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INTEGRATION OF SCIENCE BEHIND YMANDAYA ISNAG'S FARMING PRACTICES

RUTH A. TUMANENG

Apayao Center for Historical and Cultural Studies, Apayao State College Luna, Apayao.
E-mail: ascrde@gmail.com

Abstract

This study explored the farming practices of the Ymandaya Isnag people in the Philippines. The aim was to identify scientific concepts embedded in their agriculture that could be used to develop science-learning resources. The study made use of the qualitative descriptive method with key informant interviews, focus group discussions, and documentation as gathering tools. The researcher interviewed 10 elders and five teachers in Calanasan, Apayao. Findings showed that traditional farming practices, such as land preparation *(magoman)*, planting *(magtugnu)*, weeding *(magballat)*, harvesting *(maggani)*, and post-harvesting *(makpinta')*, incorporate scientific concepts such as mechanics, measurements, work, power, energy, matter changes, preservation, and physical quantities. These findings were used to create science-learning materials that are culturally relevant and promote student interest in science and cultural preservation.

Keywords: Indigenous Agriculture, Indigenous People, Apayao Province, Learning Resources in Science, Science Concepts.

INTRODUCTION

Some schools in the world acknowledge the value of Indigenous Knowledge Systems and Practices (IKSP) (Kaya & Seleti 2014; Abah et al. 2015; Banes & Cruz 2021). In Sub-Saharan Africa, for instance, integrating local knowledge into school curriculums is seen as a way to tackle regional challenges and promote sustainable development (Owuor 2007). The situation in the Philippines highlights the need for a similar approach. Many students, particularly indigenous learners in Apayao province, struggle with science due to abstract concepts and a disconnect from their cultural background (Von Aufschnaiter et al. 2008). This disconnection can lead to disinterest and even dropping out of school.

With this, indigenized science instruction offers a potential solution. By incorporating cultural practices and local resources into science lessons (Patricio 2001), educators can make science more relevant and engaging for indigenous students. This approach is actively supported by the Department of Education (DepEd). DepEd Order No. 32, s. 2015 encourages teachers to localize, contextualize, and indigenize learning resources. Additionally, DepEd Order No. 62, s. 2011 (IPEd Policy Framework) and CMO No. 02, s. 2019 by CHED promote integrating indigenous knowledge into teaching and higher education curriculums, respectively. The Ymandaya Isnag are the dominant indigenous group in Apayao, Philippines. Their rich farming practices are deeply embedded in their way of life. This study focuses on understanding the science behind these practices with the aim of developing culturally based science learning resources. This research contributes to both preserving Isnag culture and fulfilling DepEd's mandate for IP education. By developing science lessons relevant to Ymandaya Isnag students,

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the study bridges the gap between traditional knowledge and formal education, fostering a deeper appreciation for science and culture.

Objectives

The study sought to investigate the indigenous farming practices of the Ymandaya Isnag in Apayao, with a particular emphasis on the science concepts incorporated in these practices, such as land preparation, planting, weeding, harvesting, and post-harvesting. The study also intended to identify science learning abilities that could be incorporated into science education based on these practices. Furthermore, the project attempted to provide scientific learning tools based on the Ymandaya Isnag's indigenous farming traditions.

METHODOLOGY

This study utilized both qualitative descriptive research and quantitative research methods to gather information about indigenous farming practices and science concepts in the Ymandaya Isnag community of Calanasan, Apayao. The research involved interviews with elders, retired government employees, and professionals, and five science teachers with at least three years of teaching experience. Purposive sampling techniques were employed to determine the sampling size.

The study was conducted in three phases, including obtaining clearance from the NCIP Apayao and Region CAR, conducting a Needs Assessment Survey, and conducting an ethnographic survey of farming practices. The descriptive method was used to gather, analyze, and tabulate data about prevailing conditions, practices, beliefs, processes, trends, and making accurate interpretations. The study also validated the gathered indigenous knowledge in farming among the Ymandaya Isnags. The second phase involved documentary analysis, bibliographic readings, and identification of learning competencies. The third phase involved the development of learning resources in science, incorporating indigenous farming practices and science concepts. The developed resources were validated by three science teachers in Calanasan, Apayao. The learning resources that were developed included the following lessons/ topics:

Chapter 1: Measurement and Physical Quantities

Sub-module 1 – Measurement: A Universal Language

Sub –module 2 – Identifying Scalar and Vector Quantities

Chapter 2: Mechanics

Sub-module 1 – Kinematics

Sub –module 2 – Dynamics: Laws of Motion

Chapter 3: Work and Energy

Sub-module 1 – Work and Power

Sub –module 2 – Energy

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Furthermore, the study used the mean as a statistical technique to analyze data. The mean rating was used to identify which topics the science teachers regarded difficult based on the needs assessment survey.

The following range of means was used in interpreting the data gathered in the survey. Below is the 5.0 Likert scale used in the needs assessment survey.

Scale	Range Interval	Descriptive Interpretation
5	4.51-5.00	Very Difficult (VD)
4	3.51- 4.50	Difficult (D)
3	2.51- 3.50	Moderately Difficult (MD)
2	1.51-2.50	Easy
1	1.00-1.50	Very Easy (VE)

RESULTS AND DISCUSSION

The Ymandaya Isnag source of livelihood is upland farming. Rice culture or *mangoman* is a one-year crop cycle that activities such as land preparation (*magoman),* planting (*magtugnu),* weeding *(magballat*), harvesting*(maggani)* and post harvesting*(makpinta)*.

The study presents the following themes and sub themes:

Indigenous Farming Practices of Ymandaya Isnag and the Science Concept Imbed

A.1. Indigenous farming practices during land preparation

The land preparation operations in Isnag are deeply rooted in the community's cultural and spiritual beliefs (Ocampo, 2014). This preparation includes *manatalun*, *tadaw*, and *si'dug*. First, *manatalun* involves clearing a field and placing a stick for reservation. Isnag farmers must follow their night dreams, which indicate a lack of production or illness among family members. Second, tadaw is done by males, which involves clearing land for a good harvest, including removing and drying branches and twigs.

The females then thresh palay for seed, known as *magaggi*, from the *alang*, or rice granary. If abundant, she organizes an *illu* or a group project. The seeds are wrapped in wilted *sapulu* leaves for insect repellant. Third, *si'dug* involves burning withered branches during *manatalun* and *tadaw* for pest control. Ash spreads over the soil, enhancing fertility. Isnags burn during midday to prevent fire from kaingin. *Maman*, flavored betel nuts, is offered to spirits during *si'dug*.

These operations are similar to indigenous strategies of sustainable farming systems in the Philippines, such as terracing, crop rotation, and soil fertility management (Magcale-Macandog, 2005). The use of local resources for soil improvement in Sindangkasih Village also aligns with these traditional practices (Alam, 2023). The implementation of terraces with improved seed and fertilizer application in Afghanistan further demonstrates the importance of sustainable land preparation methods (Maroofi, 2021).

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A.2. Science concepts imbedded on indigenous farming practices during land preparation

The Ymandaya Isnag people cultivate their land using traditional practices, such as *manatalun*, *tadaw*, and *si'dug* that weave together scientific concepts and environmental consciousness (Giancoli, 2014). Land clearing activities like *manatalun* (cutting down trees) and *tadaw* (burning secondary forests) demonstrate their understanding of physics (Giancoli, 2014). Farmers use force and motion to travel distances and exert force to clear the Kaingin region, with physical changes like split trees being a direct result.

Si'dug, another traditional practice, exemplifies their commitment to both science and sustainability. By burning leftover plant material on the surface of the kaingin field (slash-and-burn), they achieve pest control through heat that eliminates insects and their eggs (Huang, Y., Wang, Y., Sun, H., Gong, W., Wu, H., & Liu, S. ;2018). The resulting ash acts as a natural fertilizer, enriching the soil with nutrients like potassium, phosphorus, and calcium (Singh, B., & Blackwell, J.; 1997). This aligns with organic farming principles and avoids harmful chemicals, promoting long-term soil health. *Si'dug* reflects the Isnag's deep understanding of maintaining a healthy ecosystem by minimizing negative environmental impacts.

The *maggagi* technique showcases their scientific knowledge of seed preservation (Altieri, M. A.; 1995). Farmers meticulously select the best paddy seeds and wrap them in wilted *sapulu* leaves, a natural pesticide that repels insects due to its insecticidal properties (Pimentel, D., & Lehman, H.; 1997). This method is not only effective but also environmentally friendly; avoiding the use of synthetic pesticides that can harm beneficial organisms and pollute the environment (Jotwani, M. G., & Ajayi, E. C.; 2008).Table 1 summarized the indigenous farming practices/ IKSP and the science concepts imbed during land preparation.

Table 1: Indigenous farming practices/ IKSP and the science concepts imbed during land preparation

Farming Activities	Indigenous Farming Practices/IKSP (Beliefs and Practices)	Science Concepts Imbed
During land preparation *(magoman)*	1. *Mangoman* a. *manatalun* b. *tadaw* c. *si'dug* - *panasi'dug tu atad* - *maman* d. *maggagi* e. *abuyug* *illu*	• Work • Force • Motion (physical quantity, distance and speed) • Physical Change • Chemical Change • Preservation Teamwork and Mutualism or ecological relationship exhibit among the population

B.1.Indigenous farming practices during planting

Planting, termed *magtugnu*, is done by a *sagwa'* (iron rod with a wooden shaft) and a *tupang* (seed container) secured to the waist. Others do this by *ararang* (using the grip of the hands to contain the seeds) and sowing them with the same. The distance of the drill holes is around one

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foot, either by line or quincunx. *Magtugnu* begins from the starting point in a backward position, going downward. When the entire *oman* has been planted, the rice spirits are called to bless and nurture the plants until the maturity stage. The reserved small area, preferably near a stump where the spirits are called, would finally be planted. This is called Mamalin. *Tagnap* (replanting) is done for missing hills. Before doing the *tagnap*, a chick should be buried first to avoid the ill-fates of the family.

B.2. Science concepts imbedded on indigenous farming practices during planting

The Isnags practice planting in *oman* or kaingin field involves a combination of force and kinematics, with the driller holding a *sagwa* (metal rod) to drill seeds. This contact force, resulting from direct contact between two surfaces, is a common topic in mechanics. The distance between drill holes, around one foot, entails rectilinear or translatory motion. The Isnags start their planting in a backward position, going downward, to be orderly and comfortable. This is due to the law of gravity, which causes fatigue when starting at the lower portion and moving upward. Intercropping vegetables with rice plants during planting season helps sustain soil minerals and control soil erosion. This simple machine is an example of a simple farming method. Table 2 presents the indigenous farming practices/ IKSP and the science concepts imbed during planting.

Table 2: Indigenous farming practices/ IKSP and the science concepts imbed during Planting

Farming Activities	Indigenous Farming Practices/IKSP (Beliefs and Practices)	Science Concepts
Planting *(magtugnu)*	1.*Magtugnu* a. *sagwa se tupang* b. *ararang* 2.*Mamalin* 3. *Tagnap*	• Mechanics (force & Kinematics) • Law of Gravity • Work and Energy • Simple Machine • Controlling soil erosion (replanting)

C.1. Indigenous farming practices during weeding

There are four kinds of weeding: *sidut, guwang, ballat, and tabal*. Weeding is an activity done by women. *Sidut and guwang* are done by uprooting weeds or by using *aliwa*, while *ballat and tabal* are done using the *palu*' or hoe. *Palu'* has two kinds: *pinat*, whose blade is directly secured in the shaft, and *pinalabuwan*, secured by an iron loop. Weeding is done sometime in June or in July. These months are rainy seasons, so the farmers use the *taddung* (nipa leaf hat) and the *ananga* (nipa leaf coat) to protect themselves from rain or sunlight, while at the same time pepping tobacco cigars to get rid of *gu'bang* (gnats or mosquitoes).

C.2. Science concepts imbedded on indigenous farming practices during weeding

Weeding, as one of the farming chores, demonstrates scientific ideas like the preservation of the soil and even other living organisms located inside the *oman* or kaingin environment. The usage of *aliwa* and *palu'* to weed the kaingin area is environmentally friendly and prevents intoxication. Unlike now, farmers employ chemicals like pesticides to remove weeds. The *palu*

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(hand hoe) and *aliwa* (native bolo) are examples of basic machineries that do not harm biodiversity. They are used to trim grasses and weeds in an *oman*. These farming instruments are safe and environmentally beneficial. Weeding through sidut, guwang, ballat, and tabal using basic machinery such as the *palu"* and *aliwa* demonstrates work, energy, and mechanics. Table 3 presents the summary of Isnags' indigenous farming practices /IKSP and the science concepts imbed during weeding.

Table 3: Indigenous farming practices/ IKSP and the science concepts imbed during Weeding

Farming Activities	Indigenous Farming Practices/ IKSP (Beliefs and Practices)	Science Concepts
Weeding *(Magballat/Ballat)*	1. *Magballat* a. *Sidut* b. *Guwang* c. *Ballat* d. *Tabal* *(palu',pinat, pinalabuwan)*	• Soil preservation • Mechanics (force and kinematics) • Work and kinetic energy • Simple machine

D.1. Indigenous farming practices during harvesting

The Ymandaya Isnag perform a series of rituals throughout their harvest season, called maggani. These rituals involve offerings to appease the rice spirits (abulbulon ammay) and ensure a successful harvest. One ritual, *manalegat,* involves a woman collecting a rice panicle and burning it while calling upon the rice spirits. Another ritual, *maggapat,* involves burning and pounding rice seeds as an offering. Throughout the harvest, a hearth is maintained, and cooked rice is offered daily to the rice spirits. The lead reaper observes specific restrictions during the harvest, such as avoiding bathing and talking to non-family members. The Isnag also use a special vocabulary during harvest, *magsaliw,* with terms for different situations like rain, pain, and needing to use the restroom. The harvest itself involves cutting the rice panicles, bundling them, and storing them in the hut. A final ritual, mamaldung, involves uprooting a fastened rice plant and signifies the end of the harvest work.

D.2. Science Concepts Imbedded on Indigenous Farming Practices during harvesting

The Ymandaya Isnag harvest practices reveal interesting connections between their culture and scientific concepts. The physical act of harvesting uses principles of force, work, and energy. Farmers exert force on the stalks with their hands, displacing them (work) and using energy to perform the task. The *rakam,* their harvesting tool, incorporates simple machines like wedges and levers, making cutting more efficient.

The Isnag also rely on physical quantities for measurement. They track the number of harvested bundles, the size of their fields (*oman* and *alimag*), the weight of their produce, and the volume of rice they gather. Even scalar quantities like time and distance play a role. The duration of harvest and the distance traveled to and from fields are all factors they consider. These connections showcase how the Isnag have developed a deep understanding of the physical world through their agricultural practices. Their cultural rituals and tools not only hold spiritual significance but also demonstrate a practical grasp of scientific principles.

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D.2.1. Approximate Measurement of Harvest

Ymandaya Isnag farmers perform *maggani* or harvesting by cutting panicles, storing them in *arin* or hip basket and bundling palay. They use indigenous methods for measurement and estimate harvests. Table 4 shows the approximate measurement of harvest use by the Ymandaya Isnag during *maggani.*

Table 4: Ymandaya Isnags' approximate measurement of harvest

Isnags' Farming Activities	Traditional Practice / Methods of Measurement	Equivalent in Metric System	Science Concepts Imbed
Harvesting (*Maggani)*	*isa nga batta* = 1 bundle or 3 hand grip full	3.25 kg	A measurement of harvest.
	isa nga ngesing = 4 bundles of *ammay or* palay	13.0 kg	
	isa nga uyon =10 *ngesing* or 40 bundles	130 kg	
	isa nga mopu= 10 *uyon* or 400 bundles	1,300 kg	
	isa nga matungal=10 *mopu or* 4,000 bundles	13,000 kg	

The Isnag's harvest practices integrate measurement and resourcefulness. They collect even rejected rice stalks for consumption, minimizing waste. Bundles are tied with readily available materials like cogon grass or bamboo, demonstrating practical techniques. Their understanding of science goes beyond simple measurement. They recognize that the weight of a bundle is not fixed, but depends on factors like moisture content and seed quality. This knowledge helps them manage their harvest effectively. By carefully drying the rice and selecting good seeds, they can maximize the yield and ensure food security for their community. Figure 2 shows their bundling of palay.

Fig 1: *Isa Batta* – 1 bundle or 3 hand grip full of palay

Fig 2: *Isa ngesing – appat* (4) *batta* of palay

D.2.2. Approximate measurement of length

The Isnag uses body parts such as the finger, arm, palm, and foot to determine or measure length. For them, the smallest unit of measuring length is one finger node, or ***pir-it.*** They use ***pir-it to*** estimate the amount of water needed to cook rice when they are in *oman* during their

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farming activities. They use *ramayan* to describe the size of fish they catch in the river or streams. They use *dangan* and *dappa* for constructing their *sigay* or *balbalay* in *oman.* Table 5 presents the isnags' approximate measurement of length.

Table 5: Ymandaya Isnags' approximate measurement of length

Isnag's Farming Activities	Traditional Practice / Methods of Measurement	Equivalent in Metric System	Science Concepts Imbed
Harvesting (maggani) and Post-Harvesting *(mak'pinta)*	Pir-it = 1finger node	M – 2.80 cm F – 2.40 cm	Measurement of Length
	Ramayan=Finger length	M – 7.38 cm F – 7.10 cm	
	Dahulap= Palm size/ length	M – 11.0 cm F – 9.44 cm	
	Dangan = Forefinger length to index finger	M – 19.9 cm F – 12.1 cm	
	Dappa= Arm length	M -168.28 cm F- 151.98 cm	
	Dapan = Foot length	M – 24.80 cm F – 21.36 cm	

D.2.4. Approximate measurement of weight, area and volume

The Isneg people have a unique measurement system based on tools and comparisons. They don't rely on abstract units but utilize everyday objects to gauge weight, area, and volume during construction of their farms (*alang*) and dwellings *(sigay*). Prefixes like "PANG" and "MANGKA" help them compare measurements. The exact details of weight measurements for various farming structures like granaries (alang), fields (oman) and houses (sigay) can be found in figures 3.

Weight
Mangka dammat altung - as heavy as a wooden mortar

Area
Mangka lawa naya alang – as wide as the rice granary

Area
Mangka lawa naya oman – as wide as the kaingin field

Fig 3: *altung* (wooden mortar*)*, *alang* (rice granary) *& oman* (kaingin field)

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D.2.5. Approximate measurement of time

In the past, the Isnags didn't have clocks. Instead, they observed the sun, moon, stars, and even wildlife to track time. Animals like roosters (3:00 am crow), hornbills (noon call), and cicadas (dawn/dusk chirps) acted as living alarms. They also used the sun's position and shadows to tell time. This traditional system helped the Isnags manage their farm work in Oman, reminding them when to start their day and head home in the late afternoon. It was also useful for other farm activities and special events. Table 6 shows the approximate measurement of time or period of Isnags.

Table 6: Ymandaya Isnags' approximate measurement of time or period

Isnag's Farming Activities	Traditional Practice / Methods of Measurement	Equivalent in Metric System	Science Concepts Imbed
From land preparation to post harvesting	*Mun-ona taraut anu'* = dawn *Pagbarngat* = sunrise *Mangalintutugu/matuuun* = high noon *Mamreg/gidgidam* = afternoon *Si'si'dam* = sunset *Lamag* = late night *Tanga gabi* = midnight	3:00 AM 6:00 AM 12:00 PM 1:00 -5:00 PM 6:00-7:00 PM 11:00 PM 12:00 Midnight	Identifying the time

D.2.6. Approximate measurement of distance

The Isnags didn't have conventional measurements for long distances, especially when traveling to their kaingin farms. Instead, they relied on landmarks like mountains, rivers, streams, and plains to gauge distance. Their travel time was estimated in fractions of a day: *"tanga aldaw"* (midnoon), *"tanga gabi"* (midnight), and "*tanga gudwa aldaw*" (half day). This system helped them estimate how far their kaingin was from their village and how far other places were, like the *"alang"* or *"sigay"*. Table 7 present the details on these specific locations.

Table 7: Ymandaya Isnags' approximate measurement of distance

Isnags' Farming Activities	Traditional Practice / Methods of Measurement	Science Concepts Imbed
During land preparation to post-harvest	*Tanga-tanapan* = one plain travelling distance *Tanga bantay* = one mountain hike travelling distance *Tanga ba"langan* = one stream / river cross travelling distance	Estimating distance

E.1. Indigenous Farming Practices during Post – Harvesting

The Isnags have a post-harvest storage process called *maktariman*. Harvested rice is first dried in a temporary shelter (*sigay)* before being transferred to a permanent granary *(alang*). Storage methods depend on distance: *tuddal* for nearby and transport (*mangaktu/tarudtud*) for distant locations. They use a carrying yoke *(issiw)* to move rice bundles *(batta)*. Inside the *alang*, a designated person (*makpinta*) stores the rice. A ritual involving an offering (*inapugan*) and leaving the granary open overnight ensures the rice's well-being. Not all rice is stored; some are kept for immediate consumption (*pingi*l) before the first retrieval (*mangassat*) from the

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granary. The Isnags also celebrate a harvest festival called *Say-am*. This multi-day event involves thanksgiving rituals (*magaba* and *magluhut*), traditional dance (*maktalip*), and sharing food (*pakkal*) and drinks (*basi)* with guests from neighboring communities.

Fig 4: The *Pakkal* during *say-am*

E.2. Science Concepts Imbedded on Indigenous Farming Practices during post-harvesting

The Isnag farmers are masters of sustainable practices. Sun drying their rice (paddy) utilizes the sun's heat for a natural preservation method. This drying process removes moisture, preventing mold and bacteria growth, ensuring long-term food storage. The Isnags then store the dried rice in elevated granaries (*alang)* to protect it from rodents and other pests. This practice demonstrates their scientific understanding applied to a cultural tradition.

Their commitment to sustainability extends to their transportation methods. They rely on manpower and carrying yokes (issiw) to move harvested rice. This cultural practice avoids tractors and trailers, which contribute to pollution. Additionally, their use of *pakkal*, food wrapped in banana leaves, during celebrations showcases environmental awareness. *Pakkal* biodegrades naturally, unlike plastic disposables, reducing waste and air pollution from burning garbage. These practices effectively blend cultural traditions with scientific knowledge to promote a sustainable way of life.

II. The Science Learning Competencies in the Ymandaya Isnag’s Farming Practices

During an ethnographic survey, the science learning competencies in Ymandaya Isnag's indigenous farming practices were determined using a descriptive technique with an extensive documentary analysis on the identified farming practices, or IKSP, in agriculture. The selected science learning skills were based on the Dep Ed Science learning competencies and grouped according to Isnags' farming activities, which included land preparation, planting, weeding, pest control application, harvesting, and the post-harvest period. Table 8 shows the science learning competencies relevant to Isnags' indigenous farming practices, also known as IKSPs.

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Table 8: The Science Learning Competencies in the Indigenous Farming Practices of Isnags

A. Land Preparation
Identify the physical quantities exhibit during the *mangoman* activity Compute for the force exerted by a farmer in *tadaw* and *manatalun* Identify the benefits exhibited in *panasi'dug tu atad na oman.* Describe the natural way of preservation of Isnags in *ammay* seed. Identify the ecological relationship exhibit in farming activity of Isnags.
B. Planting Season
C. Weeding
Identify the mechanics found in *magballat.* Calculate the force and work in *sidut* and *guwang.* Identify the work exerted in *ballat and tabal*. Describe the simple machines used in *magballat.*
D. Harvesting
Identify the Newton's law exhibited in the hanging of palay panicles near the sigay' door during *manalegat.* Calculate the speed of an Isnag farmer during *maggapat*. Identify the physical quantities performed by the Isnags during harvesting. Calculate the equivalent of 5 *uyun* in *batta.* Identify the simple machines used during harvesting.
E. Post-Harvesting
Identify the work done by the *abuyug* of Isnag men carrying *batta* of ammay for tuddal. Identify the types of energy exist during post harvesting. Calculate the momentum and impulse exhibit by the farmers in *makpinta.* Compute for the speed of *Taddo* and *talip* dancers during the *say-am*. Identify the science concepts derived in *gansa* and *ludag.* Describe how Isnags preserve their food especially meat and fish. Identify the Isnags' organic way of seed preservation.

III. Learning Resources in Science

New learning resources in science were developed specifically for the Ymandaya Isnag community (Nuangchalerm, P. ; 2006). Researchers studied their traditional farming practices through surveys and analyses to create culturally relevant materials. These resources cover a range of scientific concepts, including measurement, mechanics, and work & energy. They uniquely connect these concepts to the Isnag way of life in Apayao. The resources delve into traditional farming practices like land prep, planting, weeding, and harvesting. Everyday activities like carrying rice (*ammay* or palay) are used to illustrate concepts like force, work, and power. Even transporting *ammay* with a barangay (boat) demonstrates Newton's Laws of Motion. The learning resources are comprehensive and user-friendly. Each sub-module includes an overview, learning objectives, assessments, activities, and a glossary. Pre-assessments gauge student understanding, while post-assessments track progress. Enrichment tasks solidify learning and encourage applying knowledge in new contexts. The materials were reviewed and approved by science teachers for accuracy and effectiveness.

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CONCLUSION

The study developed Learning Resources in Science, focusing on indigenous farming practices and science learning competencies of Ymandaya Isnags in Apayao. The research involved three phases: obtaining clearance from NCIP Provincial and Regional Offices, conducting a documentary analysis of indigenous knowledge, and identifying learning competencies and science topics. Both qualitative and quantitative research methods were used. The findings suggest that the indigenous farming practices of Ymandaya Isnags are embedded with various science concepts, including measurements, physical quantities, mechanics, kinematics, force, energy, power, work, biotechnology, chemistry, and environmental topics. The learning resources support the IPED Program of the Department of Education, promoting the integration of indigenous knowledge in teaching lessons. The study supports the theory of Bruner, Piaget, and Rousseau, stating that learning should cater to individual children's needs and enhance their comprehension.

Recommendations

The study highlights the importance of preserving cultural heritage in science lessons, highlighting the role of cultural practices in fostering student interest and responsiveness. Recommendations include face-to-face validation of learning resources, further validation by an IM expert, field-testing with students, encouraging teachers to use IKSP in teaching, and supporting teachers in developing instructional materials. Educational managers and administrators should also provide support and incentives for teachers to develop these resources.

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