THE PENNSYLVANIA STATE UNIVERSITY
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EXPLORING AGRICULTURAL EDUCATION AS A VEHICLE FOR EFFECTIVE INSTRUCTION IN LOW-RESOURCE ENVIRONMENTS: A PHOTOVOICE STUDY OF NEPALESE SCIENCE EDUCATORS

BRANDON SCOTT BIXLER
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Reviewed and approved* by the following:

Daniel D. Foster
Associate Professor, Agricultural and Extension Education
Thesis Supervisor and Honors Advisor

Laura L. Rice
Assistant Teaching Professor, Agricultural Education, Communications, and Marketing
University of Minnesota
Faculty Reader

John C. Ewing
Professor, Agricultural and Extension Education
Faculty Reader

Melanie J. Miller Foster
Associate Teaching Professor of International Agriculture
Faculty Reader

*Signatures are on file in the Schreyer Honors College

ABSTRACT

This descriptive qualitative research study sought to describe Nepalese science learning environments and the educational resources perceived by educators with a specific focus on the potential of agriculture to be used as a context for teaching science content. In the country of Nepal, education is frequently characterized by numerous challenges and a lack of resources, as is the agricultural sector. The research study used the photovoice method, which empowered the Nepalese science educators who participated in the study to identify educational resources within their context through the collection of photographs and accompanying descriptive interviews. The resources were analyzed in accordance with the five primary categories of assets identified in the Theory of Asset-Based Community Development: individuals, institutions, associations, connections, and place-based assets. The research team visited ten different schools and conducted interviews with thirteen educators from government, private, and public trust schools in urban, suburban, and rural areas. The photographs and respective descriptions highlight assets that can be used to solve challenges within Nepalese science education. This study identifies individuals and institutions as the primary assets present in the Nepalese science education system and describes the diverse educational resources shaping Nepalese science education learning environments. The findings of this study highlight the potential of agriculturally related assets for increased utilization while underscoring the need for increased educator professional development opportunities to support the delivery of applied learning experiences. In sharing the photos and stories of the educators interviewed, this study aims to communicate the power of assets to solve community challenges while also showcasing the potential of photovoice as a research method with the capacity to empower and uplift the voices of the global agricultural education community.

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John 16:33.

Chapter 1 – Introduction

The United Nations (UN) identifies the target of achieving inclusive and quality education for all as Goal 4 of the Sustainable Development Goals (SDGs) identified for fulfillment by the year 2030 (2023a). The report offers that "education is one of the most powerful and proven vehicles for sustainable development" and emphasizes the importance for all students globally to complete basic education to build literacy and career-readiness skills (UN, 2023a). Around the world, science education is an important component of the overall comprehensive educational delivery system. The interdisciplinary approach of Science, Technology, Engineering, and Math (STEM) education prepares students for academic and career success through the integration of technical, scientific content areas with problem-based learning approaches (Southern Illinois University, 2023).

STEM education is closely connected to the growing field of Technical and Vocational Education and Training (TVET) (Rauner & Maclean, 2008). According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), TVET is comprised of "education, training, and skill-development relating to a wide range of occupational fields, productions, services, and livelihoods" (2015b, "Technical and Vocational Education and Training" section). Agricultural education bridges both STEM education and TVET by focusing on the issues of food, fiber, and natural resource production. By nature, agricultural education is an international discipline that prepares future leaders for an industry that impacts global trade and food security for the estimated global population of over eight billion people (Rauner & Maclean, 2008; UN, 2023a). Study of science education programs in international contexts contributes to the global understanding of how agricultural content is being delivered to learners through the broader contexts of TVET and STEM education.

Agricultural and science education can be used to train students to deliver solutions in accordance with the UN SDGs (O'Brien, 2021; UN, 2023c). When students in primary, secondary, and tertiary education around the world are engaged in meaningful and applied instruction with the SDGs, they can have critical conversations about the state of the world (Bokova, 2015; UN, 2023c). Former UNESCO Director-General Irina Bokova introduced the 2015 report *Rethinking Education; Toward a Common Global Good?* by stating "there is no more powerful transformative force than education – to promote human rights and dignity, to eradicate poverty and deepen sustainability, and to build a better future for all" (UNESCO 2015a, p. 4). Students engaged in quality and comprehensive science instruction using the SDGs as a framework are equipped with the knowledge and skills necessary to solve global challenges (Teach SDGs, 2023).

Significance of the Study

In Nepal, the education system is often characterized by readily apparent challenges of quality and equity, including a lack of educational resources, funding, and teacher preparation (Mathema, 2007). A report in the European Bulletin of Himalayan Research outlines a study in rural schools that identified a profound lack of "physical, instructional, and human resources" that resulted in minimal teaching and learning (Mathema, 2007). Proposed recommendations for change include establishing literacy programs – specifically for girls and adult learners from underserved backgrounds – removing politicization in higher education reform, and implementing TVET programs after primary and secondary education (Mathema, 2007).

While it is important to consider the challenges present within under resourced communities, Kretzmann and McKnight outline the theory of Asset Based Community Development (ABCD) that shifts the focus to resources present within an identified community (1993). By starting with the community assets already in existence, stakeholders can use the tools available to them to solve challenges and improve their own lives. Research following the ABCD approach generates constructive solutions and aids communities in forming action plans based on clear understanding of identities, interests, and preferences (IIPs) (CIFOR – ICRAF, 2021).

Integrating science education and TVET allows science educators to prepare students with career-readiness skills rooted in STEM curricula. Through hands-on application, science educators allow their students to develop both practical and technical skillsets. In Nepal, agriculturally related application of science content is a logical application given the importance of agriculture to the national economy (FAO, 2023). Agricultural development in Nepal is seen as a critical piece of rural development strategies designed to uplift livelihoods of people living in rural Nepal (Chaudhary & Pasa, 2015). Phanindra Chaudary and Rajan Pasa of Tribhuvan University in Nepal identify a lack of youth mobilization and participation as primary barriers to rural development efforts (2015). A study of current science education programs across central Nepal offers local significance in an effort to understand current science educational resources with a forward-looking focus on expanding agricultural education as a tool for community development.

Purpose and Research Objectives

The purpose of the study was to explore perceptions of available assets in the Nepalese educational delivery system as well as opportunities for utilization of agricultural education in low-resource environments by science educators at 10 schools in Central Nepal. The following research objectives guided the study:

1) Describe Nepalese science educators' perceptions of their educational delivery system through the lens of the Asset Based Community Development Theory.
2) Describe Nepalese learning environments as perceived by Nepalese science educators.
3) Describe educational resources for science education as defined by Nepalese science educators.
4) Explore perceptions of Nepalese agriculture as a context for science education by Nepalese science educators.

Context of the Study

Many communities in developing countries around the world – including the South Asian country of Nepal – rely heavily on agricultural production, comprising a significant proportion of community livelihoods (Sijapati et al., 2015). Estimates from the Food and Agriculture Organization of the United Nations (FAO) state that 66 percent of the Nepali population is engaged in agricultural production (2023). The industry contributes approximately one-third of the national Gross Domestic Product (GDP), mostly from small-holder farms often marked by low productivity and high risk of natural disasters and pest outbreaks (FAO, 2023). Analysis of labor markets and migration trends within Nepal show over half a million young Nepali citizens leaving the country each year in pursuit of employment opportunities abroad (Sijapati et al., 2015).

Nepal's approach to labor-related policy and TVET is guided by the *Labour and Employment Policy* of 2005 (Sijapati et al., 2015). A more recent national TVET policy from 2012 outlines Nepal's technical and vocational qualification mechanisms that is designed to meet the demands of domestic and international labor markets (Sijapati et al., 2015). The scope of the policy includes both migrant workers seeking international employment within its scope and training programs in specific skill areas to support the development of a knowledgeable and prepared domestic labor force. Without specific certification and credentialing systems in place in the secondary and tertiary education system, Nepali workers struggle to demonstrate their knowledge and skillset in both domestic and international labor markets (Sijapati et al., 2015). A 2015 estimate in the *Analysis of Labour Market and Migration Trends in Nepal* found that the agriculture sector comprised 6.4 percent of overall trainees within TVET programs in Nepal (Sijapati et al.).

Around the world, it is generally understood that a lack of education contributes to increased poverty, but minimal research explores the linkages between the two variables within Nepal (Thapa, 2015; UN, 2023b). South Asia is often regarded as the poorest region in the world; in 2013, the region was home to 44 percent of the world's population living on less than $1.50 a day and 46 percent of the world's illiterate population (Thapa, 2015). Education provides a basis for development and improvement of the socio-economic conditions within a country by improving literacy rates and fostering the development of employable skillets. Surya Thapa, Tribhuvan University, outlines the concept of education poverty, in which individuals who lack access to quality education are trapped below the poverty line with minimal potential for upward socio-economic mobility (2015). Until 1951, education in Nepal was reserved for members of the ruling family, but access was expanded following a time period of revolution. While access to educational opportunities through both government and private schools has expanded over the last 70 years, numerous barriers still remain for students seeking quality education, including cost, proximity, and obligations to family (Thapa, 2015). Research on existing educational resources and programs in Nepal will help to inform recommendations for future policy and practice to improve educational access, equity, and quality.

GTAN Research Framework

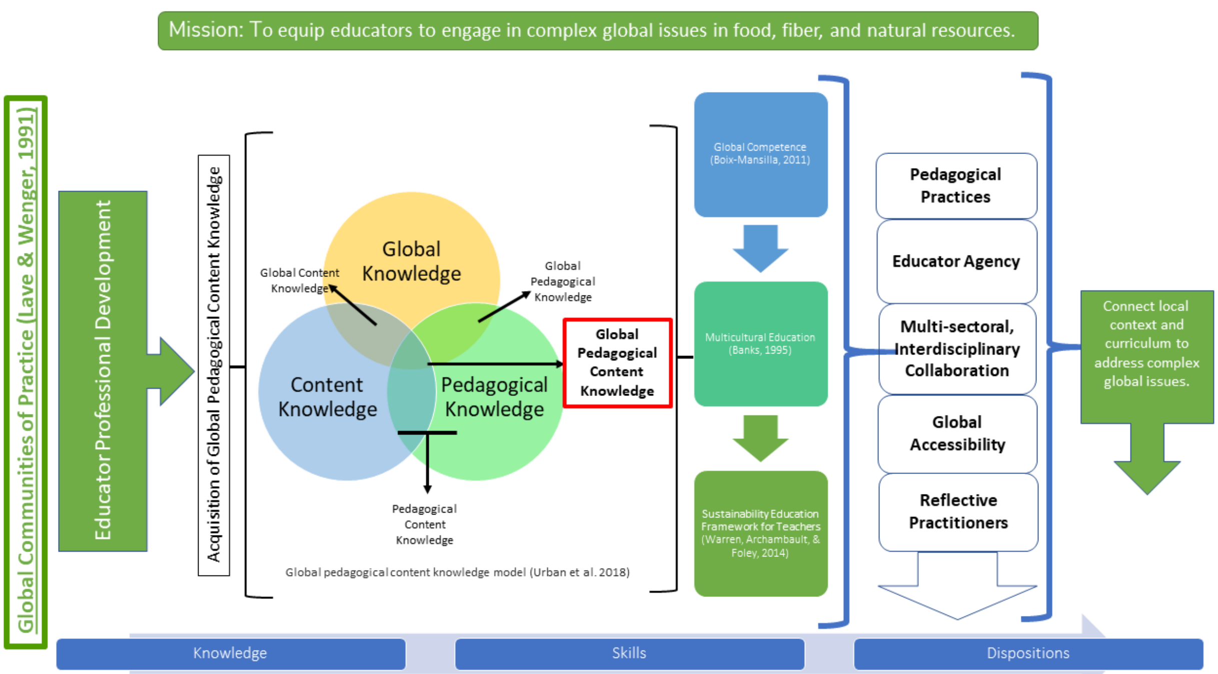
This research study was conducted in accordance with the research framework outlined by the Global Teach Ag Network (GTAN). GTAN empowers educators to address global food systems transformation by cultivating a global community of practice and conducting multi-sectoral, interdisciplinary research (Rice et al., 2023). The GTAN Research Framework facilitates the development of globally focused knowledge, skills, and dispositions.

This research study aligned with research priorities related to global food, fiber, and natural resource issues and educator agency. Research surrounding global teaching and learning supports scholarly understanding of educators' impact on global trends influencing food security, poverty, and sustainability (Rice et al., 2023). Educator agency – the capacity of educators to act purposefully and constructively to direct their professional growth and deliver meaningful learning outcomes – is a key area of research for GTAN and other stakeholders with an interest in the capacity of education to solve global challenges.

The GTAN research framework in Figure 1.1 highlights the idea of situated learning and research as a process rooted in the social practices of a given community (Lave & Wenger, 1991). Within global communities of practice, individuals can develop their respective global competence through engagement with multicultural education focused in sustainability training for educators (Asia Society, 2023; Boix Mansilla & Jackson, 2023; Banks, 1995; Warren, et al., 2014). By understanding the broader context in which a community is situated, researchers can better position themselves to grow their understanding and study educational practices with the goal of addressing global issues.

Figure 1.1

GTAN Research Framework (Rice et al., 2023)

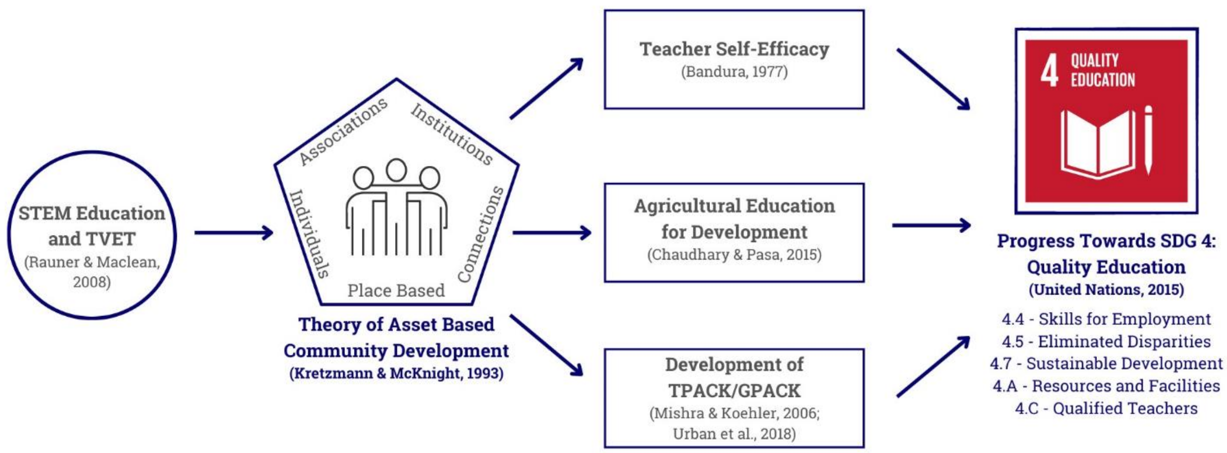


Conceptual Framework

Figure 1.2 showcases the relationship between STEM education and TVET and an asset based view that uses existing resources to foster teacher self-efficacy, community development, and effective educator knowledge. These outcomes create progress toward UN SDG 4: Quality Education (UN, 2023a).

Figure 1.2

Conceptual Framework for Asset Based View of TVET/STEM Education



The delivery of science education falls within the broader categories of STEM education and TVET outlined by Rauner and Maclean (2008). The theoretical foundation of the Asset Based Community Development theory centers on the existing educational resources that can be used to empower educators, students, and other stakeholders within the Nepalese science education community (Kretzmann & McKnight, 1993). In turn, community assets mobilized for positive development lead to the development of positive teacher self-efficacy, community development through agricultural education, and global/technical pedagogical content knowledge for educators (Bandura, 1977; Chaudhary & Pasa, 2015; Mishra & Koehler, 2006; Urban et al., 2018). The result of this progression culminates in progress toward UN SDG 4: Quality Education for All.

As outlined by Albert Bandura, self-efficacy describes people's belief in their own ability to control the events that affect their lives (1977). More specifically, teacher self-efficacy refers to the confidence of teachers to educate effectively throughout the circumstances they encounter. Through the delivery of effective science education with relevant application in the agricultural science context, Nepalese science education stakeholders can use their knowledge and skills to contribute to community development, particularly in rural communities (Chaudhary & Pasa, 2015). Moreover, the development of technical pedagogical content knowledge (TPACK) supports educators in their mission to deliver effective teaching and learning through proficiency in the necessary educational technology, teaching methods, and the relevant content area (Kurt, 2019; Mishra & Koehler, 2006). In 2018, Urban et al. from the University of Georgia further define the concept of global pedagogical content knowledge (GPACK), enhancing the background of educators to include elements of global competency (Asia Society, 2023; Boix Mansilla & Jackson, 2023).

Each of the individual aspects that arise from the effective identification and utilization of resources and assets help to achieve targets identified in the goal of providing quality education for all (Kretzmann & McKnight, 1993; UN, 2015). Target 4.7 in the UN Resolution announcing the goal states that "all learners acquire the knowledge and skills needed to promote sustainable development", in turn offering needed solutions and change for their local communities, countries, and the world (Bokova, 2015; UN, 2015, p. 17). Targets within SDG 4 addressed by this conceptual framework include 4.4, 4.5, 4.7, 4.A, and 4.C, which address Skills for Employment, Eliminated Disparities, Sustainable Development, Resources and Facilities, and Qualified Teachers (United Nations General Assembly, 2015).

Assumptions

In conducting this study, it was assumed that all Nepalese science educators who participated in the study were identified honestly and correctly by their school administrators and our local partner, the Rebuild Nepal Education Foundation (RNEF). RNEF had existing relationships with most of the schools visited during this study and translators were present during all interactions with both administrators and science educators to ensure clarity of communication. It was assumed that all study participants answered honestly regarding their personal background and educational resources as evidenced in the collection of photographs and corresponding descriptive interviews. In each interview, I provided the instruction page and list of prompts in both English and Nepali and answered any questions the educator asked in coordination with the translator to ensure each participant understood the directions fully. To reduce the risk of educators answering dishonestly, I made sure to express that the purpose of our study was not to evaluate the educator or their resources, but rather to describe educational resources and examine learning environments for science education.

Limitations

Several limitations impacted the execution of this research study. The in-person data collection for this study was conducted over a period of two and a half weeks in Nepal. While the transcription and translation processes prior to analysis were completed upon my return to the United States, the interviews were conducted within the confines created by the trip’s limited duration. This time frame limited the scope of the research study in terms of the total number of educators I could interview and the geographic area which I was able to cover during my time in-country. Despite these limitations, I was intentional in considering the school locations and educators who were interviewed in this study.

The significant language barrier present during our data collection process was another limitation in this study. Neither I nor any other members of the research team from GTAN were fluent in Nepali, the native language for the educators participating in our research study. The participants held varying degrees of fluency in English and were encouraged to complete the interviews in whichever language they felt most comfortable. I relied heavily on translators during the interviews in which the educators requested to be interviewed in Nepali or when specific clarification was needed beyond what I could provide through communicating in English. Following the conclusion of the interviews, the recordings were transcribed into English for analysis by a native Nepali speaker also fluent in English. Due to the barriers of geography, technological access, and language, member checking of the transcripts was not completed with the research study participants.

Another significant limitation in this study was the use of a convenience sample of participants identified by RNEF. Potential school locations at which to conduct interviews were identified by RNEF either through existing relationships or prior knowledge of the school location. Although an intentional effort was made to conduct interviews with educators from diverse backgrounds teaching at schools in urban, suburban, and rural areas, I was still limited in scope to the knowledge and connections held by a single local partner organization.

Operational Definitions

The following terms are operationally defined for this research study as follows:

Technical and Vocational Education and Training (TVET) – TVET encompasses the education, training and skill development designed to prepare students for specific areas of employment, production, or service (UNESCO, 2023). TVET is considered to be a part of life-long learning and integrates work-based learning with other forms of professional development such as literacy and skills acquisition. For the purposes of this paper, TVET is used to refer to the broader category of educational approach under which agricultural education falls.

Science Education – The field of science is defined as the "study of the structure and behavior of the physical and natural world" through means of observation, experimentation, and testing (Cambridge Dictionary, 2023). Science education describes the delivery of scientific content to students. In Nepal, science education is a compulsory subject for students at both the primary and secondary levels of education (Dhakal, 2016).

Agricultural Education – Agricultural education encompasses all instruction related to the production of food, fiber, and natural resources with the goal of preparing students for agricultural careers (Phipps et al., 2008). While formalized structures are not widespread, agricultural education helps prepare Nepalese students with the knowledge and skills necessary for work in the agricultural sector (Chaudhary & Pasa, 2015).

Government Schools – Government schools refer to public schools that receive funding from the Nepali government. These schools help to fulfill the mandate for free, compulsory education contained in the Nepali constitution, but many students still pay a fee to attend these schools (Ghimire, 2022). Government schools generally employ traditional methods of instruction involving memorization using textbooks and other government provided resources.

Private Schools – Unlike government schools, private schools do not receive funding from the government. Nepali private schools have increased significantly in number since the establishment of government policy in 1980 encouraging the growth of schools in the private sector (Joshee, 1994). While private schools are generally perceived as offering higher quality education than government schools, there is limited conclusive research on this topic (Joshee, 1994).

Public Trust Schools – Educational charities around the world fund schools designed to offer quality educational opportunities to students with otherwise limited opportunities. Schools funded through public trusts seek to meet high educational standards and support the development of the surrounding community (Confederation of School Trusts, 2023).

Educational Resource – Any materials or tools used to support teaching and learning in the context of Nepalese science education are referred to as educational resources in this paper. The ability of science educators to identify and explain their respective educational resources through collecting photographs and providing descriptions was central to this study.

Interpretive Biography

Throughout the course of this research endeavor, it was important to consider my own background and identities and the ways in which they may have impacted the design and delivery of this study. While the research methodology was designed to limit researcher influence to the greatest possible extent, I recognize that my cultural background and public perception as a white American male university student had inherent implications in my interactions with stakeholders in Nepalese science education. I acknowledge the significant imbalance of privilege I carried into many interactions during this study, especially in schools often considered to be under resourced. Cultural differences between the United States and Nepal including religion, diet, and language frequently presented opportunities for discussion and meaningful learning, allowing me to build my global competence through multicultural interaction (Boix Mansilla & Jackson, 2023).

Many aspects of this experience were new to me, including traveling to Asia and conducting qualitative research for the first time. As an undergraduate researcher, I benefited greatly from the experience and perspectives of other members on the GTAN research team. The research team traveling to Nepal included four individuals from Penn State University: myself, another undergraduate student in Agricultural and Extension Education, and two faculty members in the College of Agricultural Sciences and the College of Education. When conducting interviews, we traveled to schools with an American man who led our local partner organization (RNEF), a Nepalese translator who had previously attended university in the United States, and our Nepalese guide.

I relied heavily on the Nepali members of our team to communicate my intent and focus as clearly as possible while conducting the research. It was not uncommon to hear our translator reassuring study participants that our goal was not to assess the quality of their educational resources or teaching, but rather to simply understand the resources they use to teach and how the resources help them deliver educational outcomes. While my personal training is in Agricultural and Extension Education, our research participants were science educators. While agricultural education falls underneath the broader umbrella of science education, I recognize that my specified area of study influences my perception and analysis of science education.

Summary

Access to quality and sustainable education for all students around the world is a current shared priority among stakeholders in the international development and educational spheres (Bokova, 2015; Chaudhary & Pasa, 2015; Neupane, 2015; UN, 2023a). STEM education and TVET disciplines allow educators to prepare students for careers through experiential learning and hands-on application. While individuals in developing countries around the world – including Nepal – often lack access to robust, formalized TVET programs, vocational training can empower individuals by fostering the development of knowledge and skillsets used to seek employment. In Nepal, agricultural education as a form of TVET is especially valuable given the high percentage of individuals working in the agricultural sector and its large share of the national GDP.

This study was designed to explore the educational resources used by Nepalese science educators to understand their use in the delivery of desired teaching and learning outcomes. The research objectives align with the GTAN theoretical framework in which agricultural education can be used to understand and solve global challenges. This descriptive qualitative study used the photovoice method, allowing the research study participants to drive the data collection process by capturing photos and describing their educational resources. Research indicates that education resulting in employable knowledge and skillsets can help transform communities and reduce food security and poverty, which warrants further study of the resources used by Nepalese science educators (Bokova, 2015; Chaudhary & Pasa, 2015).

Chapter 2 – Review of Related Literature

This chapter will discuss existing literature and research findings that provide contextual background and support for various components of this study. A review of literature reveals that educators' use and perception of science education resources has not been widely examined in the context of Nepal. However, existing research does provide broader context related to the current state of education in Nepal and its role in preparing students for success in careers. In addition, the following chapter will review the existing literature for each component of the conceptual framework for this study: STEM Education and TVET, the ABCD Theory, Teacher Self-Efficacy, Agricultural Education for Development, TPACK/GPACK, and UN SDG 4: Quality Education.

Purpose and Objectives

The purpose of the study was to explore perceptions of available assets in the Nepalese educational delivery system as well as opportunities for utilization of agricultural education in low-resource environments by science educators at 10 schools in Central Nepal. The following research objectives guided the study:

1) Describe Nepalese science educators' perceptions of their educational delivery system through the lens of the Asset Based Community Development Theory.
2) Describe Nepalese learning environments as perceived by Nepalese science educators.
3) Describe educational resources for science education as defined by Nepalese science educators.

4) Explore perceptions of Nepalese agriculture as a context for science education by Nepalese science educators.

Need for Effective Education to Address Global Issues

The need for education to address global issues has been thoroughly demonstrated in the existing scholarship surrounding education and community development worldwide (Bokova, 2015; Chapman & Aspin, 2013; Chaudhary & Pasa, 2015; UN, 2023). Chapman and Aspin (2013) discuss the widely accepted notion that education is of global importance, particularly as the world becomes increasingly interconnected and globally interdependent. Efforts to deliver globally focused education often face challenges when seeking to consider multiple factors that are critical to educational delivery. These factors include balancing political and economic goals in a specific context, considering family contributions to education, and integrating human virtues and education of the whole person (Chapman & Aspin, 2013). In low-resource educational contexts, efforts to deliver quality global education that addresses all student needs presents a significant challenge, even though these environments represent situations where quality and comprehensive education is most needed (Chapman & Aspin, 2013; Chaudhary & Pasa, 2015).

UN Sustainable Development Goals

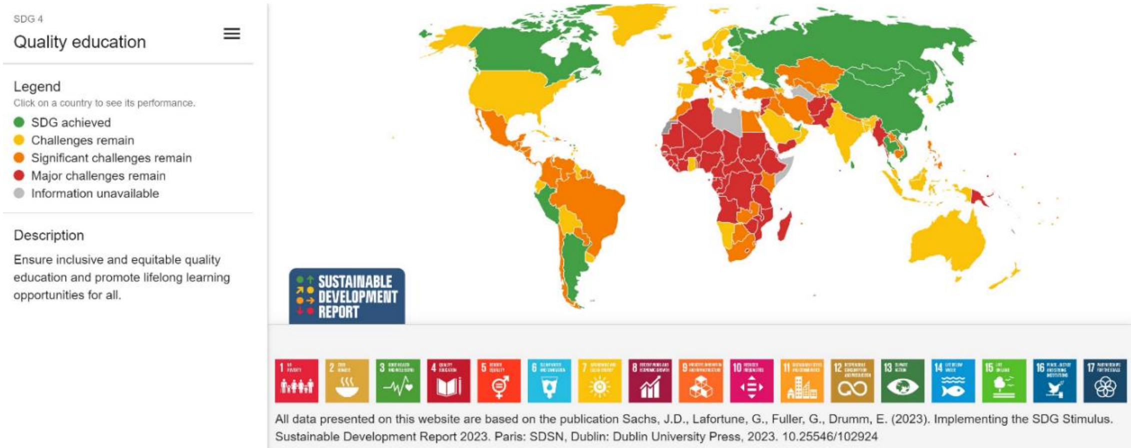
The UN SDGs identify 17 specific goals as targets to be met by the year 2030 to ensure sustainable development for all countries, both developed and developing (UN, 2023c). The SDGs are designed to provide a blueprint to ensure “peace and prosperity” for all people and for the planet and touch many factors related to both the social and natural sciences (UN, 2023c). In designing the goals, the United Nations acknowledges that global challenges are interconnected and multi-faceted in nature and contends that any thorough solution must seek to address the complex array of factors contributing to the current challenges on a global scale (UN, 2023c).

SDG 4 specifically highlights the need to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (UN, 2023a, "Goal 4"). Across the world, the COVID-19 pandemic negatively impacted learning in over 80 percent of the world's countries, and low to lower-middle income countries face a nearly $100 billion funding deficit in pursuit of their educational goals (UN, 2023a). If the targets for progress outlined in SDG 4 are not met by the 2030, the UN estimates that nearly 84 million children will be out of primary school and nearly 300 million children globally will lack basic numeracy and literacy skills (2023). These statistics point to a lack of access to education altogether for many children and a lack of quality education even in certain places where students have access to a basic formal education.

The Sustainable Development Report produced a map shown in Figure 2.1 indicating the progress towards the targets outlined in SDG 4 by country (Sachs et al., 2023). While several countries around the world have achieved SDG 4, Sachs et al. illustrate that significant or major challenges remain for many countries, particularly in Africa, the Middle East, and Southern Asia. Nepal is identified as having significant challenges remaining (Sachs et al., 2023).

Figure 2.1

Sustainable Development Report – SDG 4 (Sachs et al., 2023)



Education for Sustainable Development

Bokova (2015) identifies education as the primary tool to drive sustainable development worldwide. Quality education surrounding relevant global challenges and potential solutions – such as the targets identified in the UN SDGs – allows students to take the knowledge and skills gained through education to solve these challenges within their respective communities (Bokova, 2015; UN, 2023a). Due to the interdisciplinary nature of the challenges preventing sustainable development, research shows that quality education must exist in coordination with other necessary entities, including government bodies and the private sector, to ensure communities have the capacity to fully address development challenges (Bokova, 2015; Chaudhary & Pasa, 2015; Dhamala et al., 2021; Mathema, 2007; Neupane, 2015; Thapa, 2015; UN, 2015).

Science education is one specific content area connected to multiple components of approaches to sustainable development (Chaudhary & Pasa, 2013; UN, 2023a). Within the category of science education, agricultural education allows the concepts of STEM education and TVET to be applied within a practical, career-focused context. In Nepal, agricultural education is significant for the nearly two-thirds of the population that is directly engaged in agricultural production (FAO, 2023). Chaudhary and Pasa (2015) contend that development approaches in rural areas that seek to reduce poverty and improve food security are nearly impossible without the proper management of farmers and agricultural students.

Nepalese Education

Existing research provides an overview of the Nepalese education system related to both its structure, delivery, and common challenges (Bhattarai, 2023; Dhakal, 2016; Dhamala et al., 2021; Joshee, 1994; Mathema, 2007; Sijapati et al., 2015; Thapa et al., 2020 ; UNICEF, 2023). Historically, Nepal's education system was based off of the Gurukula system, and focused on apprenticeship to provide education in philosophy, religion, and technical skills (CollegeNP, 2023). For much of the country's history, formal education was restricted to the ruling class and most of the general population was illiterate. The increased access to education in Nepal followed the wide-spread democratization of the education system after the fall of the Rana Dynasty in 1951 (CollegeNP, 2023; Dhamala et al., 2021; Thapa, 2015). As Nepal has opened to the influence of other outside countries, the education system has also undergone modernization CollegeNP, 2023).

The education system in Nepal is governed by the Ministry of Education, Science, and Technology and is compulsory through the eighth grade (CollegeNP, 2023; Dilas et al., 2018). Although this basic level of education is required, enforcement of the mandate and overall access to free primary and middle-level education is not equitably provided throughout the country (CollegeNP, 2023; Dilas et al., 2018). Instruction is provided using both English and Nepali languages, but many instructional materials including textbooks are provided specifically in English in the higher years of education (Dilas et al., 2018).

Levels of Opportunity

Education is structured in Nepal at the primary, secondary, and tertiary levels (Dilas et al., 2018). In a traditional education trajectory, students complete 12 years of primary and secondary education, four years of tertiary education, and two additional years for students completing a masters degree (Pathak, 2023). The largest tertiary institution in Nepal is Tribhuvan University, which serves over 300,000 students across its constituent campuses and affiliated colleges across the country (Pal et al., 2021; Time Higher Education, 2023). The education system has been more formally established in urban areas, whereas education in more remote areas of Nepal generally has more opportunity for improvement (Shrestha, 2023).

Primary and secondary education are primarily delivered through government schools and private schools throughout the country (Joshee, 1994). Public trust schools supported by international non-profits are also available in certain communities (Confederation of School Trusts, 2023). The educational quality is generally regarded to be higher within private schools, but the cost to attend private schools is often higher than that of government schools. Although the Nepalese constitution provides for free and compulsory education through the eighth grade, many public schools charge a school fee to compensate for budget deficits, especially within recent years (Ghimire, 2022).

Challenges

The Nepalese education system struggles with documented challenges attributed to a lack of available resources and funding (Dhamala et al., 2021; Mathema, 2007; Moore, 2014).

Inequality exists in numerous forms across the Nepalese education system, often reinforcing existing inequalities in underserved area, such as those related to socioeconomic status and development challenges (Gandharba & Pant, 2023; Mathema, 2007; UNICEF, 2023). Studies have shown minimal learning taking place in rural government schools, which does little to generate positive public perception surrounding the value of education (Moore, 2014). In terms of economic disparity, UNICEF reports that only 12 percent of children in the lowest economic quintile are on track to meet literacy and numeracy benchmarks as compared to 65 percent from the upper quintile (2023). Gender inequality also presents challenges in addition to economic disparity (Moore, 2014; Paudel, 2019). While significant strides have been made in expanding equitable access to primary education, more than 80 percent of girls have left school by the time they reach 11th grade, failing to complete their secondary education (Paudel, 2019).

Gandharba and Pant (2023) provide an example within the prevailing caste hierarchy in Nepalese society in which students from the *Dalit* population are negatively impacted by structural barriers in the education system. The *Dalit* caste is regarded as one of the lowest castes in Nepal within a *Varna* system that believes a caste is emerged out of an individual's birth (Gandharba & Pant, 2023). Despite the "Leave No One Behind" (LNOB) agenda outlined in the UN SDGs, *Dalit* students suffer from inequality and social exclusion as evidenced by lower literacy and mathematics performance rates (Gandharba & Pant, 2023). *Dalit* students have the second lowest primary school completion rate of any underserved group, only trailed by Muslim students (Moore, 2014). Ethnic and religious lines often mark significant disparities in student's respective access to and success in formal education.

Compounding the challenges of inequality are low performance across the educational system. Despite the constitutional provision for free and compulsory education, 770,000 children between the ages of 5-12 are not in school, and only half of students in grades 3, 5, and 8 meet academic achievement criteria in Nepali and mathematics (UNICEF, 2023). Dhamala et al. (2021) indicate the challenges related to physical infrastructure and human resources that prevent the Nepalese education system from obtaining development goals, particularly in areas related to science and technology education. The lack of child-friendly and earthquake safe schools is of particular concern, especially following the devastating earthquake on April 25th, 2015 (Tucker, 2019). Estimates show that only 11 percent of Nepalese schools are earthquake-resistant, which raises questions about the fulfillment of fundamental safety needs to support student learning (Maslow, 1943; UNICEF, 2023).

COVID-19 has presented numerous challenges in the delivery of education across Nepal (Pal et al., 2021; Thapa et al., 2020). Pal et al. outline the long term impacts of COVID-19 related shutdowns, describing the “noxious impacts affecting the psychosociological and livelihoods of people” (2021, p.1). Because the Nepalese education did not have access to ample resources to support virtual learning during times of lockdown and social distancing, the pandemic closed schools and disrupted learning for extended periods of time (Pal et al., 2020). Government schools were widely used as quarantine centers during the national lockdown (Pal et al., 2020). The significant disruption to education and broader challenges brought on by the COVID-19 pandemic have strained educators and educational resources within the Nepalese educational system (Thapa et al., 2020).

Identified Assets

Despite the numerous challenges present, the Nepalese education system has numerous identified assets that support the delivery of instruction. Communities with identified resources are better able to mobilize their assets and generate solutions to challenges they face, particularly when striving to achieve development goals (Kretzmann & McKnight, 1993; The University of Memphis, 2023). The education system within Nepal is one of the youngest in the world, which allows greater opportunity for growth and structural adjustments than in more well-established formal education systems around the world (Moore, 2014). Research from UNICEF shows that Nepal has made considerable progress towards educational goals, and enrollment in primary education has increased by 97 percent over the last 20 years (2023). There is also considerable global investment from non-profit organizations and educational foundations to support quality and equitable education in Nepal (Moore, 2014).

While limited research exists studying existing educational resources used by educators, the Educational Resource and Development Center Nepal (ERDCN) exists to equip educators with resources and unite educational stakeholders around quality education and lifelong learning objectives (ERDCN, 2023). Examples of resources supported through ERDCN include sports materials, literacy classes, classroom furniture, and sexual education programming. In addition, ERDCN works to provide agriculturally related resources – including vegetables, buffalo, and poultry – to support agricultural education as a critical form of TVET (ERDCN, 2023).

The Nepalese Ministry for Education has integrated a School Sector Development Plan (SSDP) and consolidated equity strategy for the education sector to outline development goals for their education system (Ministry of Education, 2016; UNICEF, 2023). The SSDP was adopted in coordination with Nepal’s new constitution in 2015 and was "developed with the vision to contribute to the development of self-sustainable, competitive, innovative, and value-oriented citizens for the socio-economic transformation of the nation” (Ministry of Education, 2016, p. iii). The plan focuses on expanding equitable access to quality education and lists stated goals of improving basic primary and secondary education while also expanding TVET opportunities to prepare students with relevant and necessary careers for student success (Ministry of Education, 2016).

STEM Education and TVET

STEM education and TVET provide practical applications of science related concepts to prepare students for career success (Kandel, 2018; Rauner & Maclean, 2008; Scherer et al., 2019; Southern Illinois University, 2023; UNESCO, 2015b). Experiential learning through inquiry and problem-solving approaches allows students to learn through hands-on learning exercises (Southern Illinois University, 2023). STEM education describes instruction related to technical and scientific content, while TVET encompasses career training and skill development delivered through experiential learning and practical application of content (Rauner & Maclean, 2008; Southern Illinois University, 2023, UNESCO, 2015b) Research indicates that students who engage in STEM education develop skillsets in innovation and critical thinking, which allows them to generate solutions to challenges and be adaptable within their career fields (Southern Illinois University, 2023; Warren et al., 2014). TVET is provided throughout Nepal in formal, nonformal, and informal modalities, each one serving individual needs of students as they prepare for their future careers (Asian Development Bank, 2015).

STEM Education/TVET in Nepal

STEM education is provided through academic programs and integrated education across primary and secondary program (Belbase, 2019). Research on STEM education in Nepal has offered that an integrated approach to STEM education goes beyond a specific content focus by transforming curricular and pedagogical approaches (Belbase, 2019). Nepalese educational stakeholders have given a greater focus to STEM education as goals for higher rates of primary school enrollment have been met in recent years (Kandel, 2018). In accordance with educational development goals outlined in the SSDP, the Ministry of Education has interest in integrating environmentally focused “green STEM” and innovation in engineering related fields (Kandel, 2018; Ministry of Education, 2016). Nepalese scholars contend that Nepalese educators must do a more effective job of integrating hands-on experience into the classroom earlier in student’s schooling, beginning in primary school (Kandel, 2018).

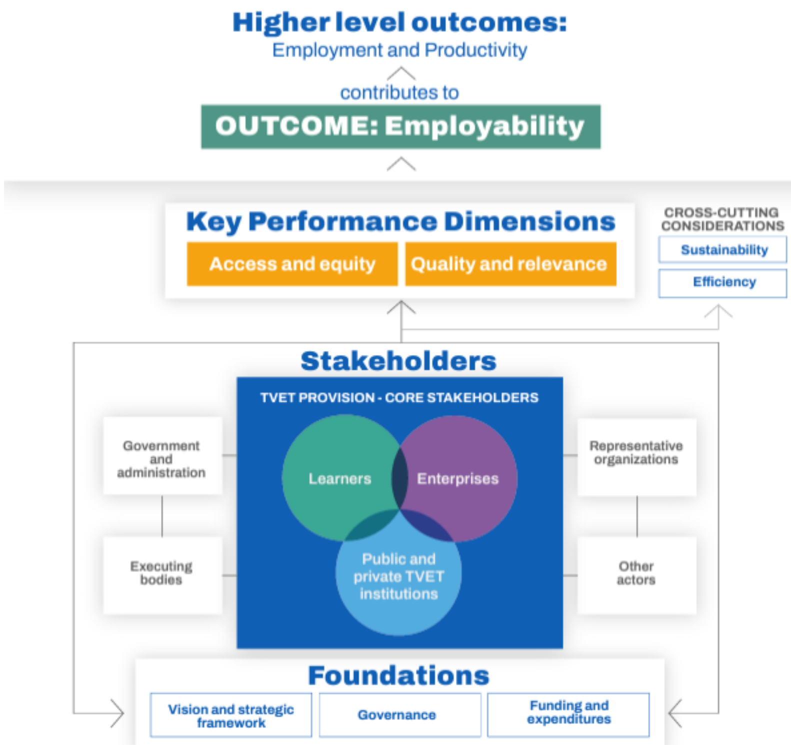
According to the Asian Development Bank’s report entitled Innovative Strategies in Technical and Vocational Education and Training for Accelerated Human Resource Development in South Asia: Nepal, the Nepalese TVET system is nearly 40 years old (2015). Most students participating in TVET are at the secondary level in 10^{th} grade or above (Asian Development Bank, 2015). Within the formal setting, students can access TVET in secondary and tertiary education institutions aligned with their area of career interest. Formal TVET programs typically have performance assessment, often resulting in certification or a diploma following program completion (Asian Development Bank, 2015). In the nonformal setting, various technical schools and training centers offer TVET for students with specific interests or needs. TVET also occurs informally in any instance where experienced individuals share their knowledge in order to assist other individuals in relevant skill development, whether in the place of work, on the farm, or in the kitchen (Asian Development Bank, 2015). Nepal's TVET sector has seen notable success in the 21st century. Between 2000 and 2010, the number of skilled training graduates increased from 15,000 to over 80,000 over the ten-year time period (Asian Development Bank, 2015).

Application to Low- and Middle- Income Countries

A joint study by the World Bank, UNESCO, and the International Labour Organization (ILO) focused on TVET in low- and middle-income countries found that urgent reform of TVET can support global development (2023). The study discusses the widespread perception of TVET as preparing students for second-tier careers and acknowledges the broken linkages between TVET programs and labor markets in low- and middle-income countries (World Bank, UNESCO, & ILO, 2023). Despite the challenges, significant opportunity stemming from shifting demographic trends leading to growing youth populations and increasing rates of primary school completion will allow for an exponential increase in the number of secondary TVET students in developing countries globally (Leatherby, 2023; World Bank, UNESCO, & ILO, 2023). Figure 2.2 outlines a framework for successful TVET execution in low- to middle-income countries and its connections to effective coordination with necessary stakeholders (World Bank, UNESCO, & ILO, 2023). Although many developing countries place low-value on TVET and do not have access to ample resources to support educational efforts, successful implementation of TVET can be a powerful tool for economic transformation in low-resource communities (Norton & Norton, 2016; World Bank, UNESCO, & ILO, 2023).

Figure 2.2

Conceptual Framework for TVET in Low- and Middle- Income Countries (World Bank, UNESCO, & ILO, 2023).



In a study of Nepalese STEM education, effective STEM integration was found to create and reinforce social meaning related to the concept of development alongside the development of student's knowledge and skills (Wallenius, 2017). In low-resource environments in schools across Nepal, proponents contend that using even simple materials in STEM education will allow students to develop skills in creativity, innovation, and problem-solving (Kandel, 2018). Moreover, Prakriti Kandel of the *Nepali Times* writes that scientists and development practitioners desire to see national policies that incentivize scientific and technical careers to allow Nepal to retain the world-class talents of its students (Kandel, 2018). The problem of "brain-drain", where highly skilled and educated people emigrate to more developed countries in pursuit of opportunities for ideal employment, salaries, or living conditions has caused many competent individuals to leave Nepal (Dahal, 2023; Kandel, 2018). While these challenges are complex in nature, effective integration of STEM education may improve public perception of opportunities for meaningful careers and inspire more individuals to remain in or return to Nepal to lead development efforts (Dahal, 2023; Kandel, 2019; Wallenius, 2017).

Agricultural Education Relevance to STEM Education/TVET

Agricultural education is a specific discipline that bridges both STEM education and TVET by providing a context for science instruction through hands-on, experiential learning (Chaudhary & Pasa, 2015; Phipps et al., 2008; Thapa et al., 2020). Data from a 2010 study from the Asian Development Bank, identified 27 technical colleges and training centers as providing a diploma for agriculture specific programs (2015). The Agriculture and Forestry University in Bharatpur, Nepal describes the agricultural sector as a key pillar in poverty alleviation and rural development programs (Agriculture and Forestry University, 2023). The first vocational agriculture school was established in Nepal in 1937, but formalized agricultural education only began in Nepal in 1957 under the Department of Agriculture following the democratization of the education system (Agriculture and Forestry University, 2023).

While some agricultural theory is integrated into existing science courses, many students lack practical exposure due to a lack of quality lab and farm facilities (Pen, 2019). Through changes in the agricultural market structure and globalization, there is an increasing need for human resources in Nepal's agricultural sector (Agriculture and Forestry University, 2023; Pen, 2019). While minimal literature examines educational resources being used to deliver agricultural education in primary and secondary education, the importance of agricultural education to Nepal's national development is acknowledged. Chaudhary and Pasa offer that "rural development without productive and transformative agricultural education system is almost impossible" (2015, p. 44).

Educator Impacts on Learning Outcomes

Educators play a critical role in supporting the delivery of quality and equitable education as outlined in UN SDG 4 (NCSSLE, 2023; UN, 2015; Yoshida, 2020). In Nepal, educators struggle from poor public perception surrounding the quality of education, particularly in government schools in rural areas (Moore, 2014). Significant challenges also exist related to student performance, which is widely used as a point for evaluation of teacher effectiveness (UNICEF, 2023). Despite significant obstacles, educators in Nepal are still critical to delivering positive student learning outcomes. Research shows that students build stronger, beneficial connections within their schools and communities when they have a trusting and supportive relationship with their teachers (NCSSLE, 2023). According to the National Center on Safe Supportive Learning Environments (NCSSLE), educators who implement a variety of instructional strategies to address individual student's needs can promote opportunities for meaningful learning and success (NCSSLE, 2023). The *International Task Force on Teachers for Education 2030* states that teachers are key stakeholders in achieving all goals outlined in the SDG 4 Education 2030 agenda (Yoshida, 2020). Yoshida describes the evolving role of educators as both teachers and facilitators in the "new environment" with increased demand for students with 21st century skills and advanced technology skillsets (2020).

Importance of Educator Professional Development

Educator professional development allows educators to improve their performance and effectiveness in the classroom, ultimately supporting positive student learning outcomes (Kshetree, 2021; Francis, 2021). Tangible benefits of educator professional development include providing educators with new information, technology, resources, and instructional strategies to improve instruction in their area of instruction (Francis, 2021). Beyond the direct benefits seen in improved student performance, professional development can support teacher retention goals by reducing burnout and turnover rates within school systems (Francis, 2021). Effective training of educators can provide a higher degree of equity in access to education (OECD, 2012).

In Nepal, professional development is available to educators in various capacities even though access to professional development is not equitable throughout the country. Teacher training is an essential component of the SDG 4 Education 2030 Agenda (UNESCO, 2015a; Yoshida, 2020). The World Education Forum's *Incheon Declaration* of 2015 states the need to "ensure that teachers and educators are empowered, adequately recruited, well-trained, and professionally qualified" (UNESCO, 2015a, p. 9; Yoshida, 2020). Existing programs such as the Teacher Professional Development (TPD) program for Nepalese English teachers are designed to address specific needs identified by educators (Kshetree, 2021). Professional development programs respond to the challenges remaining even after investment in educational goals, demonstrating broader flaws in the educational delivery stemming from inadequate training and preparation of teachers (Kshetree, 2021). In the limited teacher professional development programs that exist in Nepal, studies have shown that the programs lack effective coordination and structure. For example, the TPD program suffered from the hasty "selection of teachers…making training unmanaged. The TPD impact on the teachers was found to be less efficacious…they sometimes selected teachers who had never taught English. The demands of teachers were not addressed properly" (Kshetree, 2021, p. 58). Quality professional development for educators at all levels in all disciplines is an expressed need within the Nepalese education sector (Francis, 2021; Kshetree, 2021)

Theory of Asset Based Community Development (ABCD)

The ABCD Theory utilizes the assets found in communities to empower individuals and organizations to come together to address needs and challenges (Kretzmann & McKnight, 1993). By building an understanding of resources within a community coupled with an understanding of the community itself, the ABCD Theory allows researchers to generate constructive solutions and plans of action (CIFOR – ICRAF, 2021; Kretzmann & McKnight, 1993). As described by researchers from DePaul University, the ABCD Theory "is concerned with how to link micro-assets to the macro-environment" (Collaborative for Neighborhood Transformation, 2023). Within the theory, communities are viewed as diverse networks of people with varying skills and assets that can be mobilized to solve challenges, shifting the focus in development away from the present challenges towards the tools used to build solutions (Collaborative for Neighborhood Transformation, 2023). Five key areas of assets are identified in the ABCD Theory: individuals, associations, institutions, place based assets, and connections (Collaborative for Neighborhood Transformation, 2023). Underneath these broader categories of assets, individual resources allow communities to act to create desired changes.

Photovoice as a Research Method

This study used the photovoice method as outlined by Wang and Burris (1997). Photovoice research is a visual research methodology originally used in the health sciences that is designed to bring about social change (Budig et al., 2018; Wang & Burris, 1997) When used in participatory research, photovoice enables researchers to gain perspectives from participants that truly represent their context and experiences through collection of photos and accompanying descriptions. Photovoice research highlights local expertise and knowledge to address needs and goals in individual communities, aligning with the tenets of the ABCD Theory (Kretzmann & McKnight, 1993; Wang & Burris, 1997). Previous research on the impacts of the photovoice showed positive outcomes related to empowerment, including the development of new knowledge and awareness, improved self-perception and self-efficacy, and expanded social networks (Budig et al., 2018).

Teacher Self-Efficacy

Bandura outlines the concept of self-efficacy in describing the impact a person's beliefs regarding their ability and effectiveness have on their actions and eventual outcomes related to a specific task (1977). Educational resources support the development of positive teacher self-efficacy, described as an educator's perception of their ability to exercise control within their classroom (Bandura, 1977). Educators who believe in their personal ability to create change and teach effectively are well positioned to deliver positive outcomes within their classroom (Mojavezi & Tamiz, 2012). Teacher self-efficacy is a critical influence on effective education and has been demonstrated to have a direct correlation with student motivation and achievement (Mojavezi & Tamiz, 2012; Tschannen-Moran et al., 1998). Existing literature on teacher self-efficacy shows teachers with positive levels of self-efficacy improve the educational experience for students as well as themselves (Zee & Koomen, 2016). Teacher self-efficacy has been shown to reduce burnout and improve psychological well-being and classroom organization (Zee & Koomen, 2016).

Agricultural Education for Development

Agricultural education is an important tool used to drive progress towards goals in rural development (Chaudhary & Pasa, 2015). In a study in the *International Journal of Economic Sciences*, Nowak and Dahal (2016) illustrate the direct correlation between access to primary, secondary, and tertiary education and Real Gross Domestic Product per capita in Nepal. Education seeks to address short-term economic and policy goals while also supporting longer-term solutions related to human capacity building and socio-economic growth within a given context (Nowak & Dahal, 2016). Broad educational goals such as literacy and numeracy skills coupled with career-specific education at higher levels – including agricultural education as part of TVET and STEM education – comprise the overall educational system preparing students for successful contributions to development goals (Nowak & Dahal, 2016; Rauner & Maclean, 2008).

A significant challenge related to TVET and agricultural education delivery in Nepal is the low employment rates of TVET graduates (Asian Development Bank, 2015; Bagale, 2018; Kurata et al., 2020). Kurata et al. (2020) and Bagale (2018) describe how a mismatch between the market needs and program content leave TVET students without the appropriate skills to secure employment or contribute to development goals and initiatives. TVET expanded widely in Nepalese secondary education following the 2013 Nepal Ministry of Education’s *School*

Sector Reform Plan, with agricultural education being one form of TVET delivered at the secondary level (Kurata et al., 2020). Alignment between current industry goals and standards taught in TVET courses is necessary to increase effectiveness of career-focused instruction, including in agricultural education (Bagale, 2018). An emphasis on local relevance and industry connections for educators delivering TVET is a necessary step in designing effective educational courses and programs (Bagale, 2018).

In a case study performed in Nepal by researchers from Shinshuu University in Japan, it was found that agricultural education programs in Nepal's Mustang District lacked sufficient education of local farming practices to effectively prepare graduates (Kurata et al., 2020). Recommended improvements emerging from the focus group discussions included expanding connections with local farmers, increasing the use of comparative research in learning experiences, and integrating effective use of school farm facilities into the curriculum to teach concepts such as value-addition (Kurata et al., 2020). Because the training and licensing program for agricultural educators in Nepal was not established prior to the start of the agricultural education program, researchers contend professional teacher training in agricultural content is an area of need (Kurata et al., 2020).

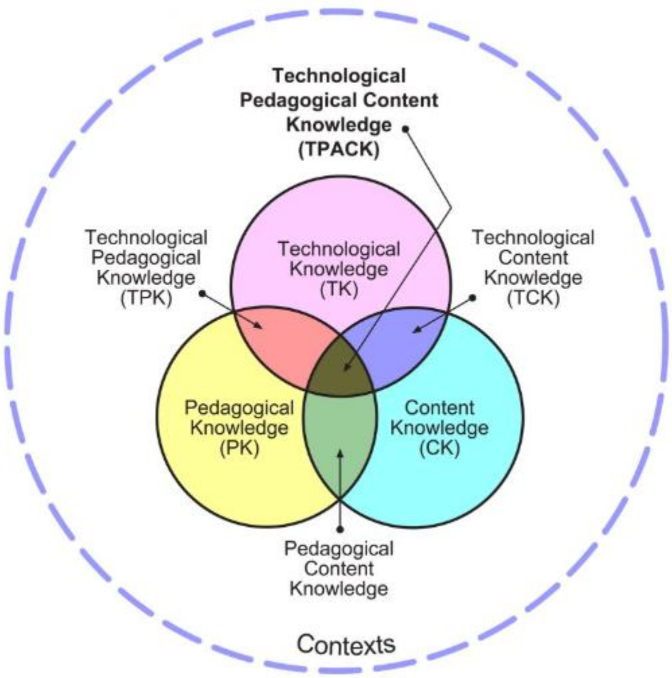
TPACK/GPACK

Mishra and Koehler (2006) outline the Technological Pedagogical Content Knowledge (TPACK) framework in which the researchers aim to represent the essential qualities of teacher knowledge. Within the TPACK framework, the separate domains of technological knowledge, pedagogical knowledge, and content knowledge are brought together to show the interconnected and multifaceted nature of effective instructional delivery (Kurt, 2019; Mishra & Koehler, 2006).

Figure 2.3 illustrates the TPACK framework and outlines the specific relevance of TPACK with an educator's specific context and community (Kurt, 2019). Teachers must understand the content and information within their specific discipline, the pedagogical methods regarding how to teach effectively within their content area, and the technological resources that can be used to integrate collaboration and innovation in the process of instructional delivery (Kurt, 2019; Mulholland, 2014; Mishra & Koehler, 2006).

Figure 2.3

Technological Pedagogical Content Knowledge Graphic (Kurt, 2019)



Urban et al. (2018) adapt the TPACK framework to include global knowledge by proposing the model of Global Pedagogical Content Knowledge (GPACK). The model originally used for the integration of effective technology usage is also relevant for including elements of globally focused education in instructional design (Urban et al., 2018). In a study of faculty members at the University of Georgia, teacher training in the areas of content, pedagogy, and global issues proved to be an effective method of preparation with benefit beyond specific training in a single knowledge area (Urban et al., 2018). Within the Nepalese context, globally focused education can support progress toward educational and development goals (Chaudhary & Pasa, 2015; UN, 2015; UNESCO, 2015b).

Summary

Education is viewed as a valuable tool driving sustainable development and contributing to social and economic progress in countries and communities around the world. Many of these goals are captured in UN SDG 4: Quality Education (United Nations General Assembly, 2015). Educators play a pivotal role in helping to achieve these goals and shaping student success related to learning outcomes (NCSSLE, 2023). The Nepalese education system is commonly marked by challenges, including low-quality primary and secondary education, poorly prepared teachers, and a lack of desired educational resources (Mathema, 2007). Despite these challenges, the Nepalese education system has seen considerable improvement in primary enrollment and literacy scores and gains support from international investment (UNICEF, 2023).

Within the Nepalese education system, STEM education and TVET provide students with career-focused experiences through experiential learning opportunities (Kandel, 2018). TVET education is of value in low-resource environments such as Nepal, as it allows students to develop employable skillsets that can be used to contribute toward development efforts. Agricultural education is one form of TVET that supports rural development in agricultural areas (Nowak & Dahal, 2016). Currently, Nepalese TVET and agricultural education suffer from minimal connections to the industry and market needs, leading to low-employment rates for TVET graduates (Kurata et al., 2020). When viewed through the lens of the ABCD Theory, the educational resources identified by Nepalese science educators through the photovoice research method can be used to support the development of teacher self-efficacy, rural development through agricultural education, and the development of TPACK/GPACK for educators through professional development and training (Bandura, 1977; Chaudhary & Pasa, 2015; Kretzmann & McKnight, 1993; Mishra & Koehler, 2006; Urban et al., 2018; Wang & Burris, 1997).

Chapter 3 - Methods

This chapter presents the research methods used in this descriptive qualitative study. To ensure quality scholarship, research methods and data collection procedures based on discipline standards were created to guide this research study. The photovoice methodology involving data collection of both participant-captured photographs and accompanying narrative interviews will be discussed. In addition, this chapter will outline the procedures used for data analysis and thematic coding of findings. The study design, data collection, and analysis are outlined in this chapter according to the APA 7th Edition Publication Manual (American Psychological Association, 2020).

Purpose and Objectives

The purpose of the study was to explore perceptions of available assets in the Nepalese educational delivery system as well as opportunities for utilization of agricultural education in low-resource environments by science educators at ten schools in Central Nepal. The following research objectives guided the study:

1) Describe Nepalese science educators' perceptions of their educational delivery system through the lens of the Asset Based Community Development Theory.
2) Describe Nepalese learning environments as perceived by Nepalese science educators.
3) Describe educational resources for science education as defined by Nepalese science educators.
4) Explore perceptions of Nepalese agriculture as a context for science education by Nepalese science educators.

Theoretical Foundation

Sijapati et al. (2015) and Rauner and Maclean (2008) outline the importance of STEM education and TVET as critical to the development of career skills for an engaged and productive population. Within Nepal, science education is an important component of the overall educational delivery model, and prior research has focused on the ability to effectively utilize inexpensive resources and technology to increase student interest in science education (Neupane, 2015). Effective access to and utilization of educational resources allow educators to teach effectively and demonstrate fundamental scientific concepts.

Within the context of the Nepalese science education community, previous research has frequently illustrated challenges of reduced access to quality educational resources (Mathema, 2007; Sijapati et al., 2015; Thapa, 2015). The *Education Research International* journal discusses the importance of science education to currently developed countries and contends that an improved understanding and public perception of "the use of science and technology in industrial development is highly significant, especially for underdeveloped and developing countries" (Dhamala et al., 2021). Dhamala et al. of Tribhuvan University identify the "fundamental bottleneck" preventing the expansion of science and technology education as stemming from policy ambiguity and physical infrastructure (2021). While Nepal's education system made major democratic shifts in the 1950s, the authors contend that the vision of a "prosperous and developed Nepal" has not been fully realized within either the education or science and technology sectors (Dhamala et al., 2021; Thapa, 2015). In accordance with the GTAN research framework outlined in Figure 1.1, research related to available educational resources helps to build an understanding of an educator's pedagogical approaches and respective personal agency in their classroom (Rice et al., 2022).

While challenges within the delivery of science education are readily apparent, the ABCD Theory outlined by Kretzmann and McKnight (1993) emphasizes the importance of community-led development using existing resources (Nurture Development, 2018). A shift from a deficit-based model to an asset-based approach can help to spur positive development and mobilize community assets. Figure 3.1 contrasts the processes and impacts of deficit based and asset based approaches, demonstrating the transformative impact of the ABCD Theory. Research following the ABCD Theory identifying stakeholders, mapping assets along the five primary categories (associations, connections, individuals, institutions, and place based assets), and engaging community members to leverage the existing assets and grow resources for development (Kretzmann & McKnight, 1993; Nurture Development, 2018).

Figure 3.1

Contrast of Deficit and Asset Based Approaches (Nurture Development, 2018)

	Deficit Based	Asset Based
Purpose	Changing community through increased services	Changing community through citizen involvement
Method	Institutional reform	Citizen-centred production
Accountability	Leaders are professional staff, accountable to institutional stakeholders.	Leaders area widening circles of volunteer citizens. Accountable to the community.
Significance of Assets	Assets are system inputs. Asset mapping is data collection.	Assets are relationships to be discovered and connected. Asset mapping is self-realization and leadership development.
Production Resource	Money is the key resource. Falls apart without money.	Relationships are the key resource. Falls apart when money becomes the focus.
Operating Challenge	How do we get citizens involved?	How do we channel and build on all this citizen participation?
System Dynamic	Tends to spread itself thinner over time.	Tends to snowball over time.
Evaluation	Success is service outcomes, measured mostly by institutional stakeholders.	Success is capacity, measured mostly by relationships.

Deficit Based Process vs Sustainable Community Development Asset Based Approach

Institutional Review Board

The Pennsylvania State University in accordance with federal guidelines requires review and approval of all research studies involving human subjects. Following review, the human subjects research proposal for this study was deemed exempt by the Institutional Review Board at The Pennsylvania State University prior to the execution of the study. The Study ID for this study was STUDY00020027. The Institutional Review Board Exemption Determination form is presented in Appendix A. A copy of the Consent for Exempt Research form is provided in Appendix B. The handout document approved for distribution to study participants can be found in Appendix C.

Study Context

This study was conducted by a research team from GTAN comprised of two faculty members and two undergraduate researchers. The research team traveled to ten schools across central Nepal in connection with the RNEF. RNEF is a non-profit organization working to support schools in Nepal by raising awareness and financial support (Schiller, 2023). The research team traveled to Nepal to conduct an exploratory trip focused on opportunities for educator professional development alongside the execution of this research study.

RNEF identified schools in urban, suburban, and rural areas at which to conduct qualitative interviews. The locations of all interviews shown in Figure 3.2 were conducted in the greater Kathmandu and Pokhara area.

Figure 3.2

Map of School Locations

Within Nepal, science education is compulsory for all students in both primary and secondary school (Dhakal, 2016). The Teachers Service Commission in Nepal is responsible for appointing teachers in schools across Nepalese communities, and has expressed a severe lack of qualified teachers who have passed their necessary exams to fill vacant science education positions (Bhattarai, 2023). Research has shown that science education is viewed as a daunting subject by Nepalese students and low levels of scientific literacy are indicated by poor scores on national-level examinations (Bhattarai, 2023). Nepalese educator Miltan Bhattarai highlights a lack of skilled teachers, outdated curricula, and poor evaluation methods as the primary challenges facing science education in Nepal (2023). Bhattarai advocates for science educators to focus on expanding critical thinking and scientific inquiry skills within their students as a means for improving the perception and performance by students related to national science education goals (2023).

Study Population

To ensure diverse perspective were represented in our study, the research team interviewed male and female Nepalese science educators from government, private, and public trust schools. These schools were also located across urban, suburban, and rural areas. Thirteen Nepalese science educators from ten different schools participated in the research study. Table 3.1 highlights the demographic breakdown of educators across the gender of educator, school type, and school location.

Table 3.1

Demographic Breakdown of Educators Interviewed

Demographic Variable:	N	Percentage
Gender of Educator (N=13)		
Female	3	23.1
Male	10	76.9
School Type (N=10)		
Government	5	50.0
Private	4	40.0
Public Trust	1	10.0
School Location (N=10)		
Urban	4	40.0
Suburban	4	40.0
Rural	2	20.0

All ten schools were identified by RNEF – GTAN's local partner in Nepal. At eight of the schools visited in this study, one science educator was interviewed. At one urban school, two different science educators were interviewed. At one suburban school, three different science educators were interviewed. All educators interviewed in this study taught science at the secondary level; some of the educators also taught primary students. While several educators participating in the study taught at multiple schools within Nepal throughout the course of the school year, each educator was interviewed at their main school of employment where they spent most of their time teaching.

Research Design

This descriptive qualitative study used a participatory action research method known as photovoice (Wang & Burris, 1997). The concept of using photography as a tool for empowerment in participatory action research was first introduced by Wang and Burris (1994) as photo novella. In accordance with principles outlined in the *Pedagogy of the Oppressed* (Freire & Ramos, 1970), the photo novella method allows for participants to document and discuss their lives as they saw them (Wang & Burris, 1994). Because the term photo novella is "commonly used to describe the process of using photographs or pictures to tell a story", Wang and Burris use the term photovoice as a term to describe the broader process of allowing individuals within a community "to act as recorders and potential catalysts for change" (Wang & Burris, 1997, p. 369).

Theoretical Foundation of Photovoice

Photovoice is highlighted as "a process by which people can identify, represent, and enhance their community through a specific photographic technique" (Wang & Burris, 1997, p.

369). The photovoice methodology was created from three main conceptual sources: education for critical consciousness, feminist theory, and documentary photography (Wang & Burris, 1997). Wang and Burris applied the photovoice methodology in the Yunnan Women's Reproductive Health and Development Program in southwestern China (1997). A focus on problem-posing education and critical consciousness allows participants to identify central themes and direct the dialogue surrounding their communities and resources (Freire & Ramos, 1970; Spence, 2020; Wang & Burris, 1997). Frisby et al. (2009) highlight the importance of removing bias from participatory action research, underscoring the importance of doing research "with" participants instead of research "on" participants. The application of documentary photography allows the photographic data captured in participatory action research to speak of human connection (Hubbard, 1991; Spence, 2020; Wang & Burris, 1997). Individuals within an identified community are empowered to tell their story through the collection of photographs as first-hand evidence, often showing challenges previously unseen by the general population in a new way (Wang & Burris, 1997).

Photovoice as Needs Assessment

A strength of the photovoice research method lies in its ability to link a needs assessment with community participation (Wang & Burris, 1997). Photovoice research can affirm the perspective of the most vulnerable populations within a community and provides visual images that fulfill the necessary descriptive nature of a needs assessment (Wang & Burris, 1997). While this specific study relied on the ABCD Theory put forth by Kretzmann and McKnight (1993), the ability of photovoice to identify and describe community needs alongside the identified assets is transformative in its potential for impact. Traditional needs assessments where individuals are “counted, interviewed, and questioned” may unintentionally create feelings of inferiority, while photovoice and its role in participatory action research help to uplift participant voices and instill a sense of pride and ownership in the process (Wang & Burris, 1997; Spence 2020).

Application of Photovoice

The goal of photovoice as an innovative form of participatory action research is to guide and direct change at all necessary levels for communities in need (Latz, 2017; Wang & Burris, 1997). To inform policy and governance changes surrounding social, economic, and political issues, photovoice gives individuals the opportunity to record and reflect upon issues to promote a critical dialogue surrounding the relevant issues (Wang & Burris, 1997). The use of photographs allows participants to represent the reality of their communities honestly and accurately (Spence, 2020; Wang & Burris, 1997). Whyte et al. of Cornell University (1989) advocate for the value of participatory action research and its approach to actively engaging participants in the research process through self-representation. As a result of this authentic engagement, participants benefit from being able to witness first-hand the impacts and changes brought about by their participation (Latz, 2017; Spence, 2020; Wang & Burris, 1997).

Data Collection

In *Photovoice Research in Education and Beyond,* author Amanda Latz of Ball State University outlines eight primary steps in the photovoice research process: identification, invitation, education, documentation, narration, ideation, presentation, and confirmation (2017). Figure 3.3 outlines the eight steps of the photovoice methodology as executed in this study.

Figure 3.3

Implementation of Eight Steps of Photovoice Methodology

Step 1: Identification	RNEF identified schools and a visit time was scheduled.
Step 2: Invitation	I traveled with the GTAN Research Team and RNEF staff to a school and met with school administrators. School administrators identified science educators at the school who taught at least some secondary science classes.
Step 3: Education	I met with the science educators and discussed the objective of the study. I provided the educator with the consent form and obtained necessary permission before continuing.
Step 4: Documentation	After a brief introductory conversation to learn more about the educator and their background (recorded for later transcription), the educator was given a mini i-pad device and a list of photo collection prompts. The educator was given as much time as they needed to use the i-pad camera and collect as few/many photos as they chose in response to the prompts.
Step 5: Narration	After concluding their photo collection, the educator would return to the group meeting place. Together, we would go through the photos they collected and follow the narration prompts to learn more about each photo. These narrative interviews were recorded for eventual transcription.
Step 6: Ideation	Following the conclusion of data collection, I worked with the GTAN research team to operationalize definitions of assets using the ABCD Theory and analyze the photographs and narrative interview transcripts.
Step 7: Presentation	The results of the data are presented in various forms, including this thesis, a journal article, and oral/poster presentations at relevant professional conferences.
Step 8: Confirmation	The study findings are communicated to each of the thirteen study participants and shared with the local partner (RNEF) to support community transformation efforts.

Introduction and Consent

Each school visited in this study was identified by RNEF. RNEF founder Ernest Schiller was the primary individual who identified the schools we visited during our time in Nepal. Mr. Schiller worked with our van drivers and translator to coordinate the logistical details of this study. Arjun Adhikari was our primary guide during our trip in his role with Earthbound Expeditions Ltd. Mr. Adhikari helped to arrange our travel and helped to explain our trip upon arrival at each school. Bishal Thapa served as our primary translator throughout each of the 13 interviews the research team conducted. Mr. Thapa is originally from Nepal and attended university at the University of Idaho in the United States. Mr. Thapa was fluent in both English and Nepali, and translated both our spoken words and written materials when requested by any individual we interacted with during this study, primarily school administrators and the educators participating in this study.

Upon arriving at each school, our group was typically greeted by administrators at the school. With help from our translators, I requested that we go to an administrative office or other meeting room to explain our goals during the visit. During this initial visit, the school administrators generally told our research team about the students and teachers at their specific school and the work that they did as leaders of the school.

Next, myself and the other members of the research team outlined the purposes of our research study and explained that we wanted to interview science educators who teach at the secondary level to learn more about their educational resources. Upon our request, the administrators identified one or more science educator(s) at each school and coordinated a formal introduction with our group, which typically involved sending a lower-level administrator or assistant to go call the science teacher from their classroom to come to the office or meeting room. Our research team made it clear that we did not desire to interrupt instruction that was in progress, but we found it was customary and well accepted for a teacher to leave their class to meet with guests even if it meant stopping instruction. During this time, the students remained in their classroom.

After the science educator arrived at the office, we would do brief introductions sharing our names and institution. I proceeded to ask the science educator if they were interested in participating in our research study related to educational resources, and if the educator indicated they were, we would either move to a different location or have the administrators leave the meeting space. Administrators were not present during any portion of the interviews and data collection with the science educators so as not to influence the educator's data collection or interview responses. If there were multiple science educators participating in the study at the same school, we split up as a research team to conduct multiple separate interviews simultaneously.

After moving to the private location, I presented each educator with a copy of the Consent for Exempt Research found in Appendix B. In reviewing the form, the educators were informed that their anonymous participation was voluntary and that they were free to end their participation in the study at any point. In giving a verbal yes, the educators gave their consent to participate fully in the study as outlined. After verbal consent was provided, I initiated the interview. All interviews were recorded using the Voice Memos application on the mini I-pad devices used in this study.

Each interview began with a brief introductory conversation focused on each educator's educational background, prior experiences, and specific instructional focus. These introductory conversations followed the format of nondirective interviews in which the participants guided the process of information sharing (Billups, 2021; University of Illinois, 2023). I did not utilize an established list of pre-determined questions during the introductory conversation, but rather used broad questions that allowed each participant to share details about their personal background they deemed to be important. The purpose of these nondirective conversations was to allow each participant to share at length the aspects of their personal background and identity that they deemed most relevant to their work as a science educator. General content covered in the introductory conversation included details on each educator's personal tertiary education, interest in science education, and experience in their teaching field.

Photo Collection

At the conclusion of the introductory conversation, each participant was given a copy of the Nepalese Educator Handout found in Appendix C. I explained to each participant that they would be given a mini I-pad device to use during the photo collection portion of the research study. The participants were to use the camera application on the mini I-pad device and capture photos in response to a list of prompts related to their educational resources. Participants were instructed not to capture photos showing their students' faces to comply with the approved exempt research proposal approved by The Pennsylvania State University Institutional Review Board. The following prompts guided photo collection:

1. Describe how you define educational resources.
2. Show what educational resources mean to you.

3. What is your favorite instructional tool?
4. I consider _________________ a conventional educational resource.
5. I consider _________________ a non-conventional educational resource.
6. Show what content you teach.
7. ___________________ helps me develop effective instruction.

After translating the handout and prompts if necessary, I received verbal confirmation that the participant understood the photo collection prompts. If the participant was unsure of how to use the mini I-pad camera, I would demonstrate the process to them by taking one example photo in the room we started in. If requested, I accompanied the educator during the photo collection, but did not give guidance as to whether the educator should capture a photo of a specific resource even when asked. If confusion arose, our translator helped to clarify the expectations to the educators. We repeatedly ensured the educators that any item they felt was an instructional resource was valid and that our goal was not to assess the quality of a given educational resource, but rather to simply understand what resources the educators use to teach.

Narrative Interview Protocol

After the educator felt they had captured all the photos they desired to fully answer the prompts, they indicated that they had finished the photo collection process. At this point, we returned to our previous private meeting space and began the narrative interview portion of the data collection. These interviews followed the structure of a semi-structured interview in which the researcher follows a pre-determined set of questions from an interview guide but may ask additional follow-up questions brought about by the trajectory of the conversation. (Cohen & Crabtree, 2006).

To begin the semi-structured narrative interview, I would take the mini I-pad device and navigate to the photos application to find each of the pictures the participant had captured. After resuming the recording using the voice memos application, I began with the first photo the participant had captured and went through each photo individually. Photovoice protocol emphasizes this phase of the research as an exercise in "storytelling and active listening" (Latz, 2017). This reflective narration provided verbal context to the photos and supported our understanding of the photographs. The following prompts using the "PHOTO" acronym as outlined by Latz (2017) guided the narrative interview discussion of all photos:

1. Describe your **P**icture.
2. What is **H**appening in your picture?
3. Why did you take a picture **O**f this?
4. What does this **T**ell us about your educational resources?
5. How can this picture provide **O**pportunities for educational instruction and resources?

After each of the photos captured by the participant had been discussed in the narrative interview, each participant was given a chance to share any additional information that they desired related to their educational resources. After they had finished, I stopped the Voice Memos recording and thanked the educator for their participation in the study. We exchanged contact information with the educators by typically sharing email addresses and Facebook accounts that would allow us to communicate and eventually share the results and final presentations of this study with our participants. I presented each participant with a chocolate bar as a token of our appreciation for their participation in the research study. Afterwards, we would conclude our school visit with the educator(s) and school administrators before leaving the school.

Data Analysis

Following my return to the United States, I began the process of analyzing the data collected during the study. Because the interview recordings on Voice Memos contained both English and Nepali, the Otter.ai transcription software I had intended to use to generate transcripts was not able to produce satisfactory results. GTAN was able to connect with an individual who was able to both translate and transcribe the recordings to produce complete and accurate transcripts of the interviews in English. Following the completion of the translation, the transcripts were uploaded to MAXQDA for qualitative analysis.

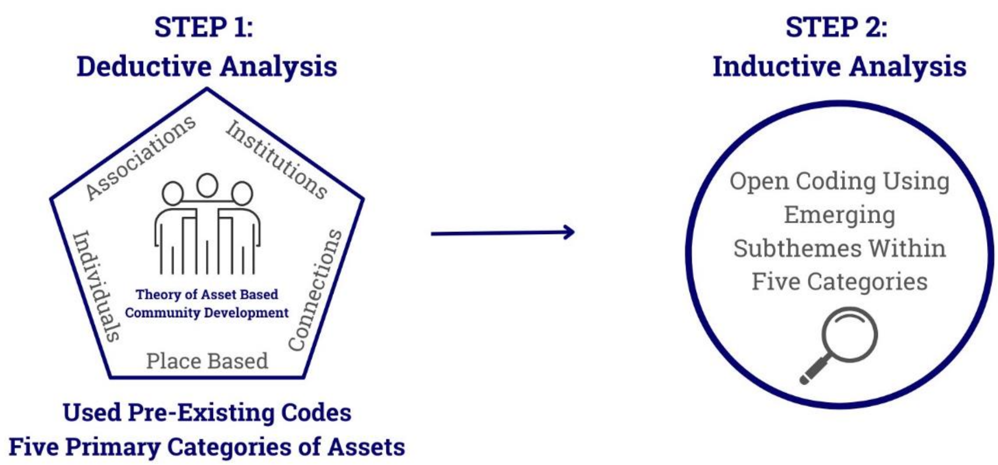
Phenomenological Approach & Hybrid Thematic Analysis

The qualitative analysis using MAXQDA was completed by myself and one of the faculty members who was part of the GTAN research team. The coding process was done using a phenomenological approach, in which the narrative interviews as part of the photovoice method were used to give meaning to the photos captured by the participants (Tsang, 2020; Plunkett et al., 2013). In contrast to the critical approach, the phenomenological approach favors researcher-led analysis (Tsang, 2020). The researchers build their understanding of the participant’s lived experiences and emerging phenomena from the participant’s narrations of the photographs (Tsang, 2020; van Manen, 1997). During the data analysis process, the photos captured by each participant were taken together with the transcript from the corresponding narrative interview for analysis of meaning.

The coding process followed a hybrid thematic analysis as outlined by Fereday and Muir-Cochrane (2006), in which the same set of qualitative data is analyzed using both deductive and inductive coding (Proudfoot, 2023). In this hybrid process, the mutual reinforcement of the two coding approaches can provide greater rigor in the resulting findings (Proudfoot, 2023; Fereday & Muir-Cochrane, 2006). Figure 3.4 illustrates the hybrid thematic analysis process.

Figure 3.4

Hybrid Thematic Analysis Process



Deductive Analysis

The initial qualitative data analysis followed the process of deductive coding. In deductive coding, the researcher uses a pre-determined set of codes in an established coding frame, often related to an existing theory or framework (Skjott Iinneberg & Korsgaard, 2019; Saldaña, 2013). Deductive coding allows a researcher to connect findings to well-established themes in pre-existing frameworks rather than identifying emerging themes from only the data as is done in the inductive coding process (Skjott Iinneberg & Korsgaard, 2019; Saldaña, 2013).

The codes used within this study were drawn from the ABCD Theory and are presented in Figure 3.5. Complete thoughts as stated in the interview transcripts were used as the unit of analysis upon which to make decisions during the coding process (Roller & Lavrakas, 2015). The ABCD Theory outlines five primary categories of resources: associations, connections, individuals, institutions, and place-based assets. In addition to these existing codes from the ABCD Theory, any statement describing a challenge identified by educators was coded as such.

Figure 3.5

Theory of Asset Based Community Development Categories

To create a codebook using the five primary categories of assets as outlined in the ABCD Theory, I developed operationalized definitions for each of the categories. These operationalized definitions were refined in multiple iterations of inter-coder reliability meetings. After reaching an inter-coder reliability score with the additional coder of greater than 90 percent using three example transcripts, I proceeded to code all thirteen transcripts using the finalized codebook and supported my coding decisions using the photographs captured by each participant.

Inductive Analysis

After the process of deductive coding was completed, I transitioned to an inductive coding process for codes leading to themes within each of the five primary categories of assets. This process did not use an existing set of codes and allowed me to build deeper understanding within each category of assets (Tsang, 2020; Proudfoot, 2020; Fereday & Muir-Cochrane, 2006). In the constant comparative analysis process based in grounded theory (Glaser & Strauss, 2017), qualitative data that is coded and compared across categories can be used to identify and refine patterns leading to themes and findings. This process sought to identify emergent themes that "lead to generalizable theories of human society" emerging from close analysis of qualitative data (Williams, 2008). The codes identified through the inductive coding process informed the development of relevant themes that accounted for the observed phenomena. This secondary process follows the protocol for selective coding where the data is refined into central themes and ideas that capture the essence of the research findings (NEAG School of Education, 2023).

Data Presentation

Data is presented in accordance with the four primary objectives of this study and connects to emerging themes connected to the five primary categories of assets outlined in the ABCD Theory (Kretzmann & McKnight, 1993). Following the method of photovoice participatory action research, photographs and transcriptions of the accompanying narrative interviews comprise the total data set of this study (Wang & Burris, 1997; Latz, 2017). Results of the hybrid thematic analysis using an initial deductive coding approach aligning with the ABCD Theory and a subsequent inductive coding approach to elucidate codes and themes in each connect data to broader ABCD Theory categories (Fereday & Muir-Cochrane, 2006; Kretzmann

& McKnight, 1993). Using this structure, the data will be used to address the purpose and objectives of this research study.

Validity

To ensure the validity of our data analysis approach during the deductive coding process, the two researchers ensured an inter-coder reliability score of greater than 90 percent using the MAXQDA Agreement software. When sufficient proportions of agreement were not obtained in initial iterations, myself and the additional coder would work to revise our operationalized definitions to increase clarity and shared understanding of the codebook. A list of meeting records and inter-coder reliability score results can be found in Tables 3.2.

Table 3.2

Inter-Coder Reliability Meeting Record – Initial Deductive Coding

Iterations:	Date:	Percentage of Agreement:
Round 1	04/13/2023	30
Round 2	04/15/2023	65
Round 3	04/22/2023	91

Following the initial deductive coding process, the two researchers followed the process of constant comparative analysis in which the data were coded using an inductive coding process to identify sub-codes that led to the identification of themes (Glaser & Strauss, 2017).

Trustworthiness and Credibility

Throughout the study, having reliable and knowledgeable translators present helped to ensure the accuracy of our data. In any situation in which it was uncertain that a participant fully understood a question or prompt, our translator spoke in Nepali to clarify. Several interviews were conducted entirely in Nepali, where the translator would repeat each of our question in Nepali and restate all of the participant's answers back to me in English. Several participants requested to complete all or some of their interview in English but were welcomed to switch to speaking Nepali if at any point they became more comfortable in doing so.

The credibility of the data was also reaffirmed upon receiving the fully translated transcriptions from the transcriber. The transcriptions included the word-for-word translation from both the participant and the translator who had helped to conduct the interviews in Nepal. Only the words spoken by the participants were used in analysis, and this also allowed us to verify the understanding we had leaving the interviews based on the initial responses and on the spot translation of our translator.

Limitations

Several different factors presented challenges and limitations during this study. The language barrier between the research team who did not speak Nepali and the study participants who had varying degrees on English proficiency presented limitations that force the study to depend heavily upon our translators. In addition, this study was based off a convenience sample of Nepalese science educators who were most accessible in terms of geography and connection to RNEF (Edgar & Manz, 2017). The research team was dependent upon the connections of RNEF as the local partner organization and only had access to science educators teaching in schools where RNEF already connections or was able to make new relationships in the two-week timeframe we were in Nepal to conduct this study. Other variables related to geographical limitations and technological access also limited our capacity while conducting this study. The scope and duration of our experience limited the geographic range in Nepal we could cover and the total number of interviews we could complete, yet the research team was intentional about the schools we visited and the educators we interviewed as far as it depended upon us.

Because many of the same barriers that limited effective communication in Nepal remained after my return to the United States, member checking of the interview transcripts was unable to be completed with the study participants. According to Birt et al. (2016), member checking can enhance the credibility of results in qualitative research studies by providing participants with an opportunity to engage with data to clarify and ensure they are accurately represented. While the final results of our study will be communicated to our study participants through email and shared directly with RNEF as the local partner, it was not feasible for participants to review and approve their transcripts due to the language barrier and limited technological access.

An additional limitation related to this study is a current lack of multiple partners to disseminate the information and findings. The local partner RNEF will receive the results in full and can share the results with science education stakeholders within the country. However, RNEF functions primarily as a support and fundraising organization for schools in Nepal without significant legislative or political influence. I hope to establish future connections with Nepalese science education stakeholders to determine how to best communicate the results of this study to inspire necessary changes and advocate for future research related to science education resources in Nepal.

Summary

This qualitative study used the Photovoice method as outlined by Wang and Burris (1997). When used in participatory research, Photovoice enables researchers to gain perspectives from participants that truly represent their context and experiences through collection of photos and accompanying descriptions. Photovoice research highlights local expertise and knowledge to address needs and goals in individual communities, aligning with the tenets of the ABCD Theory that guided the study (Wang & Burris, 1997; Kretzmann & McKnight, 1993). In each interview, a science educator participant was given a mini I-pad device and a set of prompts to guide the collection of photos related to their educational resources. After all photos were captured, a semi-structured narrative interview of each photo was facilitated with the participant . This reflective narration provided verbal context to the photos and supported our understanding of the findings using the phenomenological approach (Tsang, 2020; Plunkett et al., 2013).

All interactions were recorded and transcribed for use in qualitative analysis. Data analysis used a hybrid thematic analysis with an initial deductive coding process using the five primary categories of assets identified in the ABCD Theory (Skjott Iinneberg & Korsgaard, 2019; Saldaña, 2013). A subsequent inductive coding process was completed to identify sub-themes within each of the primary categories (Proudfoot, 2023). Intentional efforts were made throughout the data collection and data analysis processes to ensure the validity and credibility of the data, including thorough translation and transcription and inter-coder agreement tests of over 90 percent agreement before finalizing the codebooks and analyzing the data.

Chapter 4 – Findings/Results

This chapter discusses the themes developed through hybrid thematic analysis and constant comparative analysis of the data collected (Glaser & Strauss, 2017; Fereday & Muir-Cochrane, 2006; Proudfoot, 2023). In this qualitative photovoice study, the analysis focused on the photos captured by participants and the accompanying narrative descriptions (Spence, 2020; Wang & Burris, 1997). Thirteen science educators from ten different schools participated in the study. To ensure anonymity, the study participants will be referred to using letters, such as Educator A, Educator B, etc. Through the lens of the five primary categories of the Asset Based Community Development Theory (ABCD), this chapter explores emergent themes related to learning environments, educational resources, and Nepalese agriculture as it relates to the delivery of science education.

Purpose and Objectives

The purpose of the study was to explore perceptions of available assets in the Nepalese educational delivery system as well as opportunities for utilization of agricultural education in low-resource environments by science educators at 10 schools in Central Nepal. The following research objectives guided the study:

1) Describe Nepalese science educators’ perceptions of their educational delivery system through the lens of the Asset Based Community Development Theory.
2) Describe Nepalese learning environments as perceived by Nepalese science educators.
3) Describe educational resources for science education as defined by Nepalese science educators.

4) Explore perceptions of Nepalese agriculture as a context for science education by Nepalese science educators.

Findings for Objective 1 - Describe Nepalese science educators' perceptions of their educational delivery system through the lens of the Asset Based Community Development Theory.

Objective one addresses Nepalese science educator's perceptions of their educational delivery system through the lens of the ABCD Theory. Educators captured photographs in response to the series of prompts provided in Appendix C and provided additional context through accompanying narrative interviews that described the photographs in greater detail. A breakdown of the number of photos captured by each educator interviewed as part of this study is provided in Table 4.1.

Table 4.1

Number of Photos Captured by Each Educator

Name	Total Photos Taken
Educator A	6
Educator B	4
Educator C	15
Educator D	17
Educator E	12
Educator F	18
Educator G	13
Educator H	12
Educator I	3
Educator J	3

Educator K	21
Educator L	36
Educator M	10
TOTAL	**170**

Interview transcriptions and photographs were analyzed using MAXQDA software in accordance with a codebook of operational definitions created by the analysis team to achieve a satisfactory inter-coder reliability rate. The operational definitions for each of the five primary categories of the ABCD Theory are provided in Figure 4.1.

Figure 4.1

Operational Definitions of ABCD Theory Categories

ABCD Theory Category	Operational Definition
Individuals	Any statement recognizing the gifts and skills of individuals within the community.
Institutions	Any statement recognizing formalized, structured entities or governmental bodies that work to achieve specific outcomes.
Connections	Any reference to a relational exchange or transfer of knowledge between two groups.
Associations	Any statement referencing a group of people with common goals sharing or exchanging resources.
Place-Based	Any reference to resources or assets that are unique or specific to our identified community of Nepalese science education stakeholders.

Table 4.2 provides the holistic findings of the research study in accordance with the five primary categories of the ABCD Theory. In total, the 13 educators interviewed made a total of

460 unique references to educational resources that shape the Nepalese science education delivery system.

Table 4.2

Holistic Findings Categorized by ABCD Theory

ABCD Categories	*Frequency*	*Percentage (%)*
Individuals	156	33.9
Institutions	154	33.5
Connections	62	13.5
Associations	49	10.7
Place-Based	39	8.5
Total	**460**	**100%**

When characterizing the educational delivery system in which they teach, the Nepalese science educators most frequently mentioned assets within the categories of assets and individuals as impacting the delivery of science education. All categories were referenced throughout the interviews with the educators. Within each primary category, the researchers identified numerous sub-codes that further categorized the references to assets and resources shaping educational delivery in Nepal. Table 4.3 provides a breakdown of the sub-codes and their relation to the primary ABCD Theory categories.

Table 4.3

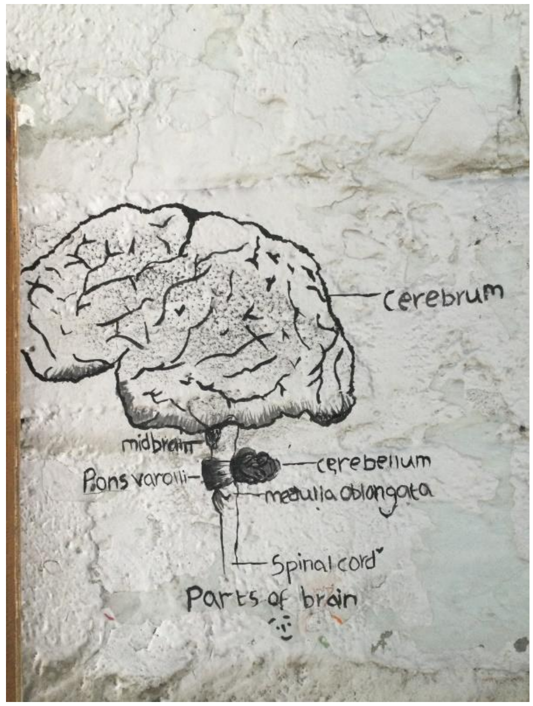
Frequency of Incidents by ABCD Theory and Sub-Codes

ABCD Theory Categories and Sub-Codes	n	N
Individuals		156
Awards	*3*	
Career and Life Experience	*18*	
Demonstration, Discussion, and Instruction	*77*	
Education and Training	*19*	
Homework Completed by Students	*7*	
Online Resources and Technology	*7*	
Personal Satisfaction and Goals	*15*	
Preparation	*10*	
Institutions		154
Curriculum	*36*	
Employment and Engagement	*12*	
Formal Teacher Training	*10*	
Laboratories and Materials	*33*	
School Resources	*63*	
Connections		62
Career Opportunities	*7*	
Community Stakeholder Engagement	*4*	
Life Application	*41*	
Mentorship	*10*	
Associations		49
External Facilities	*3*	
Non-Profit and Community Organizations	*25*	
Parental Investment	*3*	
Student Created Educational Resources	*18*	
Place-Based		39
Global Connections	*4*	
Nepalese Agriculture and Natural Resources	*10*	
Public Perception	*3*	
Secondary Education Structure	*12*	
Teacher Certification Process	*5*	
Universities	*5*	

Assets identified within the Individuals category most frequently denote instructional approaches and methods developed by the Nepalese science educators who participated in the study. These resources are used to engage with students in a variety of instructional methods, including but not limited to demonstration, discussion, and assigned homework. The Nepalese science educators brought a variety of personal experiences into their classrooms, including previous education and training and career and life experiences. These experiences were sometimes evidenced through awards and recognition educators had earned throughout their careers and personal goals educators identified during their narrative interviews. Educators spoke of their efforts to plan for and design quality instruction, which included the creation of original educational resources and identification of quality external resources – including online curricula and activities – for use in classroom instruction. Figure 4.2 shows a photo captured by an educator in the study of an educational resource they created for their individual classroom, thus classified as an Individual resource in the ABCD Framework. Science educators make important decisions surrounding the use of educational resources as they design and deliver instruction for their students.

Figure 4.2

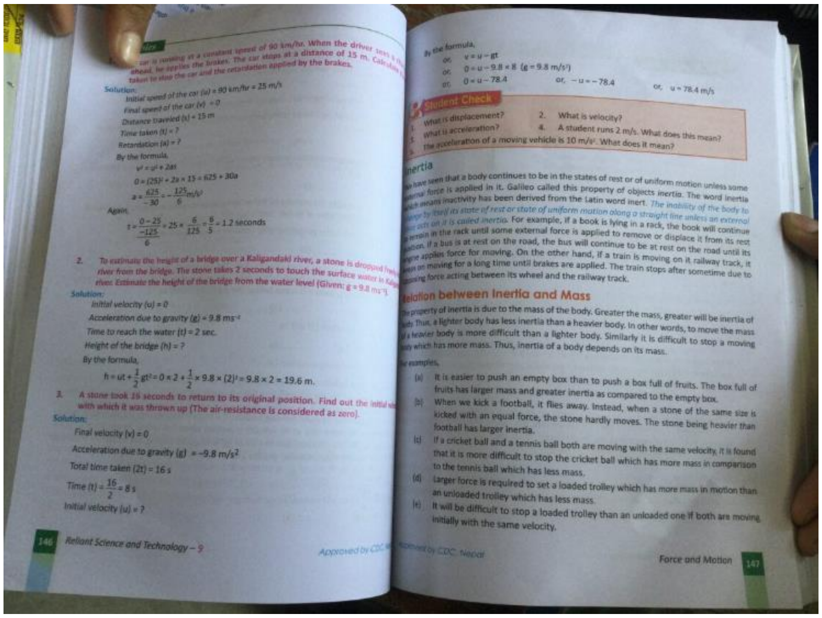
Photo of Brain Diagram Drawn by Educator (Educator C)



Assets within the Institutions category commonly describe resources provided by the school systems in which the science educators taught. Government, private, and public trust schools provide resources to their teachers to support the design and delivery of science education in the form of curriculum, school-related supplies, laboratory facilities, and more (see Figure 4.3). Systems of employment – which sometimes included teacher training and professional development opportunities within the school system – were also referenced as resources supporting instruction throughout the study.

Figure 4.3

Photo of School-Provided Textbook (Educator J)



As a category of assets, Connections described resources stemming from partnerships or relationships built on the exchange of knowledge and information between stakeholders in the Nepalese science education community. Throughout the study, participants referenced students applying their learning experiences in classroom and laboratory settings to future career opportunities or higher education following graduation from secondary school. Figure 4.4 represents a photo of an applied laboratory instructional setting captured in the study. Community stakeholders investing time to mentor students also represent connections critical to the continuing delivery and long-term success of Nepalese science education.

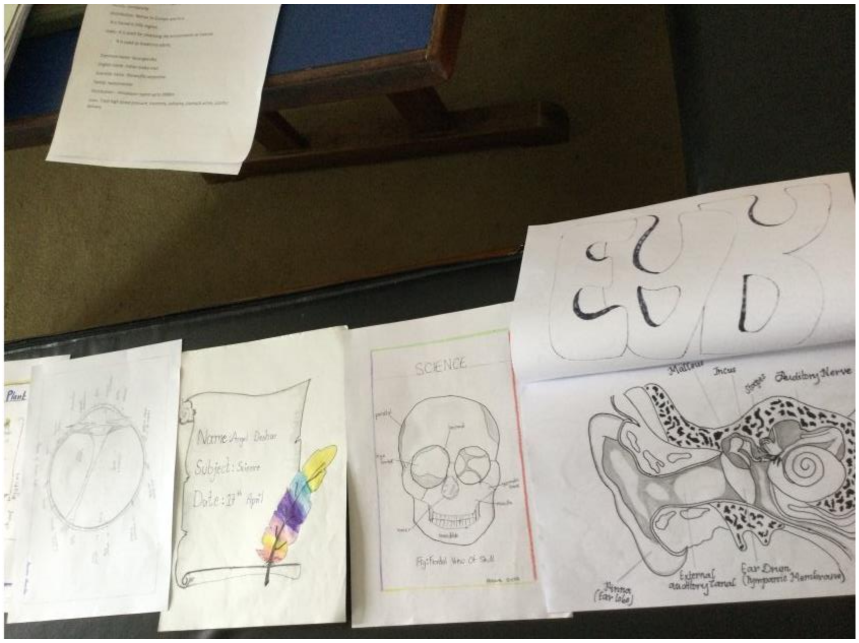
Figure 4.4

Photo of Applied Laboratory Facility (Educator K)

Educators referenced Associations in the study when discussing relationships or partnerships in which in exchange of materials or finances took place. The use of learning facilities external to the school in addition to support from parents or other stakeholders including Nepalese non-profit organizations highlight the importance of associations to the overall Nepalese science education system. In addition, students taking an active role in their own education through the development of their own educational resources (shown in Figure 4.5) demonstrate the practical value of Associations.

Figure 4.5

Photo of Student-Created Educational Resources (Educator L)



Place-Based assets identified throughout the study represent items unique to the places and communities in which the educators teach and the broader Nepalese science education community. References to both physical places and practices comprising the Nepalese education system were identified within this category. References to relevant applications of science education within agricultural contexts paint a picture of the Nepalese agricultural sector (Figure 4.6). The educators in the study often identified the specific avenues in which teachers are certified through universities and the specific secondary education system.

Figure 4.6

Photo of School Agricultural Production Facility (Educator L)

The Nepalese science educators who participated in this study perceived their educational delivery system through each of the five categories of the ABCD Theory. Assets created by and stemming from Individuals and Institutions comprise most of the resources identified (67.4 percent combined), while assets related to Connections, Associations, and Place-Based resources also contribute to the overall educational design and delivery of science education across the schools we visited in Nepal.

Findings for Objective 2: Describe Nepalese learning environments as perceived by Nepalese science educators.

In response to the prompts, the educators participating in the study described the learning environments in which they teach students through both the collection of photos and narrative interviews. When capturing photographs of their learning environments, educators primarily evidenced classrooms and laboratory facilities in which they engage with their students (Figures 4.7, 4.8, 4.9, and 4.10).

Figure 4.7

Photo of Laboratory (Educator A)

Laboratory facilities were commonly seen as settings in which to deliver applied science content. Using a variety of instructional materials and resources, students are able to complete learning activities and engage in scientific inquiry. When describing Figure 4.7, Educator A stated that in order “to run an experiment, lab space is an important educational resource”.

Figure 4.8

Photo of Computer Lab (Educator G)

With technology-related aspects comprising a critical component of the comprehensive delivery of STEM education, computer labs and similar technology-focused facilities were referenced by educators in schools with access to these facilities. Educator G described Figure 4.8 by saying “there are a lot of computers, and computers help to find different kinds of references due to the internet facilities”.

Figure 4.9

Photo of Classroom (Educator G)

When discussing learning environments, educators often focused on their classroom spaces and the resources within them. All thirteen educators demonstrated some form of classroom facility in which students were taught, often with chairs or benches with tables for student workspaces. When referencing the use of their classroom in delivering instruction, Educator K stated that “most of the time I am at the classroom and once a week we use our lab. And we use the resources that we need all the time”.

Figure 4.10

Photo of Outdoor Learning Environment (Educator L)

Educators also identified alternative learning spaces as they characterized the learning environment they create for their students. Figure 4.10 shows an example of an outdoor setting with native vegetation being used as a learning space. Educator K stated that they “love to bring to bring their students to the field. I talk about these things when teaching Biology.” An emergent theme throughout the study pointed to educators identifying aspects of quality learning environments and providing them to their students.

Within the learning spaces, educators and their students make an effort to shape environments conducive to learning. Figures 4.11 and 4.12 demonstrate efforts made to integrate decoration and engaging educational resources as part of the physical learning environment. In many instances, the learning resources are designed to add both aesthetic and educational value. Educator H describes the posters seen in Figure 4.11 by saying “there are some posters, posters related to science, with which we describe discipline and rules of the classes.”

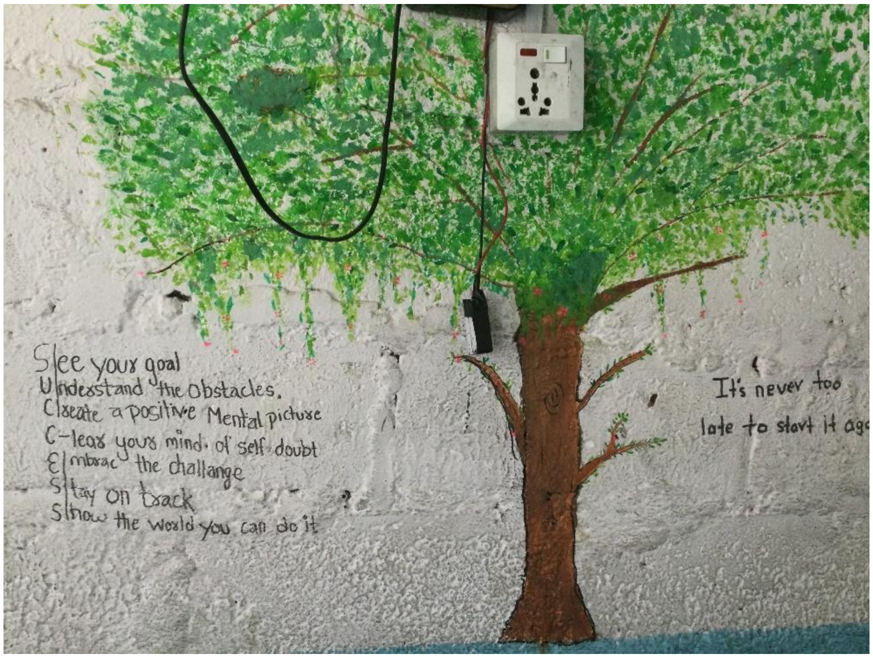
Figure 4.11

Photo of Student-Created Classroom Posters (Educator H)

Educators work to inspire students and promote meaningful learning experiences using the resources available, despite sometimes encountering challenges. Educator C describes the challenges of engaging students by acknowledging that “day to day teaching is boring and I need to make science class interesting. Being a science teacher, my job is not to make the science student bored.” By using the classroom environment to promote a culture of curiosity, they state that “first students have to know the problem and then you have to tackle it by asking the respective teacher”.

Figure 4.12

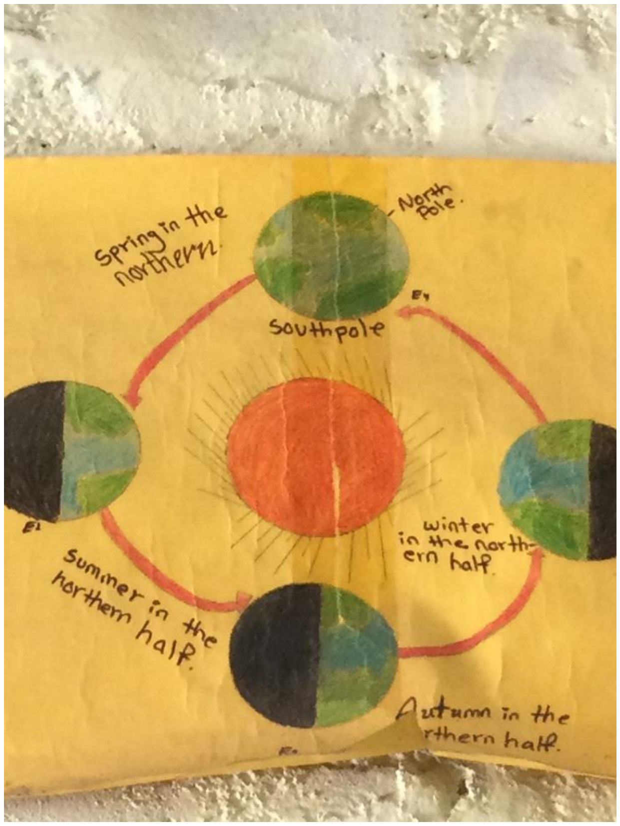
Photo of an Inspirational Wall Painting (Educator C)



The language of instruction also plays an important role in shaping the total learning environment for students. Across all ten schools where interviews were conducted, English is used as the primary language of instruction. While some instruction is delivered in Nepali, students are primarily learning in a language other than the primary language spoken in their home. Figure 4.13 shows a student project completed in English.

Figure 4.13

Photo of a Student Poster in English (Educator F)



When managing classroom environments, the science educators also spoke to the need to effectively manage student behavior. Some schools integrated classroom technology such as the security camera seen in Figure 4.14 to help monitor student behavior in the classroom. Educator G stated that the camera "helps to find out whether the students are in class or outside. It helps to find whether they are in discipline or not." When considering how to create and manage learning environments, the science educators in the study considered both the physical space and the management of it to be important to the overall goal of student success.

Figure 4.14

Photo of a Security Camera (Educator G)

In addition to the physical classroom spaces and technology that create quality learning environments for students, the knowledge, skills, and dispositions brought by Nepalese science educators are instrumental in shaping the overall educational experience. Throughout the narrative interview, Nepalese educators frequently described the influence their previous training had on their pedagogical approaches to teaching. Across the interviews, it emerged that educators in Nepalese government schools must complete a one-year teacher education program or equivalent, even if they have received a previous degree in a science related field. Educators at private schools must evidence completion of secondary education commonly referred to as “plus two” in Nepal but are not always held to same standards for teacher preparation and training.

Educator A described their Bachelor's of Education program as focused in pedagogy and teaching methods, with example teaching presentations graded by observers. Others, like Educator F, completed Bachelor's of Science degrees before entering their jobs in secondary education. Many of the science educators participating in the study had previous training in scientific fields, and several were enrolled in Master's or similar graduate-level programs concurrently to their full-time teaching responsibilities. For example, both Educators B and C are enrolled in a Master's of Physics program at Tribhuvan University in Kathmandu.

Awards are often given to educators who yield positive results in student academic performance. Educator C described a teaching award they received after "the average marks (of my students) were great and out of eleven government schools I was certified as the best teacher". The role of quality educators was evident throughout the interviews, particularly in inspiring the science educators in their own careers. Educator H attributed their personal inspiration to the impact of their own science teacher, saying "I was inspired by my science teacher when I was at school…she was a great teacher and it was the first inspiration for me to be a science teacher." Other participants noted that they were motivated to pursue careers as educators because of experiences where their own teachers had fallen short. Educator I stated that during their own experience in school "my teachers at the time did not give me much knowledge…that is why I wanted to be a teacher." Moreover, Educator L shared of their experience as an introverted student that was often overlooked by their own teachers, inspiring them to pursue a career as a teacher to support shyer students like themself.

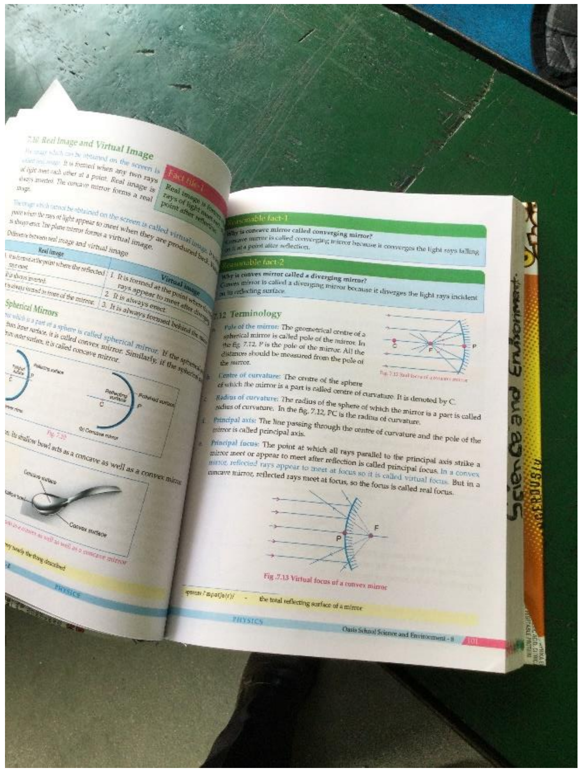
Motivation for pursuing a career in education was unique across the science educators interviewed in the study. Educator E commented that "teaching was not my core passion…it came to me because of family pressure and all that. I wanted to rise up my family standards and earn for my family." While the individual factors for pursuing a career in education differed amongst the research study participants, the theme of a generally positive public perception of education as a career emerged across the interviews. The science educators in the study often spoke about the resonance of their personal values with their impact as educators. Educator G said that "my father was also a teacher, so it was a motivation for me to teach others…this will give you personal satisfaction. That is why I love to teach and will continue as a part-time teacher wherever I am."

Findings for Objective 3: Describe educational resources for science education as defined by Nepalese science educators.

Educational resources are essential to the delivery of science education, and many resources were identified and described throughout the research study by the Nepalese science educator participants. Resources come from a variety of sources and stakeholders within the Nepalese science education community, and a common theme of educators making decisions of how to use resources effectively within their classrooms emerged throughout the study. Standard curricula in the form of textbooks, posters, and other resources provided by governmental educational entities was commonly captured in photographs taken by the participants (see Figures 4.15, 4.16, and 4.17).

Figure 4.15

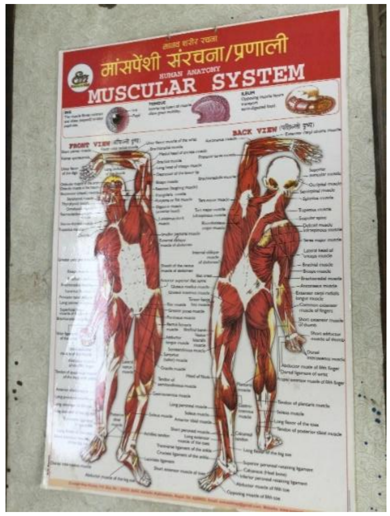
Photo of a Government Curriculum Textbook (Educator B)



Science curriculum was regularly provided by the government to address specific standards and learning outcomes. Students would regularly use the textbooks to learn new content and apply knowledge in assigned learning exercises. Educator B described the textbook as “guiding us how to go through the topic and which topics should be explained and how much syllabus has to be covered.” Our team observed textbooks being used in both government and private schools. The science educators explained that students would often work to memorize content, formulas, and information for application in class sessions.

Figure 4.16

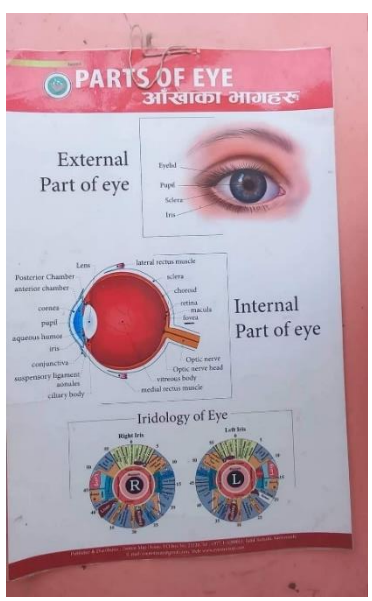
Photo of Muscular System Poster (Educator D)



Supplemental posters coincided with the curriculum provided in the government textbooks. Posters as seen in Figures 4.16 and 4.17 were observed in a majority of the schools visited during this study. In describing their instructional use of posters focused on human anatomy systems, Educator D described the posters as helpful in description "using both English and Nepali, because sometimes students do not understand." Similar posters covering different body systems were captured by multiple science educators participating in the study.

Figure 4.17

Photo of Eye Poster (Educator E)



Educational posters created by both educators and their students are implemented in instruction (see Figures 4.18 and 4.19). The science educators described creating educational resources to address the specific needs of their students and help make specific concepts easier to learn. In describing Figure 4.18, Educator B described separating out the first twenty scientific elements into a more manageable amount of content for students to learn, rather than asking students to learn the entire periodic table of the elements at one time.

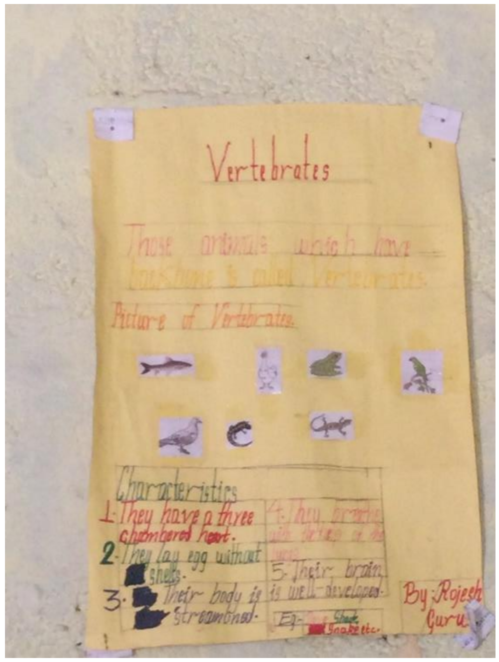
Figure 4.18

Photo of a Periodic Table Poster (Educator B)

In Figure 4.19, Educator F provides an example of an instructional resource designed to evidence student learning through the process of researching vertebrate animals. Educator F contended that “while writing or researching they gain the knowledge, which allows them to increase their potential.” Students learn by finding the pictures of the animals and by identifying the key characteristics of vertebrates. Student-made posters were found at many of the schools visited during this research study.

Figure 4.19

Photo of Student Poster (Educator F)



The participants commonly referred to the use of classwork and student projects designed to demonstrate learning outcomes as valuable instructional resources. Students are commonly asked to demonstrate learning in the form of written projects or posters, which are often displayed in classrooms. The projects are used as educational resources on an ongoing basis, demonstrating student knowledge and understanding and providing connections to content previously learned within the science course of study.

Figure 4.20

Photo of Student Project Work (Educator M)

In addition to the reference materials and textbooks used as educational resources, the science educators spoke of the use of additional books and reading materials in their instructional design. School libraries (see example in Figure 4.21) offer books for selected use by educators or for individual student reading selection. Educator C described that library and resource centers are often funded by educational foundations, many with financial support from the United States government.

Figure 4.21

Photo of Books in School Library (Educator C)

In addition to the government provided curriculum and resources, other institutional assets provided by the schools in which the science educators taught were commonly identified. Whiteboards (see Figure 4.22) are commonly used for writing vocabulary words, diagrams, and other information for students. Whiteboards and dusters are present in every school observed in this study and are essential educational resources used by science educators across schools and scientific disciplines.

Figure 4.22

Photo of a Whiteboard (Educator B)

In some schools, educators make use of digital resources and instructional technology. Figure 4.23 shows a projector used to project information on a whiteboard on the classroom wall. Educator G described the use of the projector device in saying “I found out about the projector while reading the computer application, and it is helpful for teaching…the projector helps us to grab the attention of the students.”

Figure 4.23

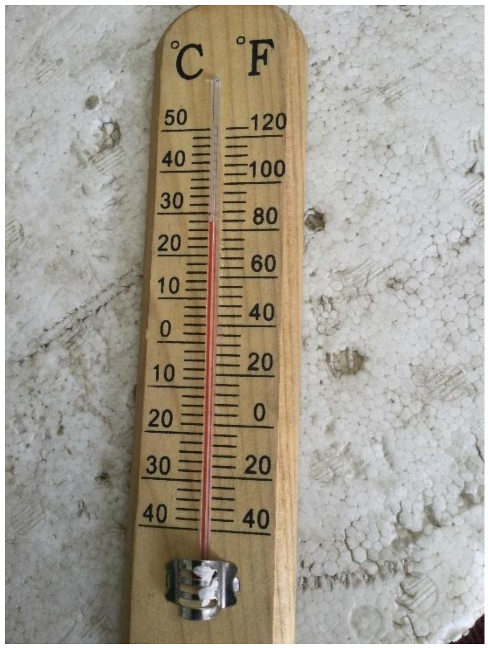
Photo of Classroom Projector (Educator G)

Resources supporting the delivery of direct instruction to students with instructions provided from the science educator to their students were referenced in many of the interviews. Whiteboards were frequently described as essential resources in the delivery on direct instruction. A theme of interaction and student engagement arose from the interviews as the science educators expressed the need to ensure students understand content and can respond correctly to critical-thinking questions. Educator B stated that while he began using direct instruction approaches, “later on I started going for interaction base with the students as well as giving day to day homework and classwork for the students.”

Physical resources supported the efforts to integrate interaction and student engagement into the science curriculum (find examples in Figure 4.24, 4.25, and 4.26). Equipping students with instruments and other materials helped to build practical knowledge and understanding of science related concepts, according to the science educators. Educator F described the use of resources such as the thermometer in Figure 4.24 in saying that they try to "encourage the students to make the practical knowledge…rather than theoretical learning."

Figure 4.24

Photo of a Thermometer (Educator F)



When discussing applied approaches to learning, Educator D (referencing Figure 4.25) offered that "with the model of the eye we can show the cornea, pupil…sensory ligaments, the iris and all those things. We show how it works." By using equipment and three-dimensional models of science related items, the science educators described their approaches to developing real-life skillsets in their students. Specifically, microscopes are present in most schools and used in a variety of applications when examining plant or animal specimens.

Figure 4.25

Photo of a Microscope and 3D Eye Model (Educator D)

An additional example of a three-dimensional model is found in Figure 4.26. Educator I described the integration of direct instruction from the government provided textbook with the human skeleton model, stating that “if we let them see this (skeleton model), then they will easily recognize the parts. If you read the text alone it will not be sufficient for them (to remember).” Equipping students with the opportunity to learn from the textbook with applied experiences in the classroom was described as a desirable instructional strategy by all thirteen science educators who participated in the study.

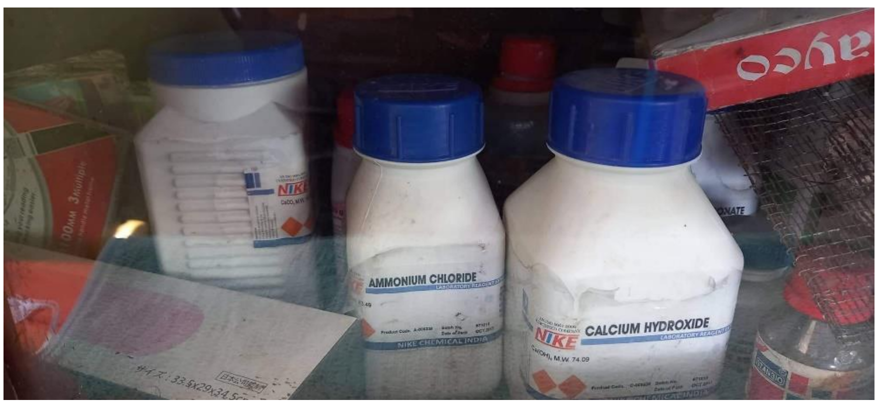
Figure 4.26

Photo of a Human Skeleton Model (Educator I)

The delivery of applied instructional approaches happened most frequently in laboratory settings, which required their own set of educational resources. Laboratory facilities were observed across the ten schools visited in this study and are used to conduct experiments and student learning exercises related to a diverse array of scientific disciplines, including biology, physics, and chemistry. Science educators typically have cabinets within the school laboratory facility that house the necessary educational resources for instructional activities (see Figures 4.27, 4.28, 4.29, and 4.30).

Figure 4.27

Photo of Laboratory Chemicals (Educator E)



For chemistry-related learning exercises, educators use reactants and chemical compounds to teach scientific principles. Educator E described the way students use the resources seen in Figure 4.27 in saying “they come through the chemistry lab…we teach physical properties and chemical properties of the thing, about their formations of some of the gases.” The use of chemistry laboratory activities is a primary method through which science educators seek to provide their students with applied learning experiences to demonstrate theoretical concepts provided in the scientific curriculum.

Figure 4.28

Photo of Laboratory Reactants (Educator I)

Educator I described the indicator materials observed in Figure 4.28 by saying “these are the materials used to find whether the given substance is acid, base, or salt. I think this works well for the students. In most of the school this is not shown…this is beneficial for the students.” The benefits of science education delivered through applied and practical means repeatedly emerged throughout this study. In addition to the reactant materials, specific infrastructure with which to conduct the learning activities is also necessary. Figure 4.29 shows a variety of laboratory glassware, including beakers, Erlenmeyer flasks, and volumetric flasks (Helmenstine, 2019). “We need these materials for chemical reactions in chemistry,” according to Educator A. “Without them we cannot run any experiments successfully.”

Figure 4.29

Photo of Laboratory Glassware (Educator A)

Laboratory facilities are used to examine specimens and apply biological concepts. Preserved specimens of plant and animal species are used at schools to teach species identification and apply biological concepts. Students learn about species both native and non-native to Nepal, including ocean species which many students have never seen in real life because Nepal is a land-locked country.

Figure 4.30

Photo of Laboratory Specimens and Microscope (Educator M)

For science educators who have received training and professional development either through formal teacher training programs from universities or from non-governmental organizations, applied learning is emphasized. Educator J offered insight into the broad educational goals they hold when engaging with students in laboratory learning exercises: "the main objective they teach us is to involve the students more in the practical works than that of class…if they do these activities in class then they can get involved in the activities." In addition to the individual motivation of the science educators to deliver applied learning experiences for their students, these goals emerged as priorities for the broader Nepalese education sector throughout our research study.

Figure 4.31

Photo of Educator Laboratory Recordbook (Educator K)

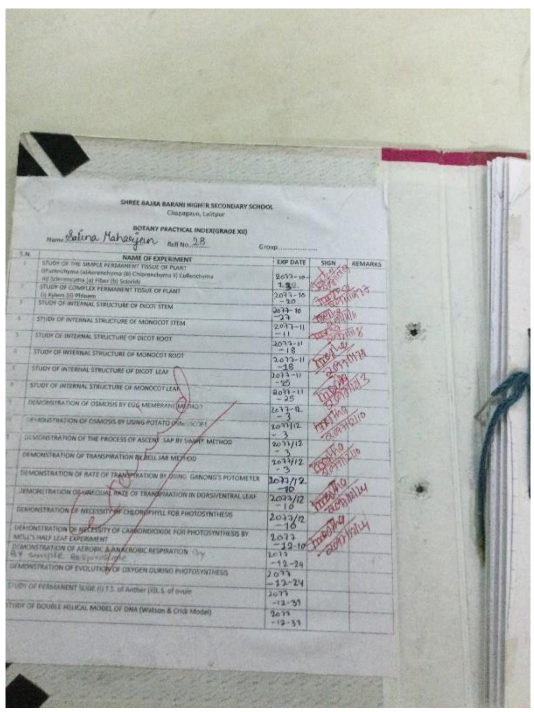


Figure 4.31 shows a record book used to record student performance in assigned laboratory learning activities. Educator K described the table as “an index of the practicals the students have done” and emphasized that it is helpful to manage student progress and is used by multiple teachers within the school. Science educators working together within a school can divide the responsibilities of delivering direct instruction, leading students through laboratory exercises and experiments, and evaluating performance in the practicals.

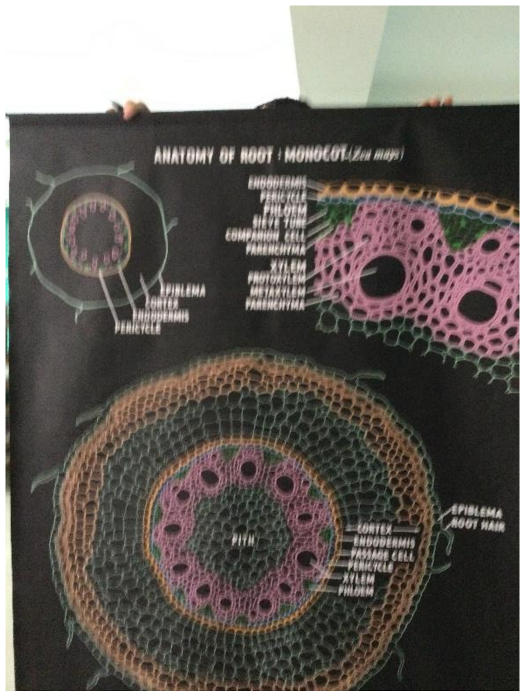
A broad variety of educational resources support the design and delivery of science education at secondary schools across Nepal. Educators described their use of resources provided by institutions including the government and their schools of employment, in addition to educational resources created by the educators and their students. A theme of practical application of scientific theory and principles was expressed by each of the science educators who participated in this study, shaping the identification and use of essential educational resources.

Findings for Objective 4: Explore perceptions of Nepalese agriculture as a context for science education by Nepalese science educators.

Nepalese science educators view the Nepalese agricultural industry and food, fiber, and natural resource products as high-quality context for teaching science content to their students. While agriculture is not always highly regarded as a profession in Nepal, science educators find value in integrating agriculture with science curriculum taught in their classes. Educator C described an activity in which their students made Dhiki, which is a traditional Nepalese rice grinder. They stated that “using the local products that we use in our daily life, if we can make that by using the local resources, then students will also be interested.” The value of agriculturally related content is found most notably in its ability to practically apply scientific concepts in a relevant manner, particularly for students from rural agricultural areas.

Figure 4.32

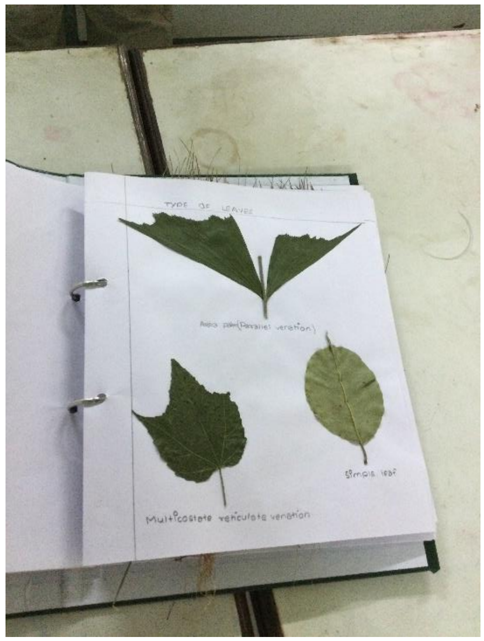
Photo of Plant Anatomy Poster (Educator K)



The Nepalese science educators integrate agriculturally related content into their classes to teach scientific concepts, particularly those related to biology. Posters and diagrams like the one seen in Figure 4.32 demonstrate concepts related to the production of plants and animals. Educator K uses the poster to teach plant anatomy content alongside real plants for the students to dissect. In describing the poster on the monocot plant stem, Educator K said that "we teach the students how to cut the stem and they look at the internal structure of the stem. That way they can learn the actual structure and compare with the picture they read." Students developing knowledge of plant anatomy can supplement their practical knowledge and experiences related to agricultural production to understand more about the plants grown within their communities.

Figure 4.33

Photo of Nepalese Native Plant Species Herbarium (Educator K)



When exploring the perceptions of the science educators related to the integration of agricultural concepts, it became clear that agricultural education in the Nepalese science education system is closely related to local communities and processes. Educators commonly use native and local species of plants for education, with students creating collections (see Figure 4.33) and observing real-life examples of plants (see Figures 4.34 and 4.35). The herbarium observed in Figure 4.33 was created by students in the science education class. Educator K stated that “we have a small chapter about the herbarium technique, we taught them (the students) how to prepare it, and then they collected and prepared it.” The collection of the leaves can be preserved for long-term use and study by the students, and the students collected the leaves on a tour to a local forest known as Bajbari located near the school. The access to the local forest helps the science educator to connect their students to the local community while integrating learning experiences related to native and local plants.

Figure 4.34

Photo of Plant Growing in Pot (Educator F)

While some schools interviewed in this study are in more urban areas without close access to forests or other natural spaces, agricultural education is still integrated into the curriculum where possible. Seen in Figure 4.34, Educator F demonstrates plant science concepts using plants growing at the school. In describing the instructional use of the plant, Educator F described how they “focus on the leaf. This is a fibrous leaf, it is long and narrow. When talking about the monocotyledon and dicotyledon, I show them the pictures and describe leaves, stems, and fruits.” In a context where students are largely unfamiliar with agricultural production, Educator F views these plants as valuable instructional resources that can help to grow students’ understanding. “Most of the students of this Kathmandu Valley…literally do not have any idea how the plants grow. And we can give them the practical lesson, by telling them to go in the field and harvest some seeds." Educator F described that after the students gain knowledge through experiential learning opportunities, they have a better understanding of how food is produced in their local area.

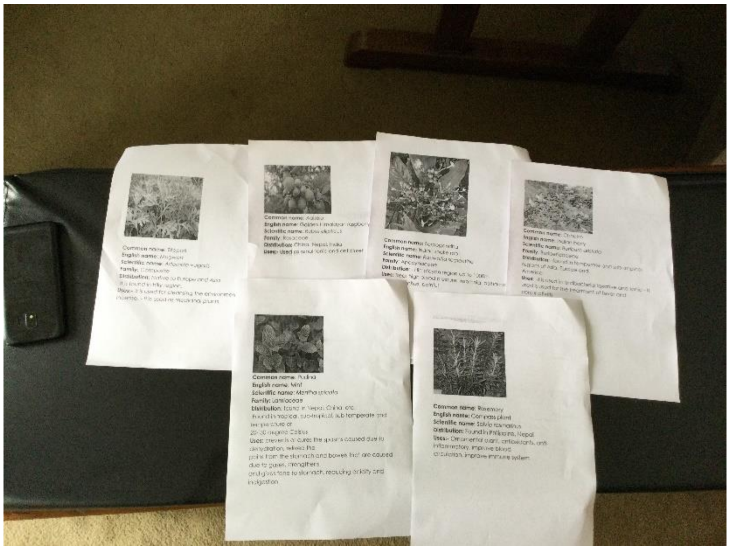
Figure 4.35

Photo of Local Flowers (Educator M)

When teaching students about plant-related scientific concepts, the use of real plants is central to the educational approach of many science educators. The flowers in Figure 4.35 are used to teach students about flower parts, where Educator M describes that "if I am teaching about flowers, then I take a real flower and show them its parts like calyx and corolla." The flowers growing within the school grounds help to extend the classroom while still providing access to tangible, practical resources for science education students. Experiences with authentic plant species help students to develop species identification skills, which are an important component of the curriculum in the Nepalese science education system. Figure 4.36 shows papers with plant identification information used in instruction by Educator L.

Figure 4.36

Photo of Nepalese Plant Identification Papers (Educator L)



Students learning to identify plants also care for them in the school's herbal garden led by Educator L. The posters contain essential information, including the common name, scientific name, area of distribution, and common uses. The project combines scientific knowledge with applied learning experiences in caring for the plants. The students in the public trust school benefit from the investment of the Vajra Foundation in the Netherlands, which funds the development of learning facilities such as the herbal garden. The need for specific investment and care for agricultural science learning facilities emerged as a theme throughout this study.

In addition to plant-related agricultural concepts, the science educators also work to integrate food science concepts in science classes. Seen in Figure 4.37, Educator L uses common spices and food items to teach about biology and chemistry related to foods.

Figure 4.37

Photo of Food Items on Plate (Educator L)

Educator L describes the implementation of the food resources in saying “I use these things to show them about taste buds while teaching about the sense organ. I use the tomato to show the acid while teaching acid, base, and salt. I also use the turmeric to show the indicator.” By using common materials, science education students gain experience with common objects and apply science concepts in learning methods that connect to existing knowledge frameworks.

For schools with agriculturally related facilities, science educators are able to make use of infrastructure and educational resources to teach agricultural science content. In describing Figure 4.38, Educator L spoke of the value of providing students with agricultural learning experiences, specifically with production practices different from what they have learned before. Using the school’s greenhouse seen, Educator L stated that although “this is not greenhouse farming, I bring them here to show what its advantages are. I like to bring them to the field to talk about its advantages.” Students with the opportunity to connect with agricultural in the school classroom will be better prepared to apply scientific knowledge to agricultural production outside of the school setting.

Figure 4.38

Photo of School Agriculture Facility (Educator L)

Animal agriculture is also a component of the total Nepalese science education system across some schools. Figure 4.39 shows a photo of chickens used as an educational resource. Educator L described how students take an active role in the responsibilities of feeding the chickens and cleaning inside of their shed, while a school staff member is ultimately assigned responsibility for ensuring that the animals receive proper care. The chickens are used in instruction related to animals and can be used practically to teach students how to care for them in the process of food production. These learning experiences help to build an informed consumer base and equip students who will engage in agricultural production for their occupation with relevant career skills.

Figure 4.39

Photo of Chickens (Educator L)

Science educators demonstrate agricultural integration across the Nepalese science education system using educational resources as part of the broader learning environment. Nepalese science educators perceive agricultural content to be closely related to place-based assets as defined by the ABCD Theory. While schools in different regions of Nepal have different access to agricultural resources, science educators integrate agriculturally related content using methods relevant to their specific context and learning environment.

Summary

The collection of photographs and accompanying transcripts from narrative interviews comprise the data reviewed in this research study. Using the five primary themes of the ABCD Theory, research transcripts were analyzed and coded according to each of the five categories of assets. Individuals and Institutions account for the greatest proportion of assets identified in this research study, with Connections, Associations, and Place-Based resources all comprising a smaller proportion of total identified resources. Additional analysis revealed subcodes within each of the categories, elucidating emergent themes related to the objectives of this study. Themes related to the use of school-provided resources, the importance of instructional approaches related to discussion and application of scientific theory, and the role of Nepalese science education stakeholders including the national government and non-profit organizations emerged in this analysis.

In analysis of learning environments, school facilities including classrooms and laboratories comprise student learning spaces. Teacher training and development emerged as important elements influencing student learning environments. Nepalese science educators design and deliver instruction using educational resources from government curriculum and school institutions in addition to their own additional work. Government textbooks and teaching materials are often used to guide direct instruction, typically delivered in classrooms using whiteboards and posters. Students are given the opportunity to apply their learning through projects and creation of their own educational resources as learning artifacts. All educators interviewed in this study highlight the importance of applied learning experience for students, which are most often delivered through laboratory exercises requiring materials related to scientific learning exercises and experiments. Nepalese science educators perceive agricultural education to be a useful context through which to teach applied science content. Educators view agriculture as specifically related to their individual communities and regions, creating different levels of access and comfortability around agricultural concepts for science educators and their students. Nepalese science educators work within their respective contexts to deliver high-quality learning and instruction for their students through relevant and applied learning experiences.

Chapter 5 – Conclusions, Implications, & Recommendations

Science education in Nepal plays a key role in supporting the development of knowledge and skills leading to career success for Nepalese science educations students. The Nepalese science education system is frequently characterized by the challenges science educators face related to their limited educational resources and challenging learning environments within a low-resource environment. While existing research efforts have examined the challenges facing Nepalese science educators, there is a need for research studying the perceptions of Nepalese science educators related to their educational resource and learning environments, particularly when viewed through an asset-based lens. The Theory of Asset Based Community Development (ABCD) is used as the research framework through which to examine the unique resources and assets held by Nepalese science educators as they design and deliver instruction, including the integration of agricultural education as a relevant context for practical application of science content. Using the Photovoice methodology, Nepalese science educators captured photos of their educational resources and described their use and implementation in qualitative narrative interviews. This study highlights emerging themes related to the resources available to Nepalese science educators and highlight recommendations for future practice and research to support the continued development and growth of Nepalese science education.

Purpose and Research Objectives

The purpose of the study was to explore perceptions of available assets in the Nepalese educational delivery system as well as opportunities for utilization of agricultural education in low-resource environments by science educators at 10 schools in Central Nepal. The following research objectives guided the study:

1) Describe Nepalese science educators' perceptions of their educational delivery system through the lens of the Asset Based Community Development Theory.
2) Describe Nepalese learning environments as perceived by Nepalese science educators.
3) Describe educational resources for science education as defined by Nepalese science educators.
4) Explore perceptions of Nepalese agriculture as a context for science education by Nepalese science educators.

Summary of Study

Thirteen Nepalese science educators teaching at ten different schools were interviewed in this qualitative study. The science educators held diverse backgrounds, and taught in government, private, and public trust schools in rural, suburban, and urban areas. In each interview, the science educators provided the research team with an overview of their personal background and motivation for pursuing a career in education. The science educators were given a mini i-pad device and a list of prompts. In response to the prompts, the educators captured photos of their educational resources, and proceeded to describe the resources and how they use them in the design and delivery of science instruction in descriptive interviews. Using this phenomenological approach, the research team identified themes related to both the availability of educational resources and Nepalese science educators' perceptions of their instructional environments and resources.

Given that sixty-six percent of the Nepalese population is engaged in agricultural production, this research study also sought to examine the potential for agricultural education to be integrated into Nepalese science education (FAO, 2023). In connection to the resources and instructional approaches identified in the semi-structured interviews, the research team sought to analyze the perceptions of the Nepalese science educators surrounding the value and purpose of using agricultural contexts to teach science content.

Conclusions for Objective 1

The data collected through the photovoice methodology that guided this study aligned closely with the central tenets of the ABCD Theory. As educators captured photos in response to the prompts, they showcased first-hand examples of educational resources present and in use in science education classrooms in schools in varying contexts across Nepal. In educational settings that are generally characterized as low-resource environments, the challenges present in the lives of science educators and their students often become the central focus of policy discussions and research efforts. Without ignoring real and present challenges, this study sought to use the ABCD Theory to highlight assets and resources already in place that can be used to address problems faced by Nepalese science educators and other stakeholders within the Nepalese science education community.

In each of the thirteen interviews conducted with educators from ten different schools, the Nepalese science educators described at least one example of resources within the five categories of the ABCD Theory: individuals, institutions, connections, associations, and place-based resources. This study points to the broad variety of educational resources used and the role that stakeholders play in the Nepalese science education system. While considerable challenges are present across various components of the Nepalese science education system, our findings highlight numerous assets that can support the development of community resilience and empowerment for all educational stakeholders (Kretzmann & McKnight, 1993).

Educators from diverse training and pedagogical backgrounds represent a strong asset in the form of individuals. Everyone in a community has unique assets and gifts to offer; educators with a commitment to sound instruction and quality learning experiences are best positioned to support Nepalese science education. Institutions are valuable assets and can support the goal of achieving desired educational outcomes. Our team found government curriculum used broadly across Nepal in schools of varying contexts, indicating institutional support and a basis for future direction. Assets in the form of connections are readily seen through opportunities for applied science learning and exchanges of learning and knowledge within the Nepalese science education sector. Associations in which exchanges of physical resources take place help to showcase the need for partnerships and practical collaboration amongst Nepalese science educators and their communities. Place-based assets – those representing that "people live here for a reason" – are represented by extensive opportunities for integration of Nepalese agriculture into the existing agricultural curriculum (Wang & Burris, 1997).

Conclusions

Nepalese science educators perceive educational resources created by individuals and institutions to be most important to their total educational delivery system. Assets from all categories outlined in the ABCD Theory are present and viewed as essential to the design and delivery of instruction (Kretzmann & McKnight, 1993). Nepalese science educators consider both assets and challenges when describing their work related to science education. Through effective consideration and utilization of unique resources present in their communities, Nepalese science educators are empowered to leverage science education for positive community change while experiencing an improved sense of teacher self-efficacy (Chaudhary & Pasa, 2015; Mojavezi & Tamiz, 2012). These outcomes align with the conceptual framework for this study outlined in Figure 1.2.

Implications

The conclusions pertaining to the first objective highlight the distinct yet closely connected role of both educators and their schools in the cultivation of high-quality educational experiences for Nepalese science education students. As individuals, Nepalese science educators make important decisions as they shape the learning environments within their classrooms. Educators are responsible for identifying existing resources and creating new resources to fit the specific needs and educational context of their students. Educators most commonly referenced the instructional strategies of demonstration, discussion, and instruction (see Table 4.3), indicating that educational resources are most commonly utilized to support this method of science education instruction.

These conclusions also point to the impact schools play in shaping science education experiences for their students. Whether a school is a government, private, or public trust school, Nepalese science educators depend upon their school to provide institutional educational resources, including but not limited to textbooks, posters, and supplies for laboratory experiments. Nepalese science educators exhibit personal agency in their instruction within the context of their individual schools, and the role of facilities and resources provided by the school cannot be overlooked when examining the total picture of Nepalese science education (Dhamala et al., 2021; Mathema, 2007; Moore, 2014).

While connections, associations, and place-based resources were not referenced as frequently when discussing the delivery of science education, Nepalese science educators maintain that the role of these resources is still of importance. Like other educational systems, the Nepalese science education community is comprised of numerous key stakeholders, including but not limited to educators, students, parents, political leaders, and non-profit organizations. As Nepalese science educators seek to equip their students with relevant, real-life experiences, the value of partnerships and collaboration between community stakeholders supports the pursuit of high-quality and sustainable science education for all students.

Recommendations for Future Practice

Whereas many educational leaders and researchers tend to adopt a deficit-based view of Nepalese science education and other educational systems in traditionally low-resource environments, the ABCD Theory offers an asset-based lens through which to view and analyze these systems (Nurture Development, 2018). All stakeholders within the Nepalese science education community offer unique insight and resources and should be included in conversations surrounding science education. The Nepalese science educators in this study specifically highlight the need for positive and constructive parental involvement in their children's educational experiences. Administrators and leaders within secondary schools in Nepal should work alongside science educators to identify resources and assets existing within the school system that can be leveraged for quality educational delivery.

A need for additional teacher training and professional development exists, particularly for Nepalese science educators who have minimal pedagogical training prior to their employment as teachers (Mulholland, 2014). Training related to the identification and creation of quality educational resources will help to strengthen existing science education approaches, especially for Nepalese science educators who are not using government created curriculum and textbooks. Efforts to expand educator awareness surrounding the potential for partnerships with non-profit organizations, community guest speakers, and other stakeholders would strengthen the role of connections and associations as categories within the ABCD Theory (Kretzmann & McKnight, 1993). Increased investment from governmental and non-profit organizations will be beneficial in working toward these goals. In addition, training related to the use of place-based educational resources, including those connected to local agriculture, will empower educators to integrate rigorous applied learning experiences without a significant additional financial investment.

Recommendations for Future Research

Repetition of this study in additional Nepalese secondary schools, particularly those in more rural and remote areas of the country, will help to expand upon the conclusions found within this study. Studies should continue the utilization of the photovoice methodology and analysis using the ABCD Theory framework to examine Nepalese science educator perceptions in new school settings.

Future research efforts should also examine the specific differences in learning environments between government and private schools, specifically regarding the use and implementation of government-provided curriculum. Government curriculum was observed across school types in this study, but further analysis and a larger sample of Nepalese schools will contribute to a more complete understanding of the differences in student’s educational experiences at both government and private schools.

Conclusions for Objective 2

The learning environment for Nepalese science education students at the secondary level is important for outcomes of success identified by the Nepalese Ministry of Education and United Nations Sustainable Development Goals (Ministry of Education, 2016; UN, 2023c). A myriad of factors shape a student's total learning environment, and these environments are often a direct result of the impact and decisions of Nepalese science educators. Throughout this study, the participants captured photos of the physical spaces and facilities that shape the learning environments in which science education is delivered. In addition, the personal backgrounds and descriptions offered by Nepalese science educators during the narrative interviews painted a picture of the learning atmosphere the educators create for their students.

While learning environments are directly related to the individual resources within them, the second objective of this research study sought to describe the broader educational context through the lens of the Nepalese science educator participants. The educators shared their ideas about the places where they teach using the photos they captured and discussed their life experiences and educational backgrounds that they bring into their classrooms. When viewed together, the Nepalese science educators identified unique aspects of the Nepalese science education learning environments while highlighting areas for continued research and improvement. By integrating quality education delivery alongside adequate resources and educational infrastructure, positive science education learning environments support holistic student success. (NCSSLE, 2023; Yoshida, 2020).

Conclusions

Nepalese science education learning environments are shaped by the physical learning spaces and facilities available in a school and by the science educator's ability to lead and manage the learning environment in their classroom. Science education learning environments are designed to maximize opportunities for applied learning experiences using the resources available.

Implications

When considering the environment in which students learn, school leaders must evaluate their facilities with a critical lens. While resource constraints often limit the capacity of Nepalese schools, secondary schools must seek to provide quality learning facilities for science educators and their students. These facilities include but are not limited to classrooms, laboratories, computer labs, and outdoor classroom facilities. Funding and resources from governmental entities and non-profit organizations may help support the addition and maintenance of quality educational facilities.

Moreover, the importance of adequate training and professional development for educators cannot be overstated. The findings related to this objective make it apparent that science educators play a key role in shaping the culture and learning environment for their students. Educators who set high standards for their students and promote a positive environment where scientific knowledge and application are valued inspire and encourage their students (Yoshida, 2020). Educators with tertiary education experience in scientific disciplines carry robust technical knowledge within their discipline but often lack confidence in their perceived ability to manage their classroom learning environment, leading to a poor sense of teacher self-efficacy (Mojavezi & Tamiz, 2012). Educators with specific training in education may face similar challenges related to a lack confidence surrounding the scientific content they teach, illustrating a need for well-rounded educator knowledge (Mulholland, 2014). Educational and political leaders within Nepal must seek to address shortcomings within science teacher preparation and training programs to properly equip and support prospective science educators.

Recommendations for Future Practice

In response to these conclusions, revision and strengthening of the Nepalese science educator certification requirements warrants consideration. Prospective educators will benefit from more robust requirements leading to the development of deeper technical expertise and more ample pedagogical knowledge. As a result, technological pedagogical content knowledge (TPACK) and global pedagogical content knowledge (GPACK) will allow for transformative educational impact as outlined in Figure 2.3 (Urban et al., 2018). Professional development programs related to classroom management and positive classroom culture should be made available to new and beginning Nepalese science educators. Several educators within this study spoke of the value of mentorship programs and learning from more experienced educators within their schools and communities. Leaders looking to develop strong, positive learning environments should consider developing mentorship programs to help train new science educators within their school. While all Nepalese science educators participating in this study stressed the importance of hands-on application, the educators demonstrated varying degrees of confidence and capacity for design and delivery of these experiences. Training focused on giving science educators experience in creating applied learning experiences will help improve the effectiveness of the Nepalese science education system.

For Nepalese science educators, advocacy for proper learning facilities is of paramount importance. Adequate training and access to necessary support regarding the use of laboratory facilities and computer labs are necessary to support student success. Schools with expired laboratory materials or defunct computers fail to equip their educators with the resources necessary for high-quality science instruction. The findings in this study stress the critical nature of applied learning experiences for secondary science students, and proper facilities and school infrastructure are essential prerequisites to these high-impact learning experiences.

Recommendations for Future Research

Future research studies might examine existing Nepalese science curriculum at the secondary level. An analysis of curriculum to determine the level of integration of applied learning experiences may help to identify areas of need for revision of existing curriculum supplied to educators, particularly within Nepalese government schools. When developing national science curriculum and standards, research should survey Nepalese schools to further identify specific resources that are widely available for secondary science teachers. Designing curriculum that is conscious of resource constraints while still integrating hands-on application activities will help to support high-impact learning experiences for students.

Future research studies should analyze Nepalese science students' perceptions of their own learning environments. While this study focused exclusively on the perceptions of science educators, the perspectives of students related to their education will be invaluable when informing future education and policy decisions. Secondary science students could provide valuable insights related to the effectiveness of their teachers, the adequacy of their school facilities, and their perceived preparedness for their desired future careers.

Conclusions for Objective 3

This study provided an in-depth look at the variety of educational resources available to Nepalese science educators. Resources sourced from the national government, created by science educators, developed through student projects, or found within the local environment all emerged as important throughout the study. Even when teaching in settings frequently characterized as low-resource environments, Nepalese science educators identified and discussed numerous examples of resources they use to teach. Throughout this study, educators identified the role existing government curriculum plays in shaping instructional delivery. In discussing the resources represented in the photos they captured, the research study participants also demonstrated high degrees of creativity and personal choice in bringing unique and original educational resources into their classrooms. The photos captured using the photovoice methodology helped to provide first-hand evidence of the resources in use. The prompts given to the educators found in Appendix C elicited a range of responses highlighting resources considered to be both conventional and nonconventional. In discussing the resources they had identified, the Nepalese science educators shed light onto the methods they use to teach in making use of the resources available to them.

Conclusions

Nepalese science educators heavily utilize educational resources and curriculum from institutional sources, including their national government. Nepalese science educators also create original resources for use in instruction. Students also take an active role in creating education resources through projects designed to evidence learning. Nepalese science educators routinely utilize laboratory facilities to provide applied learning experiences to their students, which require a unique set of resources for implementation.

Implications

The conclusions related to this objective point to the diverse nature of the educational resources utilized by Nepalese science educators. School leaders do well to equip their educators with as many possible resources, including existing curriculum and educational materials from governmental sources. Science educators who are empowered to identify necessary resources and make requests to their school administration and leadership will be most effectively empowered for transformative impact. In many existing school contexts, the constraints of limited time and physical resources limit Nepalese science educator's capacity for providing applied learning experiences to students.

Proper maintenance and care of laboratory facilities within schools is also of critical importance for the Nepalese science education community (Dhamala et al., 2021; Mathema, 2007; Moore, 2014). Even when proper laboratory facilities are present, science educators struggle to teach effectively with expired or broken resources, such as chemicals or jars. In computer lab settings, school leaders bear a responsibility to acquire necessary training and resources to keep equipment in working order. By training educators to troubleshoot challenges and solve technological problems, the educational experiences of science students may experience less interruptions. For Nepalese science educators seeking to provide their students with applied learning experiences, the effective use of appropriate educational resources can only take place with proper support from the schools in which they teach.

In addition, this study illustrates the value in allowing Nepalese science education students to take an active role in their learning experiences (Kandel, 2018; Rauner & Maclean, 2008; Scherer et al., 2019). Inquiry and project-based learning approaches to instruction allow students to develop resources as evidence of their learning that assist in the learning processes of their fellow peers. All study participants noted challenges associated with maintaining student engagement in the learning process, yet maintained the viewpoint that maximizing student engagement is critical to the success of the overall Nepalese science education sector.

Recommendations for Future Practice

As with the other objectives in this study, the recommendations related to objective three focus on expanding opportunities for educator training and professional development programs. Educators who are properly trained on the use and management of laboratory materials and facilities will be effectively positioned to support the development of practical knowledge and skills for their students. While expanded educator training and professional development programs require an investment from entities such as schools, governmental agencies, and non-profit organizations, the returns over time will strengthen the broader system of Nepalese science education across Nepal.

To provide the additional funding necessary for education solutions, Nepalese government leaders at the national and local level should create requests for proposals related to expanding teacher training and access to educational resources. These funding opportunities will allow schools and individual educators to apply for funding to support their desired initiatives in order to support educators through training and professional development. Funding opportunities can also provide support for resource acquisition and address school needs for improved and updated science education resources. Non-profit organizations can also play an important role within the grant funding space by assisting Nepalese science educators in compiling funding proposals while also offering funding opportunities of their own when possible.

Recommendations for Future Research

Future research studies should analyze the differences in resource availability and use between Nepalese government, private, and public trust schools. While educators in different school settings characterized their educational resources differently, additional research is needed to further describe the differences present across the different structures of Nepalese schools. An analysis of laboratory learning environments across Nepalese schools would also add value and clarity when seeking to identify the resources present across the Nepalese science education landscape. Additionally, research studies replicating this study in other content areas such as mathematics or social studies will add to the existing understanding of the Nepalese education system. Researchers should continue to examine the broad variety of resources used in instruction for secondary students to develop more robust understanding of the unique assets and needs that shape the entire Nepalese education system.

Conclusions for Objective 4

The fourth objective in this study specifically focused on the perceptions of Nepalese science educators related to using agriculture as a context for teaching science content. This specific focus was identified in response to the significant role agriculture plays in the Nepalese economy and workforce. High proportions of students in Nepal face the challenges of poverty and food security, many coming from agricultural communities. Throughout this study, Nepalese science educators described agricultural education as a favorable instructional strategy to provide applied learning experiences for students. Several schools visited during this study made use of specific agricultural education resources and facilities integrated within the broader secondary science curriculum. However, negative community perceptions related to agriculture present notable obstacles for science educators working to engage students in agricultural contexts. Many students who have grown up in agricultural settings hold educational and career aspirations outside of the agricultural sector; this is largely due to negative perceptions surrounding the opportunities for success and upward mobility in the agricultural sector.

Conclusions

Nepalese science educators perceive agriculture to be a high-quality context in which to teach science content. While students do not generally hold a positive view of agriculture as a career field, agriculture is of significant relevance to Nepalese science education communities and is strongly connected to a sense of locality and place. Educators have differing levels of comfortability surrounding agricultural education and differing levels of access to agriculturally related educational resources.

Implications

While agricultural integration was present at some level across most of the schools visited as part of this study, there are varying levels of comfort in teaching scientific concepts amongst the teachers interviewed. Nepalese science educators in well-resourced schools with specific agricultural learning facilities generally feel more confident in integrating agricultural education as part of their science education delivery system. For example, Educators L and K in this study strongly connected with agriculture as an educational context. These educators highlighted agricultural resources present at the schools where they taught or in nearby natural spaces where agricultural connections could be made for students outside of the school facility. Other educators interviewed in this study identified fewer agriculturally related resources and did not describe access to agricultural facilities or spaces within their learning environments. These conclusions point to the discrepancies in teacher self-efficacy related to agricultural instruction across different contexts in Nepal, which must be considered when designing agricultural science integration into existing curriculum.

The findings also point to a stark contrast between the perceptions of Nepalese science students and Nepalese science educators related to the value of agriculture. Throughout the narrative interviews, educators described a general lack of interest in agricultural issues and applications from their students. Despite the perceptions of their students, science educators value agriculture to teach core concepts within the Nepalese science education curriculum. Agricultural applications allow science educators to engage their students in practical learning experiences outside of the school laboratory setting where most other applied learning takes place.

Recommendations for Future Practice

The conclusions related to the fourth objective of this study highlight the need for increased focus and investment in agricultural education throughout Nepalese schools. Agricultural education can be provided within the science education model as a method for delivering Technical and Vocational Education and Training (TVET) (World Bank, UNESCO, & ILO, 2023). Agriculture is highly relevant to specific local communities, which presents the need for science educators to connect with their local communities through connections and associations. To effectively deliver agricultural education, Nepalese science educators will need expanded access to training and professional development efforts. Agriculturally related non-profit organizations and school leaders should work to implement training for science educators at their schools.

Expanded opportunities for secondary Nepalese science students to engage in work-based learning and TVET are strongly recommended as a result of this study's findings. Students who lack a positive perception of agriculture as a future career field may benefit from applied work and learning experiences related to food and fiber production. Within a national economy heavily connected to agricultural production, students will be equipped with practical skillsets when engaged in comprehensive school-based agricultural education (FAO, 2023).

Recommendations for Future Research

Future research studies should assess the self-efficacy of Nepalese science educators surrounding the delivery of school-based agricultural education. Researchers should analyze the specific needs and desires of science educators regarding agricultural training. Additional research studies should examine the agricultural perceptions of students related to Nepalese agriculture before and after engagement in applied agricultural learning. Additional analysis will help to shed light on the impact of agricultural education on the career goals and outlook of Nepalese science students.

School-based agricultural education in global contexts is often implemented alongside youth leadership organizations such as the National FFA Organization in the United States and YoFFA in Uganda (Kibirige & Crutchfield, 2022). Future research studies should examine existing youth leadership organizations within Nepal and analyze opportunities for agriculturally related youth leadership organizations.

Conceptual Framework Revisited

As seen in Figure 1.2, the conceptual framework for this study frames the analysis of STEM education resources and learning environments through the lens of the ABCD Theory. When seeking to achieve targets related to the United Nations' Sustainable Development Goal 4 – Quality Education, the components of teacher self-efficacy, education for development, and TPACK/GPACK contribute toward the desired growth (Bandura, 1977; Chaudhary & Pasa, 2015; Mishra & Koehler, 2006; Urban et al., 2018). Throughout this study, Nepalese science educators characterized their learning environments and educational resources through the collection of photos and accompanying narrative interviews. The development of positive teacher self-efficacy relates to effective training and professional development opportunities for educators, particularly when connected to agriculture and other applied learning approaches. When applied properly, agricultural education can be a powerful tool to support community development efforts aimed at reducing poverty and food insecurity. With proper education and training, Nepalese science educators will be empowered to integrate their technical background, pedagogical knowledge, and global competency to provide robust and meaningful learning experience for their students. As a result, Nepalese science education students will complete secondary education with relevant employment skills and be equipped to develop sustainable solutions to challenges and inequalities within their community (Gandharba & Pant, 2023; Mathema, 2007; UNICEF, 2023).

Limitations Revisited

Several limitations impacted the delivery of this study. The collection of photos and narrative interviews took place within the time constraints of the research team's two and a half weeks in Nepal. The time constraints limited the number of educators that could be interviewed and the geographic range across which educators could be interviewed. The convenience sample of educators participating in this study was identified through the Global Teach Ag Network's partnership with the Rebuild Nepal Education Foundation (RNEF). While the partnership with RNEF provided access to Nepalese schools and science educators who participated in the study, the research team had limited access to Nepalese science teachers who were not previously connected with RNEF. The language barrier between the research team and study participants also limited this study, and translators were relied on heavily throughout the narrative interviews and the process of translating the interview transcripts. Member checking of the transcripts was not feasible due to the limited communication available following the research team's return to the United States.

Holistic Recommendations for Future Research

Throughout this study, Nepalese science educators repeatedly expressed the desire for new and expanded professional development opportunities. Future research efforts should focus on the effectiveness of existing professional development offerings for Nepalese science educators and identify specific areas of interest for future offerings. The findings of this study demonstrate the need for further research related to the use of place-based resources and agricultural education as a practical form of TVET implementation. Future research efforts may consider utilizing the ABCD Theory framework to analyze educational resources and learning environments through an asset-based perspective.

Additional research efforts should analyze the goals of Nepalese science students following successful completion of secondary education. The participants in this study described the challenge of talented and motivated students leaving Nepal to pursue international employment and education opportunities, which is commonly referred to as the “brain-drain” challenge (Dahal, 2023; Kandel, 2018). Studies analyzing student and young adult motivation related to career opportunities in Nepal will help to better identify needs and opportunities for improvement within the Nepalese education and employment sectors.

Holistic Recommendations for Future Practice

It is recommended that Nepalese science educators increase agricultural integration in their science curriculum where feasible. When implemented alongside proper educational resources, agricultural contexts provide science educators with the opportunity to engage their students in first-hand application of the science curriculum. Further research should be conducted to better understand how agricultural techniques can be used to teach concepts that are outlined in the existing science curriculum.

Moreover, our study illustrates the need for increased support for science educators from school leaders, government officials, and non-profit organizations within the local community. To support the recommended solutions and act upon outcomes of this study, an increased investment from partners and stakeholders across the Nepalese science education system is required (Ministry of Education, 2016). Political leaders in Nepal should work to allocate increased funding for science education resources in government funded schools across Nepal. In private schools, non-profit organizations and community partners are encouraged to provide additional funding opportunities to allow educators and their schools to apply for funding to address needs within their classroom. As many of the Nepalese science educators involved in this study teach in low-resource environments, educators in similar context around the world may draw ideas and encouragement from the first-hand account of the educators in this study.

Holistic Recommendations for Future Policy Considerations

Future policy considerations informed by the findings in this study should center on the review of existing Nepalese secondary science curriculum and the need for increased funding. Nepalese political leaders bear a responsibility to respond to educational needs within their country, including those present within the science education sector. Leaders within the Nepalese Ministry of Education are advised to conduct a review of the existing government-provided science curriculum and identify areas for revision within the next five years. Two of the top priorities throughout the revision process should be the integration of applied learning experiences and the inclusion of agriculturally related content standards. Moreover, increases in governmental funding will allow science education programs to deliver quality TVET experiences to students when equipped with sufficient educational resources. Legislated increases in per-student funding may help to improve educational equity in Nepalese science education and increase the quality of student experiences in government-funded schools.

Summary

Throughout this research study, Nepalese science educators described their learning environments and educational resources through the collection of photographs and narrative interviews guided by the photovoice methodology. In a country typically characterized by low-resource educational environments, thirteen Nepalese science educators across ten schools highlighted first-accounts of their educational resources through an asset-based lens. The strong connections between the photovoice research method and the ABCD Theory help to drive a shift from deficit-based thinking to asset-centered views of the Nepalese education system. This research study examined the perceptions of Nepalese science educators related to learning environments and resources used to deliver applied learning experiences through STEM education, TVET, and agricultural education.

While individuals and institutions emerged as the primary asset categories contributing to the Nepalese science education sector, connections, associations, and place-based assets all contribute to the total picture of science education delivery. When equipped with proper access to physical facilities and training, educators find value in delivering applied learning experiences in agricultural contexts that are closely tied to local communities. Throughout this study, the participants made clear their desire for increased access to pedagogical and content-specific training, leading to increased teacher self-efficacy when delivering high-impact learning experiences. Moreover, the conclusions of this study call for increased focus and investment in agricultural education throughout Nepal. Future research efforts should identify opportunities for the implementation of agricultural education within science classrooms. Connecting agricultural education to readily available career opportunities within Nepalese communities will spur on the development of future assets to support community development. The findings of this study communicate the power of educational assets to solve real-world challenges – even in the most challenging contexts. The study participants demonstrate the positive potential of engaged educators working with resilience to transform their communities for the better when equipped with high-quality educational resources. Future research efforts will continue to highlight the transformative impact of agricultural education in Nepal and other global contexts to practical and relevant solutions to global challenges.

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Appendix A

The Pennsylvania State University Institutional Review Board Exemption Determination

PennState

Office for Research Protections
Human Research Protection Program
Office of The Senior Vice President for Research
The Pennsylvania State University
205 The 330 Building
University Park, PA 16802

814-865-1775
irb-orp@psu.edu
research.psu.edu/irb

EXEMPTION DETERMINATION

Date: May 5, 2022

From: Brigitt Leitzell,

To: Melanie Miller Foster

Type of Submission:	Initial Study
Title of Study:	Protecting, procuring, and preserving resources: A Photovoice of rural Nepalese educators
Principal Investigator:	Melanie Miller Foster
Study ID:	STUDY00020027
Submission ID:	STUDY00020027
Funding:	Not Applicable
Documents Approved:	• Nepal Classroom Observation Form (2.0), Category: Data Collection Instrument • Nepalese Educator Handout (2.0), Category: Other • Photovoice of rural Nepalese educators (4.0), Category: IRB Protocol • Photovoice Protocl (3.0), Category: Data Collection Instrument

The Office for Research Protections determined that the proposed activity, as described in the above-referenced submission, does not require formal IRB review because the research met the criteria for exempt research according to the policies of this institution and the provisions of applicable federal regulations.

Continuing Progress Reports are **not** required for exempt research. Record of this research determined to be exempt will be maintained for five years from the date of this notification. If your research will continue beyond five years, please contact the Office for Research Protections closer to the determination end date.

Changes to exempt research only need to be submitted to the Office for Research Protections in limited circumstances described in the below-referenced Investigator Manual. If changes are being considered and there are questions about whether IRB review is needed, please contact the Office for Research Protections.

Appendix B

Consent for Exempt Research Form

Consent for Exempt Research

The Pennsylvania State University

Title of Project: *Protecting, procuring, and preserving resources: A Photovoice of rural Nepalese educators*

Principal Investigator: *Dr. Melanie Miller Foster*

Telephone Number: *814-867-3831*

You are being invited to volunteer to participate in a research study. This summary explains information about this research.

- This project is an opportunity to represent your point of view to educational stakeholders on resources you have access to for designing and developing instruction.

- As part of this study, you are being asked to respond to prompts through photography. Participation in this study will include taking numerous photographs with a mini-iPad tablet. After capturing all the photographs, you need to capture educational resources, you will return the iPad tablet to the research team. You will meet with the researchers and interpreter for approximately 60 minutes to discuss the photographs you took. At the meeting, you will be able to look at your photographs. Your photos will not be made public in any way without your permission. The project will culminate with a public exhibition of research and photographs. Your involvement and/or participation in the exhibition is encouraged but it is completely up to you whether you participate.

  Please know that your participation in this study is voluntary. You may withdraw at any time.

  Please only capture educational resources. We ask that you do not capture any students in the photographs. Facial images should not be captured of any non-research participant.

  Educational resources can be defined as any kind of resource used in the delivery of or for the development of quality instruction.

  Be as creative as you like. There are no 'rules.' You are simply asked to respond to the prompts, in any way you like, through photographs.

- There is a small risk of loss of confidentiality if your information or your identity is obtained by someone other than the investigators, but precautions will be taken to prevent this from happening. The confidentiality of your electronic data created by you or by the researchers will be maintained as required by applicable law and to the degree permitted by the technology used. Absolute confidentiality cannot be guaranteed.

- Photographs taken will be stored on an external hard drive. No identifiers will be associated with the photographs.

- Information collected in this project may be shared with other researchers, but we will not share any information that could identify you.

If you have questions, complaints, or concerns about the research, you should contact Dr. Melanie Miller Foster at *814-867-3831* or mjm727@psu.edu. If you have questions regarding your rights as a research subject or concerns regarding your privacy, you may contact the Human Research Protection Program at 814-865-1775.

Your participation is voluntary and you may decide to stop at any time. You do not have to answer any questions that you do not want to answer.

Your participation implies your voluntary consent to participate in the research.

Appendix C

Nepalese Educator Handout

Introduction:

Thank you for agreeing to participate in this Photovoice activity! This project is an opportunity to represent your point of view to educational stakeholders on resources you have access to for designing and developing instruction. Below is some additional information to help guide this project.

Who: Nepalese educators

What: Using a mini-iPad tablet, capture photographs of the resources you have access to that help ensure students receive quality, effective instructions

Where: Your classroom, school grounds, or wherever your resources are located!

Why: To understand how rural Nepalese educators perceive their educational resources and its role in building self-efficacy.

How: Using mini-iPads, capture pictures of what you identify as an educational resource

As part of this study, you are asked to respond to prompts through photography. Participation in this study will include taking numerous photographs with a mini-iPad tablet. After capturing all the photographs, you need to capture educational resources, you will return the iPad tablet to the research team. You will meet with the researchers and interpreter for approximately 60 minutes to discuss the photographs you took. At the meeting, you will be able to look at your photographs. Your photos will not be made public in any way without your permission. The project will culminate with a public exhibition of research and photographs. Your involvement and/or participation in the exhibition is encouraged but it is completely up to you whether you participate.

Please know that your participation in this study is voluntary. You may withdraw at any time.

Please only capture educational resources. We ask that you do not capture any students in the photographs. Facial images should not be captured of any non-research participant.

Educational resources can be defined as any kind of resource used in the delivery of or for the development of quality instruction.

Be as creative as you like. There are no 'rules.' You are simply asked to respond to the prompts, in any way you like, through photographs.

Here are the prompts we would like you to use to guide your photo taking:

- Describe how you define educational resources.
- Show what educational resources mean to you.
- What is your favorite instructional tool?
- I consider ________________ a conventional (traditional) educational resource.
- I consider ________________ a non-conventional (non-traditional) educational resource.
- Show what content you teach.
- ________________ helps me develop effective instruction.

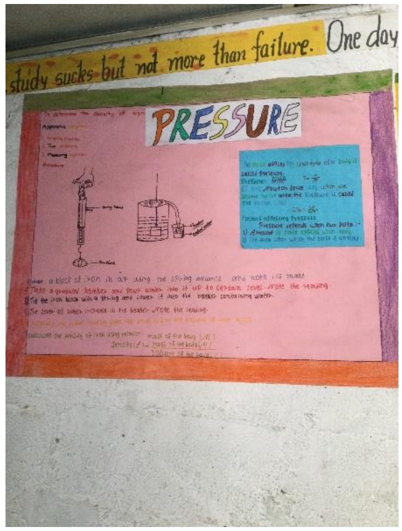
Appendix D

Additional Photographs

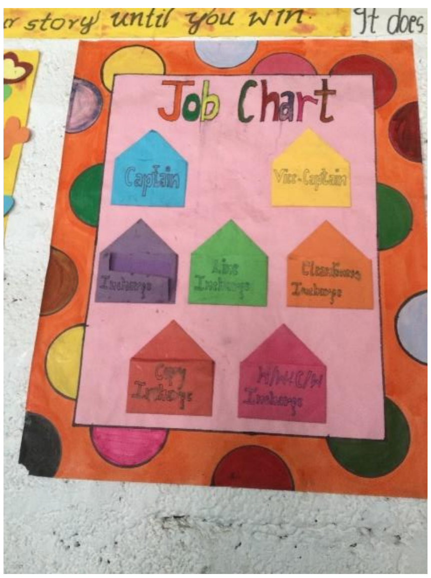
This appendix contains the additional photographs captured by the participants of this research study not included in Chapter 4. Duplicate photos captured by the same educator and photos too blurry to identify the object photographed have been omitted.

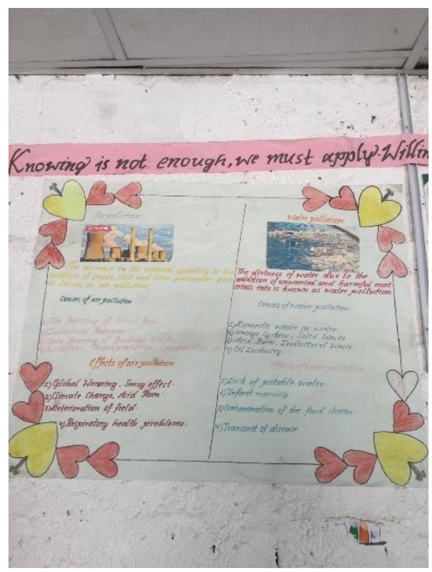
Educator A:

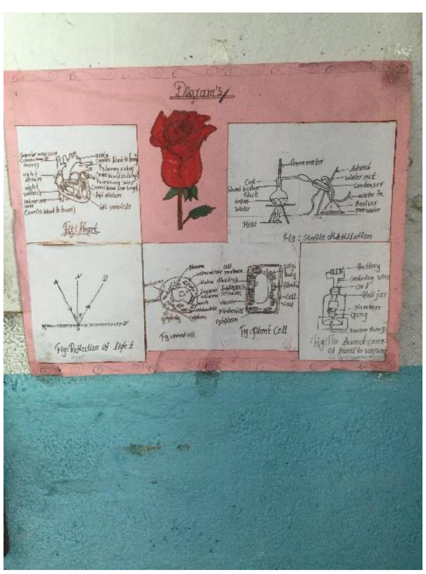
Educator B:

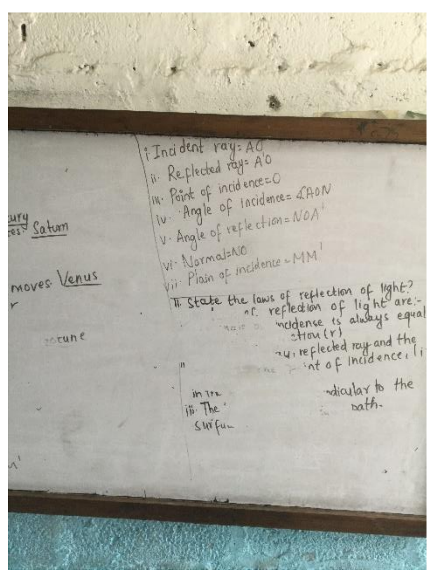


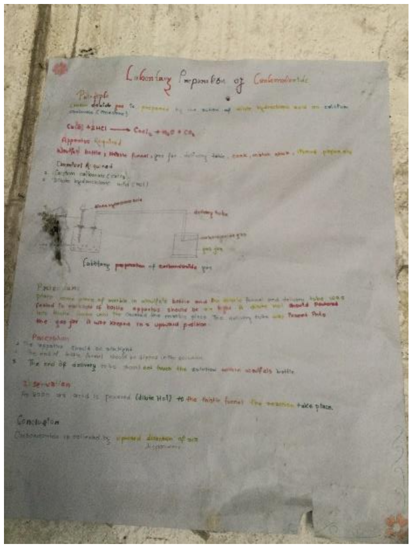
Educator C:



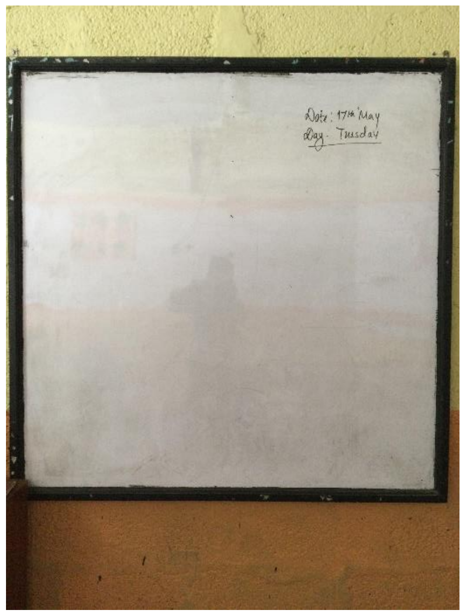


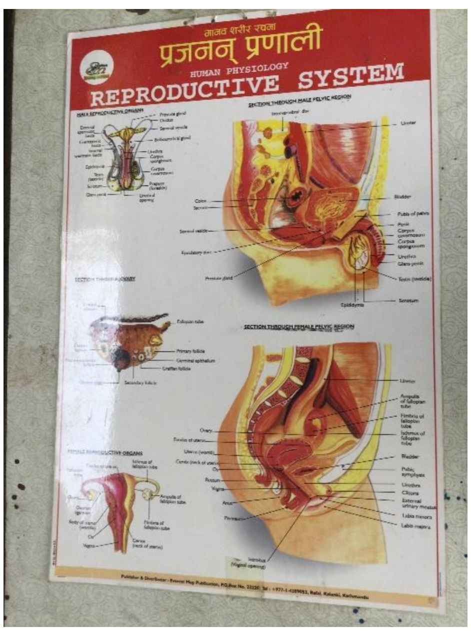


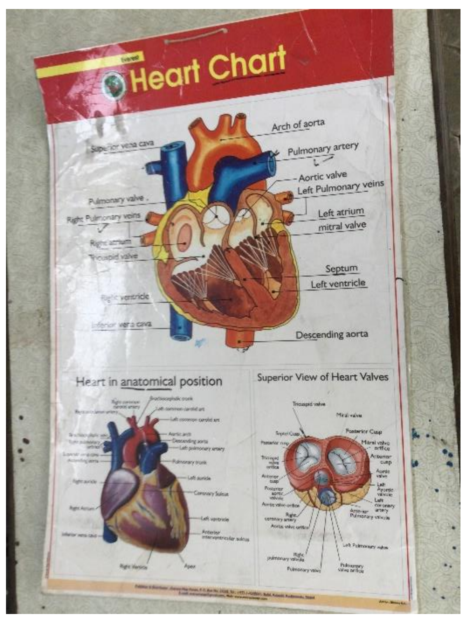


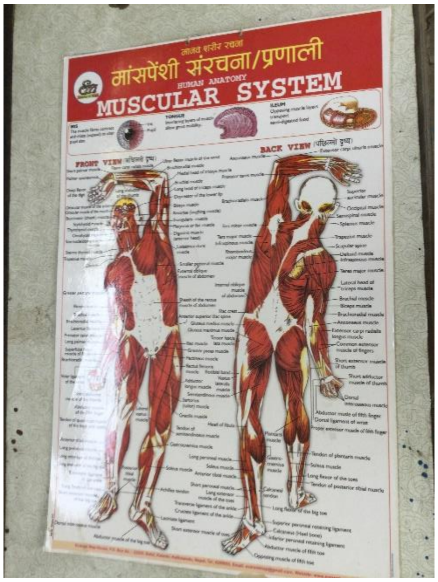


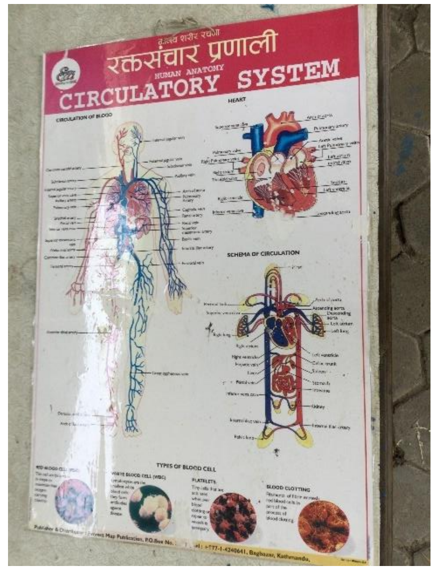
Educator D:

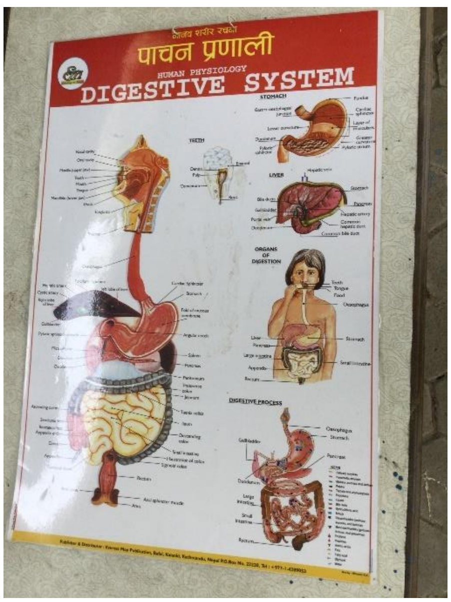

Date: 17th May
Day: Tuesday

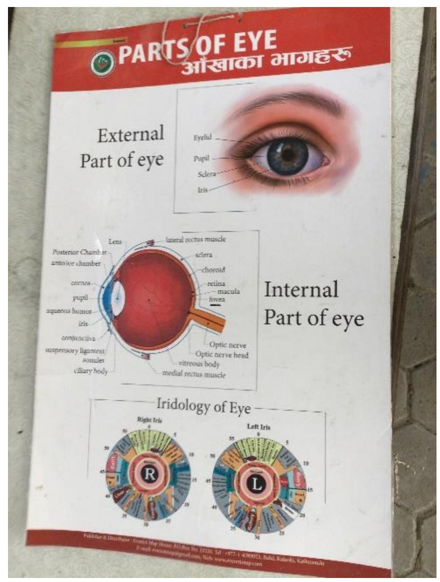

मानव शरीर रचना
प्रजनन् प्रणाली
HUMAN PHYSIOLOGY
REPRODUCTIVE SYSTEM

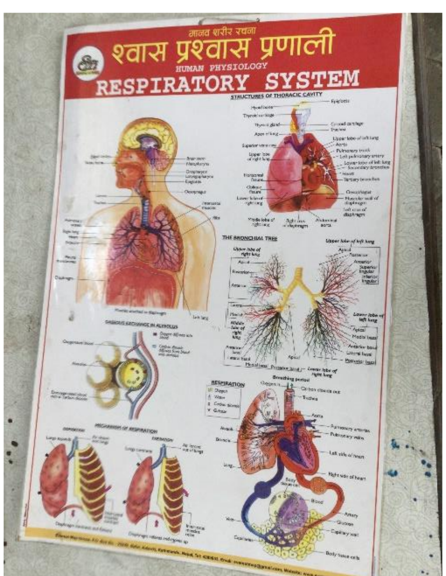

Heart Chart
Arch of aorta
Superior vena cava
Pulmonary artery
Aortic valve
Left Pulmonary veins
Pulmonary valve
Right Pulmonary veins
Left atrium
mitral valve
Right atrium
Tricuspid valve
Septum
Left ventricle
Right ventricle
Inferior vena cava
Descending aorta
Heart in anatomical position
Superior View of Heart Valves


मांसपेशी संरचना/प्रणाली
HUMAN ANATOMY
MUSCULAR SYSTEM
FRONT VIEW
BACK VIEW

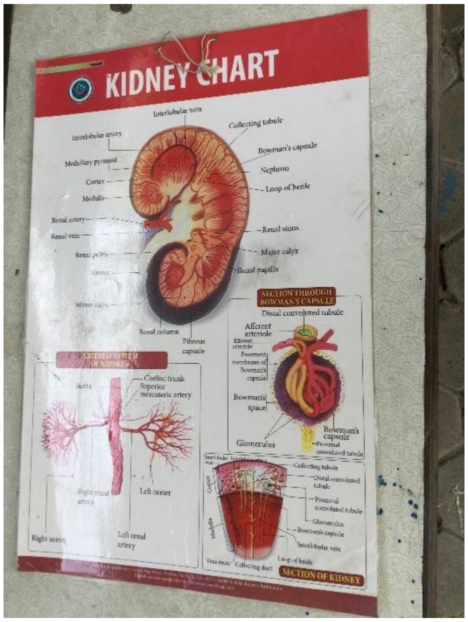

रक्तसंचार प्रणाली
HUMAN ANATOMY
CIRCULATORY SYSTEM

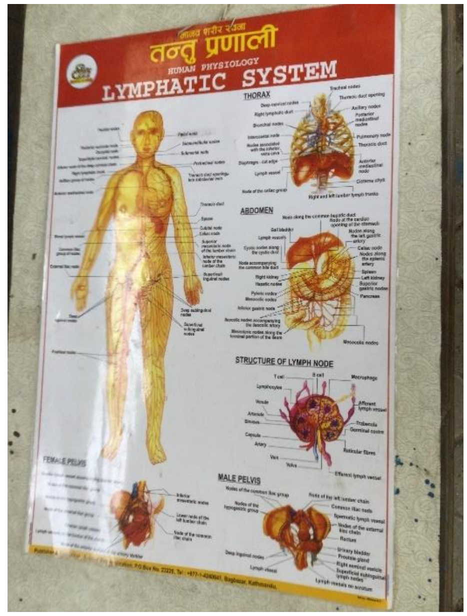

पाचन प्रणाली
HUMAN PHYSIOLOGY
DIGESTIVE SYSTEM

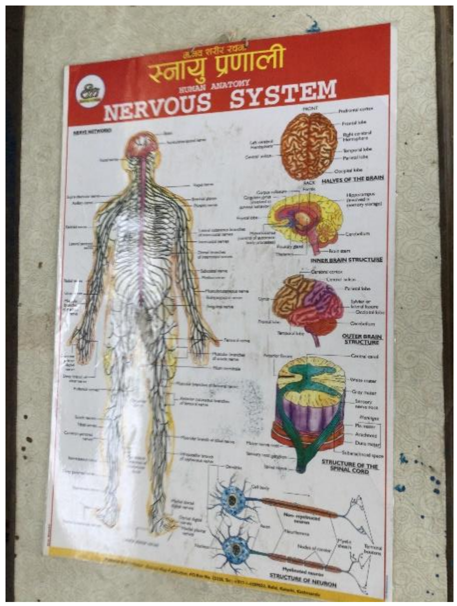

PARTS OF EYE
आँखाका भागहरु
External Part of eye
Eyelid
Pupil
Sclera
Iris
Internal Part of eye
Iridology of Eye
R
L


श्वास प्रश्वास प्रणाली
HUMAN PHYSIOLOGY
RESPIRATORY SYSTEM

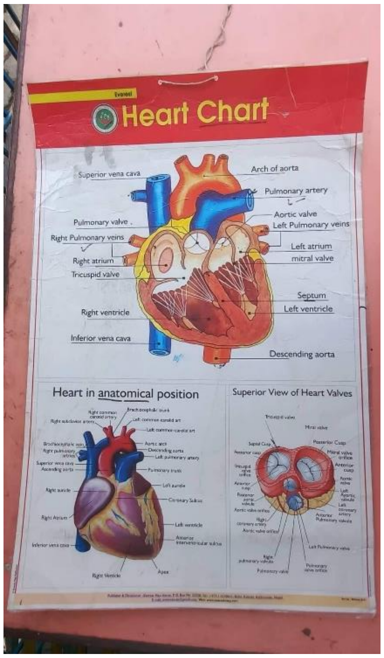

अस्थिपञ्जर प्रणाली
HUMAN ANATOMY
SKELETAL SYSTEM

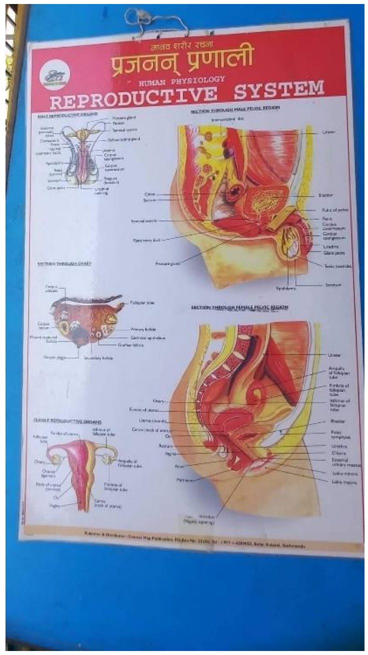

KIDNEY CHART


तन्तु प्रणाली
HUMAN PHYSIOLOGY
LYMPHATIC SYSTEM

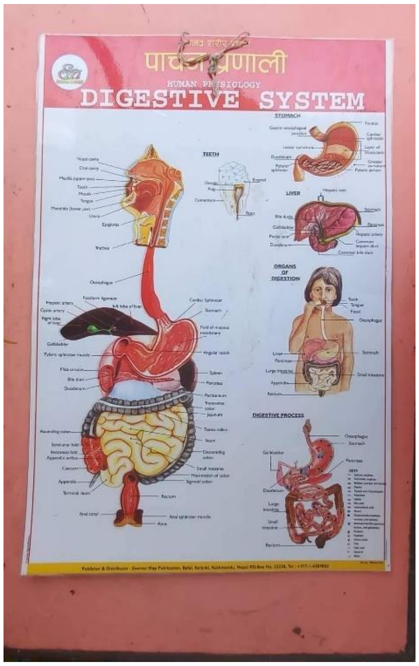

स्नायु प्रणाली
HUMAN ANATOMY
NERVOUS SYSTEM

Educator E:

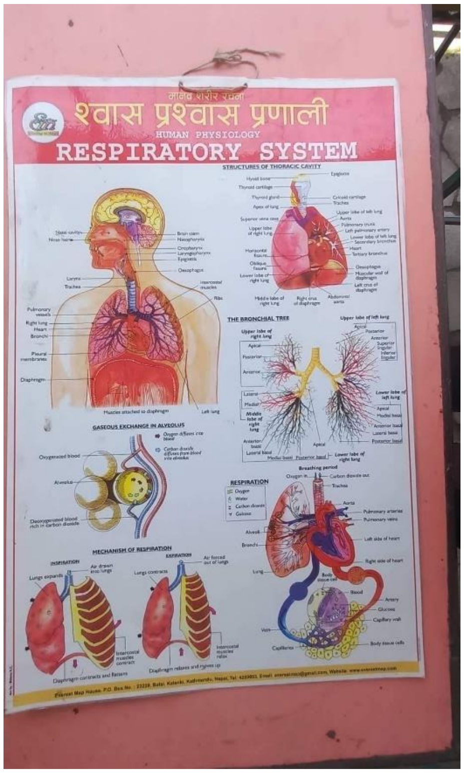

Heart Chart
Superior vena cava
Arch of aorta
Pulmonary artery
Aortic valve
Left Pulmonary veins
Pulmonary valve
Right Pulmonary veins
Left atrium
mitral valve
Right atrium
Tricuspid valve
Septum
Left ventricle
Right ventricle
Inferior vena cava
Descending aorta
Heart in anatomical position
Superior View of Heart Valves

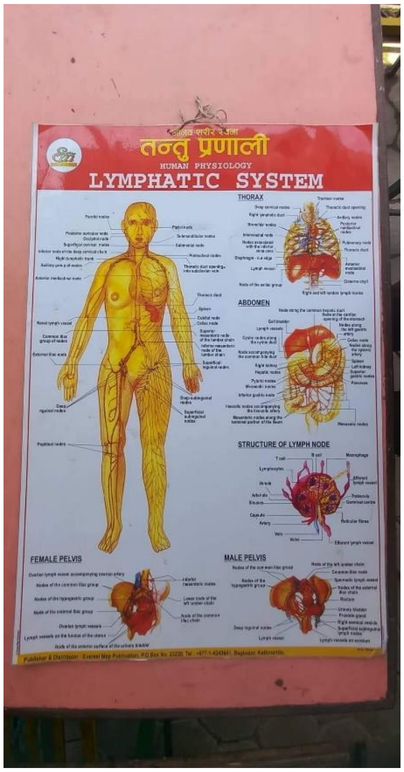

प्रजनन प्रणाली
HUMAN PHYSIOLOGY
REPRODUCTIVE SYSTEM

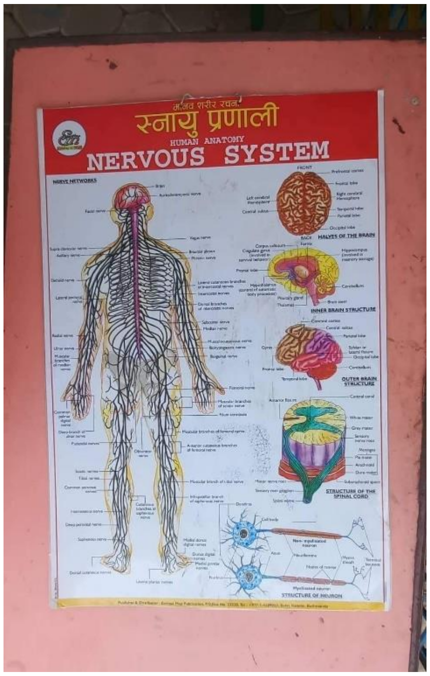

100 ml
CHEMICALS

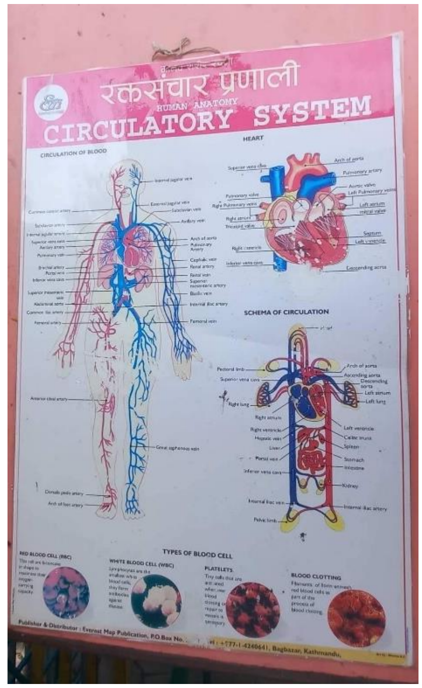

HUMAN PHYSIOLOGY
DIGESTIVE SYSTEM


अस्थिपञ्जर प्रणाली
HUMAN ANATOMY
SKELETAL SYSTEM

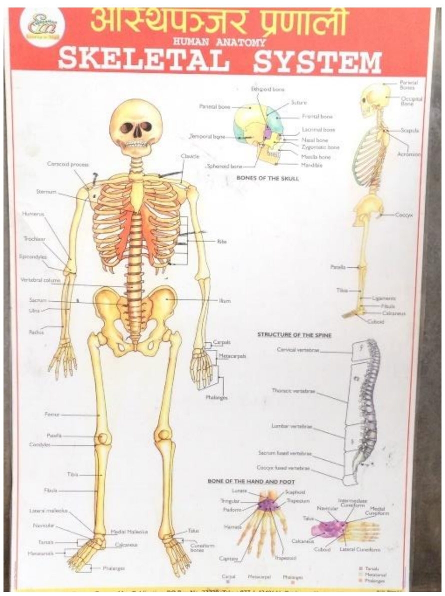

श्वास प्रश्वास प्रणाली
HUMAN PHYSIOLOGY
RESPIRATORY SYSTEM

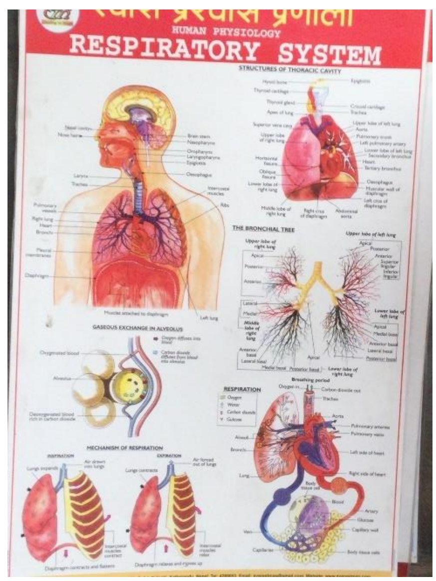

तन्तु प्रणाली
HUMAN PHYSIOLOGY
LYMPHATIC SYSTEM

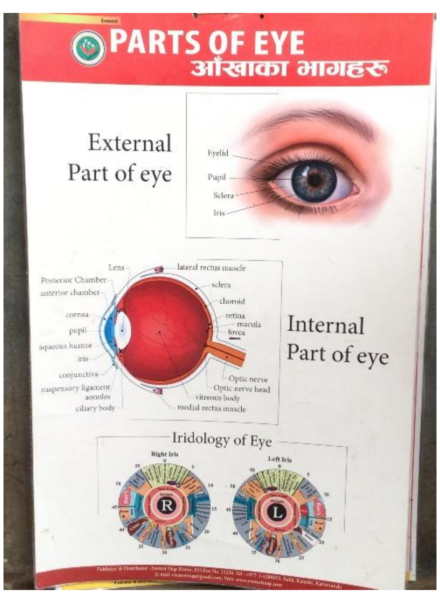

स्नायु प्रणाली
HUMAN ANATOMY
NERVOUS SYSTEM

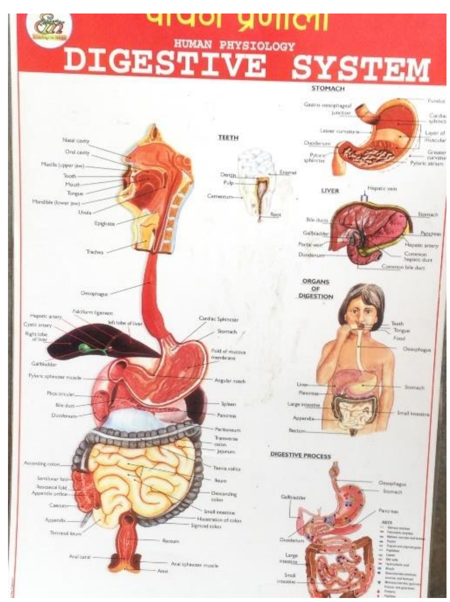

रक्तसंचार प्रणाली
HUMAN ANATOMY
CIRCULATORY SYSTEM

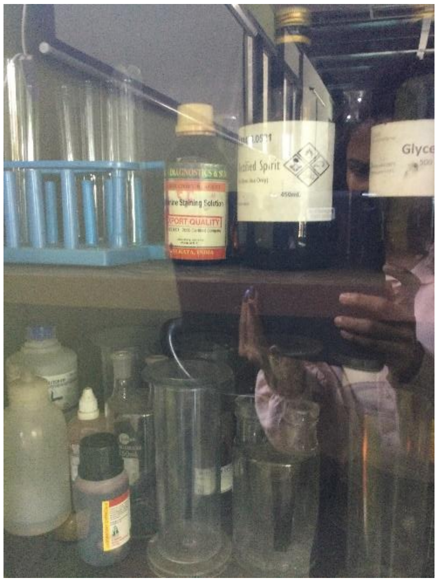
Educator F:


अस्थिपञ्जर प्रणाली
HUMAN ANATOMY
SKELETAL SYSTEM


HUMAN PHYSIOLOGY
RESPIRATORY SYSTEM

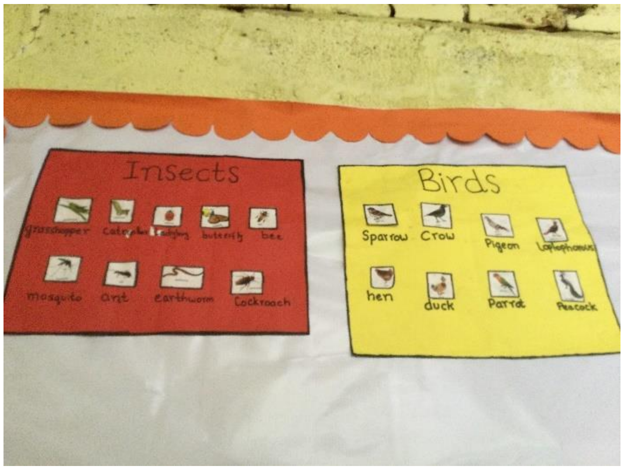

PARTS OF EYE
आँखाका भागहरु
External Part of eye
Eyelid
Pupil
Sclera
Iris
Internal Part of eye
Iridology of Eye

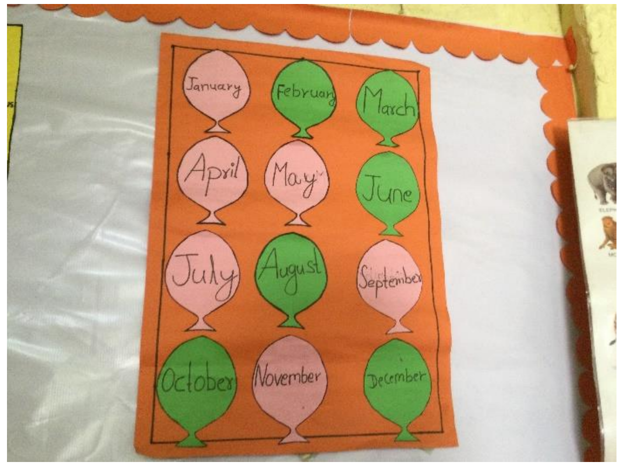

HUMAN PHYSIOLOGY
DIGESTIVE SYSTEM

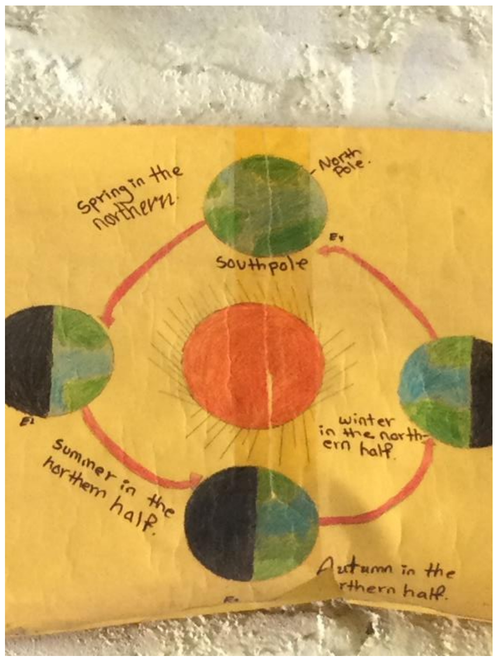



Ms Word
Ms Excel
Pen Drive or Usb drive & USB cable

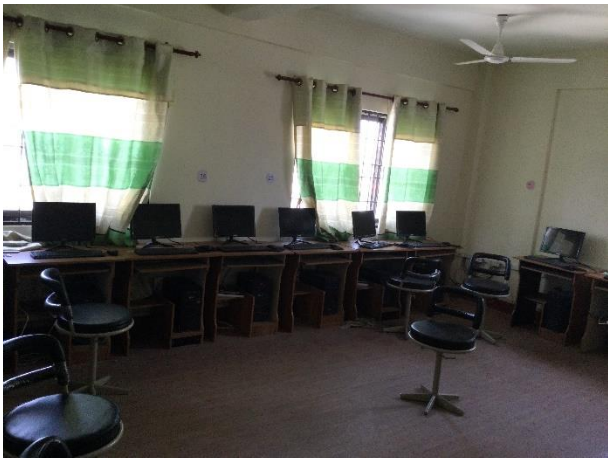

SHAPES
Oval
Kite
Heart
Square
Triangle
Circle


Insects
grasshopper
butterfly
bee
mosquito
ant
earthworm
Cockroach
Birds
Sparrow
Crow
Pigeon
hen
duck
Parrot
Peacock


January
February
March
April
May
June
July
August
September
October
November
December


Spring in the northern
North Pole.
southpole
winter in the north-ern half.
Summer in the northern half.
Autumn in the
rthern half.

Educator G:




PERIODIC TABLE OF THE ELEMENTS-LONG FORM

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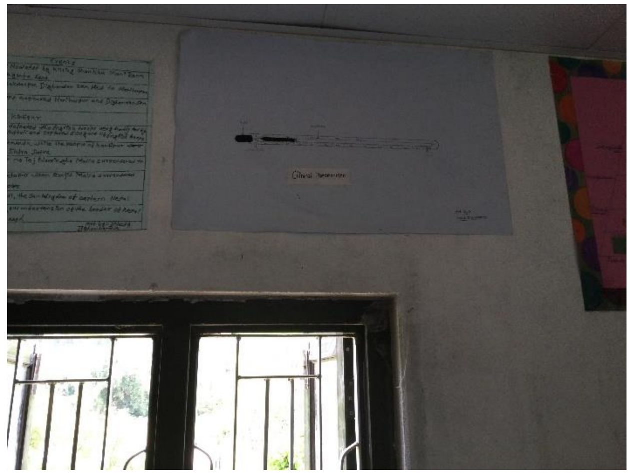
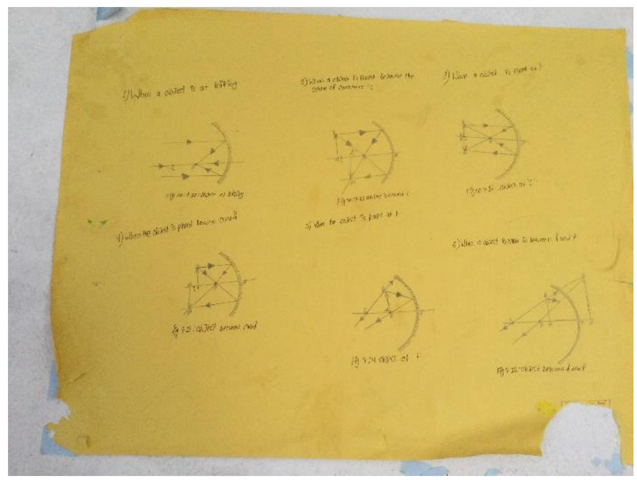
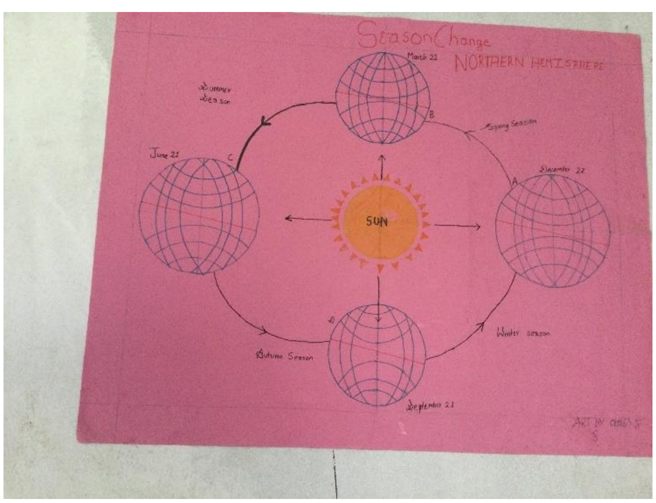
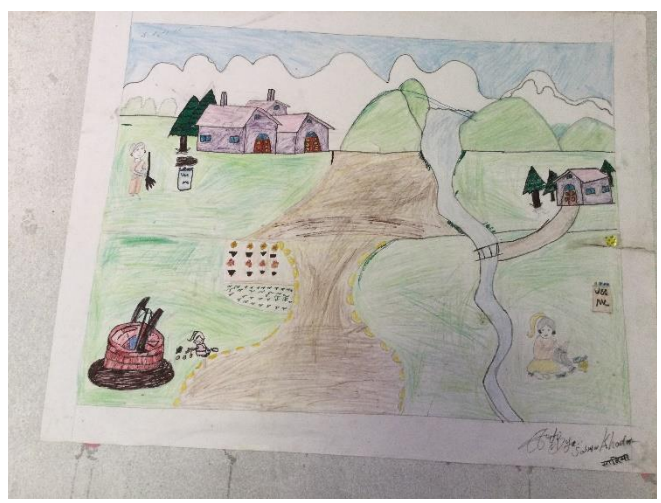
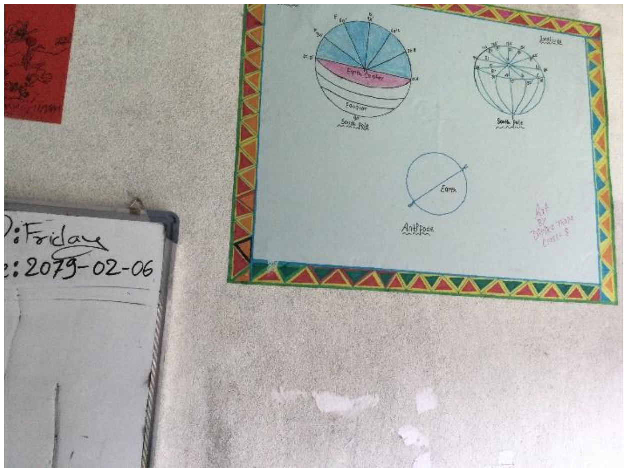




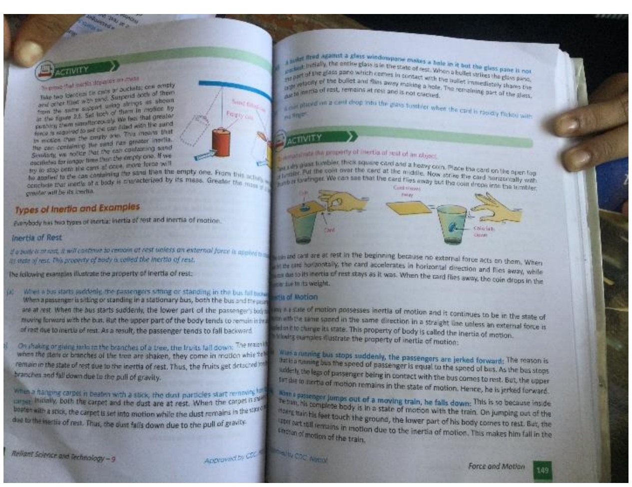


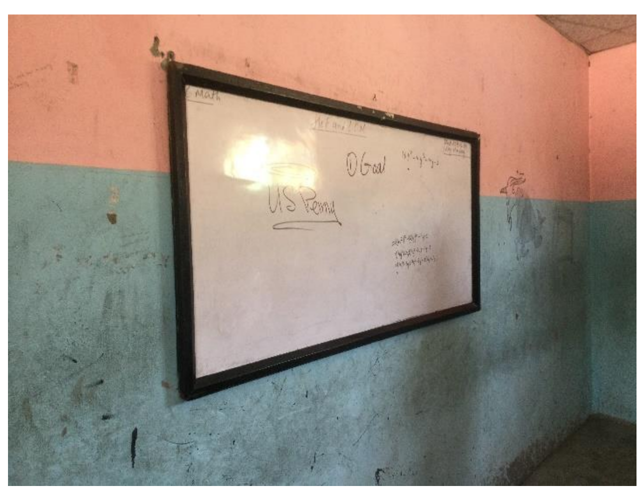




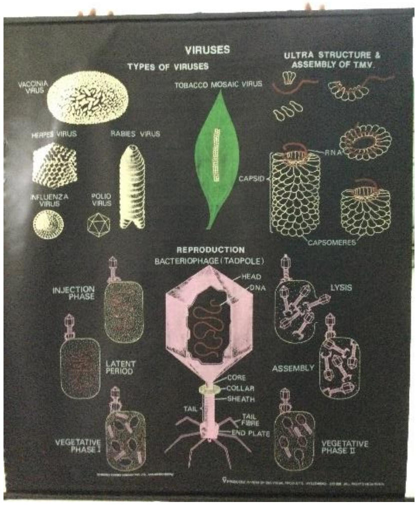
Educator I:

Educator J:

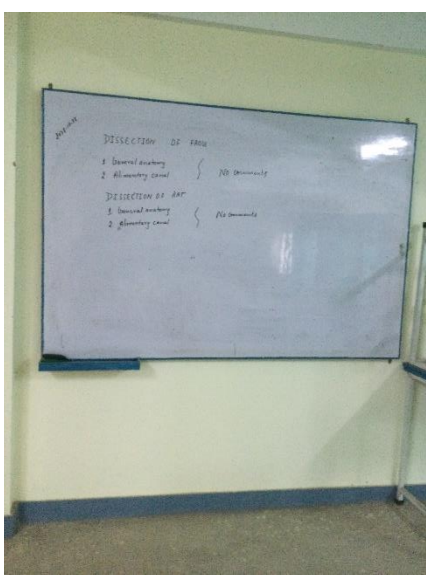




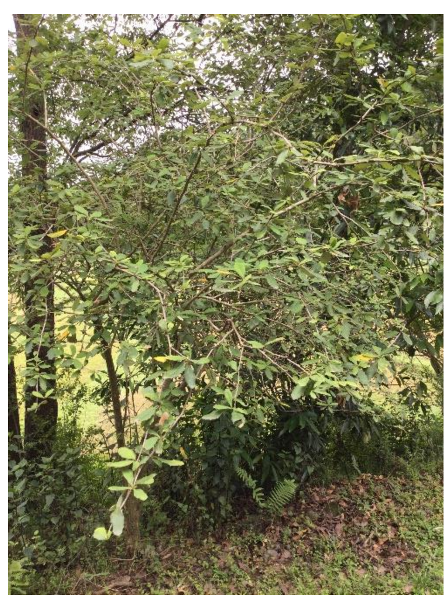
Educator K:

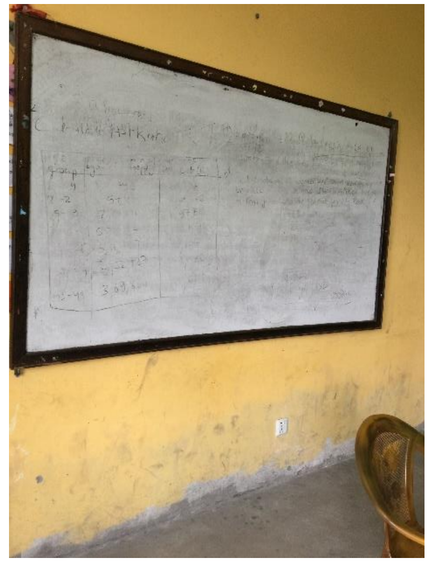

VIRUSES
TYPES OF VIRUSES
ULTRA STRUCTURE & ASSEMBLY OF T.M.V.
VACCINIA VIRUS
TOBACCO MOSAIC VIRUS
HERPES VIRUS
RABIES VIRUS
INFLUENZA VIRUS
POLIO VIRUS
RNA
CAPSID
CAPSOMERES
REPRODUCTION
BACTERIOPHAGE (TADPOLE)
HEAD
DNA
INJECTION PHASE
LYSIS
LATENT PERIOD
ASSEMBLY
CORE
COLLAR
SHEATH
TAIL
TAIL FIBRE
END PLATE
VEGETATIVE PHASE I
VEGETATIVE PHASE II

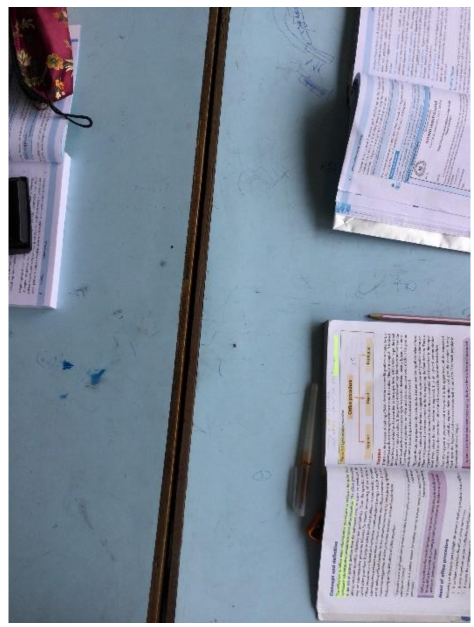

NEW ERA [7] Medium
Disposable Latex Medical Examination Gloves

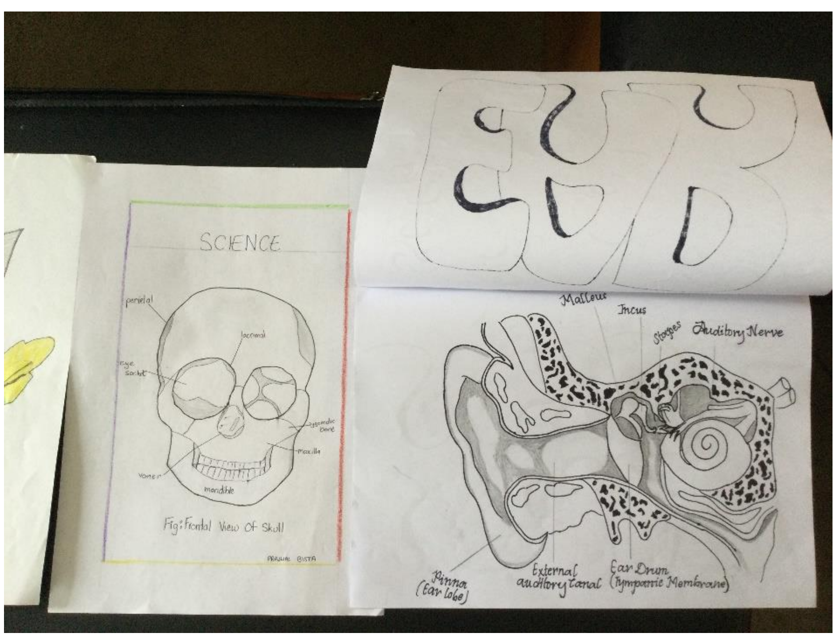


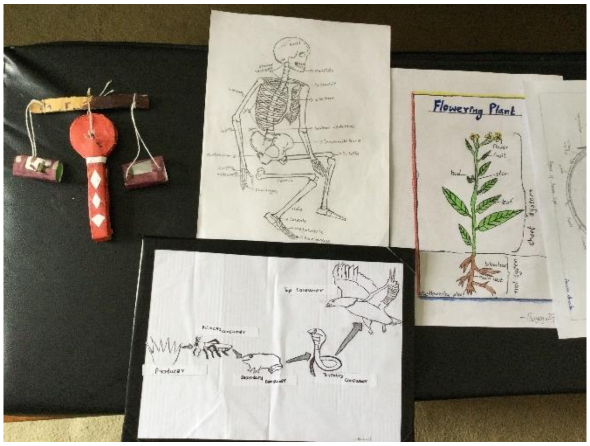
Educator L:



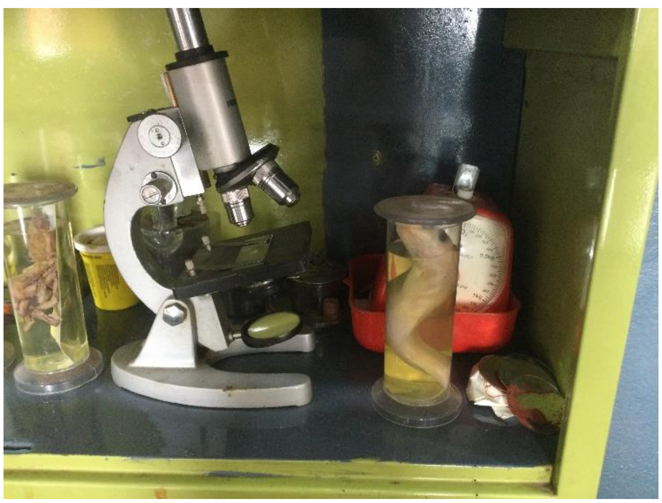


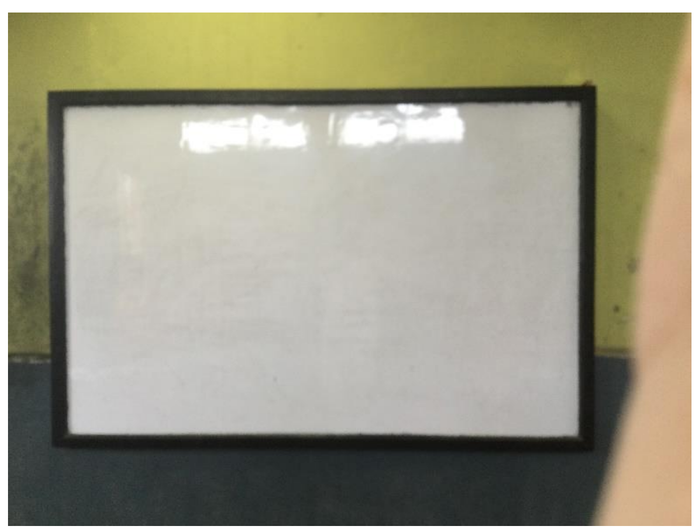



SCIENCE
parietal
mandible
Fig: Frontal View Of Skull
Malleus
Incus
Stapes
Auditory Nerve
Pinna (Ear lobe)
External auditory canal
Ear Drum (Tympanic Membrane)


Flowering Plant

Educator M:





Academic Vita of Brandon Bixler

BRANDON BIXLER

• brandonbixler0609@gmail.com • (717) 490-0972 • *linkedin.com/in/brandonbixler* •

EDUCATION

The Pennsylvania State University — **2020-2024**
B.S. Agricultural and Extension Education
Schreyer Honors College Scholar
Minor: International Agriculture
Certificate: Presidential Leadership Academy

WORK EXPERIENCE

Athens Area High School — *Student Teacher (January 2024 - April 2024)*
• Designed and delivered instruction for eight secondary agricultural education classes in department with 208 enrolled agricultural education students
• Created 17 units of instruction across the Agriculture, Food, and Natural Resources pathway
• Advised FFA chapter of fifty active members in coordination with two cooperating teachers

Global Teach Ag Network — *Undergraduate Intern (August 2020 - May 2024)*
• Empowered more than 1,100 educators for global impact in food, fiber, and natural resources through virtual delivery of Global Learning in Agriculture Community
• Developed content related to UN Sustainable Development Goals for 38 agricultural education programs

HOPE International — *Savings Group Intern (May 2022 - August 2022)*
• Reviewed agricultural pilot training programs in Haiti, Rwanda, and Burundi that trained more than 3,600 farmers in the previous year
• Coordinated qualitative data analysis using NVivo software spanning 15 hours of semi-structured interviews with HOPE International staff members and partner organization staff members

Pennsylvania FFA Association — *State Vice-President (June 2019 - June 2020)*
• Served as student leader of youth agricultural organization with more than 13,000 members statewide
• Delivered conference and convention programming utilizing both in-person and virtual formats to students from more than 60 high schools in Pennsylvania

RESEARCH & PUBLICATIONS

2023 - 2024
Bixler, B., Rice, L. L., Foster, D. D., Miller Foster, M., Ewing, J. C. (2024). *Exploring agricultural education as a vehicle for effective instruction in low-resource environments: A photovoice study of Nepalese science educators.* Research Paper *at the* American Association for Agricultural Education (AAAE) Conference. Manhattan, Kansas.
• Undergraduate Thesis for the Schreyer Honors College

2022 - 2023
Bixler, B., Shawver, G., Rice, L. L., Miller Foster, M., Foster, D. D. (2023, April). *Protecting, procuring, and preserving resources: A photovoice of rural Nepalese educators.* Oral Presentation at the Association for International Agricultural and Extension Education (AIAEE) Conference. Guelph, Ontario, Canada.
Bixler, B., Shawver, G., Rice, L. L., Miller Foster, M., Foster, D. D. (2023, June). *Protecting, procuring, and preserving resources: A photovoice of rural Nepalese educators.* Poster Presentation at the North American Colleges and Teachers of Agriculture (NACTA) Conference. Las Cruces, New Mexico.

2021 - 2022
Bixler, B., Foster, D. D., Miller Foster, M. (2022, March). *Synthesis of literature on best practices in agricultural, career, and technical education for high-risk populations domestic and abroad.* Poster Presentation at the Gamma Sigma Delta Undergraduate Research Expo. University Park, Pennsylvania.

- *1st Place - Human Behavior and Social Systems Category*

GLOBAL EXPERIENCE

Central Nepal
Undergraduate Research (May 2022)
• Conducted qualitative interviews with 13 Nepalese science educators for thesis research
• Secured more than $5,000 in grant funding

Nyeri, Kenya
CED 499 Embedded Course (May 2023)
• Supported conservation agriculture projects and worked with more than 130 children at Children & Youth Empowerment Centre (CYEC)

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HONORS

Eric. A. Walker Award
Recipient (2024)
• Honored as graduating senior whose activities and achievements have most enhanced the public esteem and renown of Penn State

AESE Department
Department Student Marshal (2024)
• Chosen to represent Department of Agricultural Economics, Sociology, and Education based on outstanding academic performance

Penn State Ag Council Youth Leadership Award
Recipient (2022)
• Received annual award for outstanding service to College of Agricultural Sciences through student leadership and involvement

Usharani and C. Channa Reddy Mission Award
Recipient (2024)
• Awarded as Schreyer Honors scholar who best exemplifies the college's mission of academic excellence, globalization, and civic engagement

Rhodes Scholarship
Finalist (2023)
• Selected to interview as finalist for international graduate fellowship at University of Oxford

National FFA Organization
American Degree Recipient (2020)
• Awarded highest national degree for diverse supervised agricultural education projects earning more than $10,000

UNIVERSITY INVOLVEMENT

Presidential Leadership Academy
Scholar (August 2021 - May 2024)
• Selected as part of 30-student cohort to study under University President and Deans regarding complex leadership issues.

University Park Undergraduate Association
Deputy Chief of Staff (March 2022 - March 2024)
• Coordinated Executive and Legislative branches of 100-member university student government
• Hosted university-wide "*What To Fix*" day

University Faculty Senate
Student Caucus Co-Chair (September 2022 - May 2023)
• Directed 30-member caucus and represented undergraduate perspective on Senate Council
• Passed legislation establishing Asynchronous Instructional Day on Election Day

Coaly Society
President (April 2023 - April 2024)
• Lead university's agricultural honor society in delivering speaking contest and senior awards

College of Agricultural Sciences
Ag Advocate (May 2021 - December 2023)
• Represented College of Agricultural Sciences by staffing student programs and tours
• Organized committee structure for recruitment and service efforts for 25 members

Global Orientation to Agricultural Learning
Fellow (August 2022 - May 2023)
• Participated in 2022 Borlaug Dialogues and developed one week of global curriculum

SERVICE

Lancaster County Community Foundation
Grant Review Volunteer (June 2021 - Present)
• Evaluated applications to distribute more than $20,000 in grant funding to community organizations

International Programs Advisory Council
Undergraduate Member (January 2022 - May 2024)
• Represented students on panel with Ag Sciences Global Dean and Faculty members

Penn State University/Extension
English Teacher (August 2022 - December 2022)
• Traveled to local dairy farm and worked 1:1 with English language learners in service-focused course

Zawadi Fund International
Board Member (August 2023 - Present)
• Supported fundraising efforts and lead development projects to benefit CYEC in Nyeri, Kenya

National Association of Agricultural Educators
#TeachAg Ambassador (August 2023 - September 2024)
• Served on a team of 12 to promote profession and direct recruitment efforts for secondary students

CrossNet Ministries
Food & Nutrition Volunteer (August 2020 - May 2021)
• Organized weekend food program for 170 elementary school students each week

PROFESSIONAL BLOG: *mrbixlersblog.blogspot.com*