis* Linn.)
64. Nyashtika
65. Nada
66. Oksha
67. Oukshagandhi
68. PippaJi*(Piper /ongum* Linn.)
69. Parushavarah
70. Parna (Palasha) *(Butea monosperma* (Lam.)
71. Patha*(Cissampelosparierа*Linn.)
72. Peela
73. Peelu*(Salvadorapersica*Linn.)
74. Pundareeka*(Ne/umbo nucifera* Geartn.)
75. Putudru (Putidaru)
76. Pushkara*(Inu/a racemosa* Hook.)
77. Prisnaparni*(Urariapicta* Desv.
78. Pauda
79. Pramandani
80. Plaksha*(Ficuslaeor* Buch-Ham.)
81. Rajani*(Curcuma longa* Linn.)
82. Rohini*(Picrorhizakurroa* Royle ex Benth.)
83. Rama (Rabha)
84. Shatavara*(Asparagus racemosus* Wild.)
85. Shyamaka*(Echinoehloafrumentaeea* Linn
86. Shyama. *(Ipomoea petaloides-Chois.)*
87. Shilanjala

88. Shilachi (Laksha) *(Cocuslacca)*
89. Shimshapa*(Dalbergiasissoo* Roxb.)
90. Sahasrakanda
91. Sraktya
92. Supamasuri
93. ShankhaPushpika*(Convulvuluspluricalis* Chois.)
94. Shana *(Crotalaria verrucosa* Linn.)
95. Shami*(Prosopisspicigera*Linn.)
96. ShandaDurva*(Cynodondactylon* Linn. Pers.)
97. Sheetika
98. Shara*(Saccharummunja* Roxb.)
99. Sheepala
100. ShepaHarshani
101. Sochi
102. Syeni
103. Saha
104. Soma *(Amanita muscaria* Linn.)
105. Swetha
106. Shuka
107. Tarunaka
108. Truna
109. Tila*(Sesamumindicum* Linn.)
110. Talasha (Talisha) (Abieswebbiana Linn.)
III. Tastuva
112. Tabuva
113. Taudi
114. Taubilika
115. Tajadbhanga
116. Traymana*(Gentianakurroa* Royle.)
117. Ucchusma (Kapikacchu) *(Mucunaprurita* Hook.)
118. Uttanaparni
119. Upajika*(Aconitum heterophyllum* Wall.)?
120. Urvaru
121. Varana*(Crataevanurvula* Buch-Ham.)
122. Varanavathi
123. Vishanaka
124. Vacha*(Acoruscalamus* Linn.)
125. Yava*(Hordeumvulgare*Linn.) (Prasad, 2000)

Apendix 5: Local Participants Used Herbal/ Ayurvedic Plants

Tulashi, Tejpatta, Kafal, Akashbeli, Dubo, Paniamala, Guava, Siudi, Khirro, Tatelo, Chilaune, Ashuro, Chilli, Ranisinka, Bhang, Dhaturo, Belpatra, Aakh, Tanki, Kapro, Dumri, Peepal, Bar, Nimaro, Byadulo, Nirmasi, Okhar, Titepati, Gurgo, Neem, Lude,

Nimro, Ginger, Turmeric, Gheukumari, Ban lasun, Timur, Chariamilo, Chillo batulpate, Alaichi, Nirmasi, Ghodtapre, Goban Yaiselu, Satuwa, Pachaule, Harsul, Dhaturo, Yarsagumba, Leamon, Harro, Barro and Amala.

Appendix 6: Interview, Focus Group and Observation Guidelines

a. Focus group interview guidelines for students

Local practice about the use of herbal plants

Locally used medicinal plants and prescribed in your science textbook

Use of Panchagabya in ritual and their connection with school science curriculum

Connection of present science curriculum with your cultural practiced knowledge

Teachers' attitude and practice of local knowledge in science teaching.

Ecological conservation practice in culture

Local agricultural practice and use of fertilizers

Locally available foods and their medicinal values.

Locally used fertilizers and pesticides and their learning in the science curriculum

Spiritual practice about the bio- diversity conservation and its scientific justice

Homa Yajna practice in culture and its connection with school science curriculum

b. Classroom observation guidelines

Connection of science content with local/ community knowledge

Students' involvement in science learning connecting their cultural knowledge

Knowledge transformation practice in the classroom.

Connection of curricular knowledge with students' previous knowledge.

Cultural knowledge connecting in science teaching

Appreciation of cultural students' knowledge in the process of science teaching

c. Interview guidelines for science teachers

Connection of science teaching with cultural knowledge

Relevancy of cultural knowledge.

Use of cow dung and urine as the fertilizers

Use and effects of chemical fertilizers

Conservation practice of land and water

Preservation practice of ecology and sustainable development practice

Use of Panchagabya and homadi Yajna

Connection of ritual practice and scientific value

d. Interview guidelines for Ethno ecologist

The traditional and spiritual practice of preservation of land, forest and water

Preservation practice of local bio-diversity

Use of fertilizers and pesticides and their impact on soil, water and air.

Vedic practice in the preservation of the environment

Impact of Homadi Yajna on the environment

Vedic sound and its effects on the environment

Naga devata and its ecological value

Modern impact on bio-diversity

Use of bastusatra

e. **Interview guidelines for local medicinal practitioners**

Use of locally available medicine and their value

Type of locally used medicines and their use in the treatment of the different types of diseases

Preservation of local medicine

Knowledge transformation practices of local medicinal knowledge

Locally available medicine and its use in the school curriculum

f. Interview guidelines for local agricultural practitioners

Use of local fertilizers in agriculture.

Use of different types of local animal dung and their agricultural value

Application of local plants as the fertilizers and pesticides

The traditional practice of seed preservation

Food land preparation and planting practice

Impacts of chemical fertilizers and pesticides and their use at the local level.

g. Interview guidelines for local priest/purohit and pandit

Use of Homa Yajna and Homadi materials and their effect

Relation between Homa Yajna and environmental preservation

Use and value of panchagavya

Ecological importance of Homa Yajna and use of different types of Homadi materials

Impact of sound pronounced in the Yajna program

h. Interview guidelines for curriculum writer

The policy of our curriculum development

Political and foreign intervention while writing the curriculum

Curriculum development practice in Nepal

Knowledge validation practice in writing the curriculum

Foreign funds and intervention in the curriculum development process

Philosophical guidance of curriculum development in Nepal

Consideration of local knowledge in the curriculum development period

Discourse on the selection of content, methods and evaluation system in the period of curriculum writing

Application and validity of local knowledge in science curriculum

i. Interview guidelines for the textbook writer

Science textbook writing procedure

Validation of science content

Content development practice

The implication of local knowledge in science content

Valuing the cultural knowledge in the science textbook

Incorporation system of local knowledge in the content development process

j. Review of documents

Studied the science curriculum of the school and university levels.

Studied the document related to Science and Technology published by the Ministry of Education.

Studied the report on Higher Education Policy

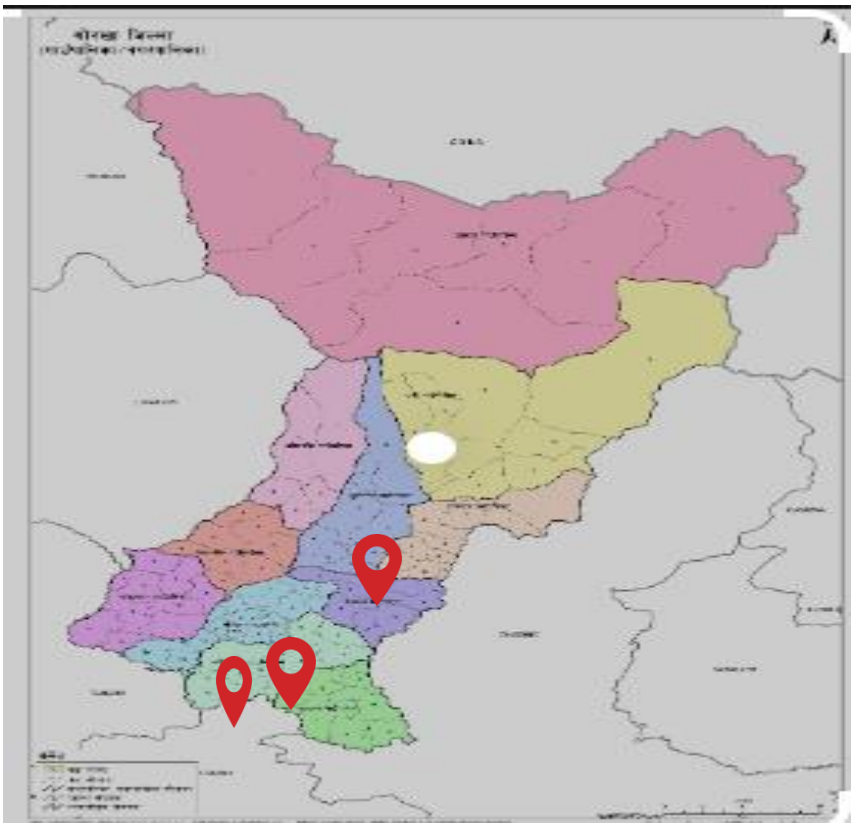
Studied the Educational policy of Nepal

International treaties and convention related to biodiversity and indigenous knowledge

Appendix 7 SE and OBT Curriculum of Grade 8 with E- EAM related contents

S.N	Subject	Unit	Contents
1	SE	Weather and Climate	Weather: Definition Factors affecting weather Weather of Nepal Monson: Monson of Nepal and its formation process
2	SE	Environment and its Balance	Natural heritages and human dependency on it 1. Food, shelter, herbal plants, and other natural resources 2. The national park, conservation areas and its conservation 3. Forest, its timber, herbal plants and their conservation 4. Forest animals and conservation of endangered animals
3	SE	Environmental degradation and its conservation	Effects of human activities on the environment and its control 1. Environmental pollution: land, water, air and sound, and its effects 2. Greenhouse effect and climate change 3. Effect of acid rain and its control 4. Natural disasters, its effect and control measures 5. Measures of environmental conservation and preservation 6. Involvement of National and International organizations for environmental conservation
4	SE	Environment and sustainable development	1. Biodiversity 2. Principles of sustainable development 3. World practice of sustainable development and its important
5	OBT	Vegetable and fruit farming	1. Vermiculture (Vermicomposting) 2. Organic fertilizers, times and use 3. Seasonal vegetables and its protection 4. Preparation of organic fruits and vegetables, its distribution and selling 5. Modern measures of preservation from pesticides 6. Planting of non-seasonal fruits and vegetables 7. Dry fruits and vegetables and its preservation
6	OBT	Herbal plants	Areas of use of herbal plants Medicine Cosmetic materials Industries Packaging of herbal plants Processing and packing of herbal plants Selling the herbal plants
7	OBT	Care of animals	Conservation of different types of animals and its different products for use in different purposes
8	OBT	Local technology	Plough Preservation of rainy season water

Appendix 8 Study Location of Gorkha District



Index
= Study Location

Appendix 9 My Participants

S. N	Name	Area of experience	Qualification
1	Durga Sharma	Teacher	B.SC / B.Ed
2	Jit Bahadur Tamang	Teacher	B.Ed
3	Prakash Wagle	Teacher	M.Ed
4	Keshari Prasad Dhakal	Ethnopractitioner	SLC
5	Krishna Prasad Dhakal	Ethnopractitioner	Literate
6	Lok Prasad Amgai	Ethnopractitioner	Literate
7	Top Bahadur Kumal	Ethnopractitioner	SLC
8	Tul Bahadur Thapa	Ethnopractitioner	Literate
9	Yam Bahadur Adhikari	Ethnopractitioner	MBA
10	Dilli Ram Koirala	Ethnopractitioner	Literate
11	Ram Bahadur Gurung	Ethnopractitioner	Literate
12	Kul Bahadur Thapa	Ethnopractitioner	Literate
13	Gobinda Regmi	Pandit	Bachelor
14	Dilliram Koirala	Purohit (priest)	Literate
15	Khil Narayan Shresth	Curriculum expert	M.Ed
16	Yadu Nath Upreti	Textbook writer	M.Ed