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TRADITIONAL ECOLOGICAL KNOWLEDGE OF THE KAZAKH PEOPLE AS A PREREQUISITE FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT

Abstract

Nowadays, environmental education is being transformed into education for sustainable development (ESD). The concept of sustainable development is a necessary condition for the continuation of life on Earth. The knowledge of the environment of Kazakh people includes a deep knowledge of the state of the climate, the spatial laws of climatic processes, and atmospheric phenomena. From the point of view of ethnic Genesis, the concept of space of people is reflected in the spiritual culture, and their traditional worldview is the basis of public consciousness. The developed spatial understanding of the Kazakh world can be traced both through its economic organization and through the toponymic system of space.

The purpose of this article is to analyze and demonstrate deep knowledge of the Kazakh people about climatic conditions as a result of their adaptation to harsh environmental conditions. Of particular interest is knowledge in the field of forecasting weather conditions, which is an indicator of the traditional knowledge of residents who have long had a nomadic lifestyle. As the experience of classical nomads shows, very important environmental knowledge was required to adequately organize nomadic herding. To adapt to these environmental conditions, a very large minimum amount of information was required, and the quality and volume of knowledge could only be subjected to transmission and accumulation from generation to generation over a very long period of history.

Quantitative data were analyzed and interpreted using descriptive statistics. The literature review was conducted based on the recommendations of the PRISMA methodology.

A lot of literature is written about the importance of the environmental experiences of our people. Therefore, in the context of globalization, it is important to awaken the national consciousness to stop the actions that lead to environmental destruction and climate change, that is, to use the experiences of the ancestors of each nation to preserve the habitat.

Keywords: ESD, traditional ecological knowledge, adaptation to the environment, knowledge of the environment, worldview of the Kazakh people.

Introduction. The 17 Sustainable Development Goals adopted in 2015 assume the fulfillment of important tasks in the environmental, economic, and social spheres. The objectives of SDG - SDG-15 conservation of terrestrial ecosystems include ensuring the conservation, restoration, and rational use of terrestrial and inland freshwater ecosystems and their capabilities, including forests, wetlands, mountains, and drylands, by obligations arising from international agreements (United Nations, 2017). Also, paragraph 15.2 emphasizes the promotion of rational use methods, 15.3 combating desertification and striving to ensure that the condition of land does not deteriorate worldwide. Achieving sustainable development is a necessary condition for the continuation of life on Earth. ESD has been recognized as a key tool for achieving sustainable development and raising public awareness and understanding of SD principles (United Nations Educational, 2022). Nowadays, environmental education is being transformed into education for sustainable development (ESD) (Abu et al., 2023). Environmental education has been formed for centuries from the experience of ancestors to preserve the environment and also learning of traditions to preserve the richness of

culture which is expressed in their way of life and architectural landscape as seen in Asia and The Middle East (Hu et al., 2021; Sengupta & Ghosh 2019; Yang 2023; Waheeb 2023). In this article, we want to emphasize the importance of the traditional knowledge of the Kazakh people for the education of the future generation and the achievement of the above tasks.

The problem of public safety, natural disasters, catastrophes, and other natural disasters has been familiar to mankind for millennia (Abdimanapov 2012). Traces of past destruction are recorded in written and oral sources. The memory of individual disasters and destruction is passed on from one generation to the next. Throughout the history of mankind, the evolution of the world of hazards has undergone changes, which were primarily determined by the existing system of natural resource management, the number of people, and the attitude of people toward dangers and nature in general (Kaimuldinova 2010).

During the period of gathering and hunting, the threat was mainly natural hazards: temperature, precipitation, strong winds, lightning, etc. At that time, people showed great interest in the environment, especially in its "vagaries", i.e., disasters and catastrophes (Kusumastuti et al., 2022). They were particularly concerned about the weather conditions because everyday life depended on them (Vilesov et al., 2009; Grecequet 2023). Ancient people, including modern ones, tried to control the weather through various magical spells, rituals, and sacrifices. Later, the vagaries of the weather began to be attributed to the will and actions of the gods. So, each ancient people had their weather gods.

Main part. Many ethnic groups, including the Kazakh people, have developed and maintained their ethno-cultural peculiarities in adapting and managing dangerous unfavorable phenomena. The management of natural hazards was based on the vast experience of the Kazakh ethnos, whose main occupation was nomadic and semi-nomadic cattle breeding (Berg 1947, Murzaev 1982). Strategically, the main examples of loss reduction were the selection of the least dangerous territories, the use of rapidly constructed buildings (yurts), and the forecasting of episodic and short-term adverse natural hazards by folk omens.

The purpose of this article is to analyze and demonstrate deep knowledge of the Kazakh people about climatic conditions as a result of their adaptation to harsh environmental conditions. Of particular interest is knowledge in the field of forecasting weather conditions, which is an indicator of the traditional knowledge of residents who have long had a nomadic lifestyle.

Materials and methods. In this study, traditional knowledge was studied. We have used many approaches to collect data. Quantitative data were analyzed and interpreted using descriptive statistics. In this regard, the usual rules and traditions of our people were used as a method of conservation to preserve and protect natural resources.

The literature review was conducted based on the recommendations of the PRISMA methodology proposed by Moher and others (Moher et al., 2009). According to this methodology, the advantages of systematic analysis and meta-analysis are primarily taken into account, that is, the search for research materials focuses on the keywords used in the study.

Results. We analyzed scientific articles on this topic and made sure that other countries are also engaged in the collection and preservation of traditional knowledge. For example, it is written about traditional ecological knowledge that it is the initial agreed knowledge, and Western social sciences - as areas that can best define and describe norms and models of how to engage in conservation (Hatfield et al., 2023). It should be noted that traditional ecological knowledge is becoming increasingly important since it can help in ecosystem management (Singh et al., 2020; Souther et al., 2023). TEK is becoming increasingly important in ecology and related disciplines. In particular, the Intergovernmental Panel on Biodiversity and Ecosystem Services explicitly recognizes the importance of the fuel and energy sector for sustainable ecosystem management, thereby elevating its status from a secondary topic to a central concept that environmentalists and conservationists can no longer ignore. TEK has been defined as "a cumulative body of knowledge, practice, and beliefs that develops as a result of adaptive processes and is transmitted to other people" (Hartel et al., 2023).

It is increasingly recognized that traditional ecological knowledge (TEK) is vital for inclusive assessments of nature and nature's linkages with people. Recent tough challenges brought about by the need to address global environmental risks, such as climate change and biodiversity loss, call for us to carefully revisit social-ecological systems in ways that connect human beings and nature at many levels and dimensions. TEK reflects a long history of natural resource management by local people based on their accumulated observations and experiences, and it not only helps local people, but outsiders, to respond and adapt flexibly to ecological or social disturbances while taking into account carefully crafted local rules. Thus, an extensive body of research has explored how TEK can guide the design and implementation of policy programs that aim to further strengthen the resilience of social-ecological systems to increased vulnerability and uncertainty due to global changes by carrying out theoretical research, case studies, and systematic literature reviews across various countries (Matsushita et al., 2023).

Also, in Ethiopia, the population uses terracing, preventing the formation of ravines and planting local trees on hillsides to restore the damaged ecology. They make a lot of efforts to solve the existing difficulties and dangers, since both the local population, the government, and public organizations are interested in preserving forest ecosystems. In general, encouraging the direct participation of residents in decision-making and the fair distribution of benefits derived from ecosystems can help overcome difficulties and risks to ecosystems (Hassen 2023).

In Kazakhstan, the strict seasonality of economic life required knowledge of timekeeping, which was associated with observations of celestial luminaries. According to the nomads, severe winter is preceded by unfavorable meteorological conditions in summer and autumn. During the summer drought, grass growth is delayed. The grass becomes dry and prickly, to which the horse reacts in the first place. It starts nibbing the tops of the karagan, trees, and even more, shedding the fruit. Kazakhs were most afraid of these signs, as they were a sign of jute, a harbinger of a harsh winter. The weather forecast for the near future was determined by the behavior of a camel, goats, cows, and other animals. So, before a blizzard and frost, the camel "blows its nose". On frosty days, goats and cows turn their heads. Cows return early from pasture before a snowstorm, and return late before the warm weather or stay on pasture all night (Boleyev 2004).

The Kazakhs called the wave of cooling the inclement weather "amal". According to Kazakhs, some "amal" occur every year approximately on the same dates of certain months. There are several such "amals".

Kus kanaty – the last days of March, when the first migratory birds begin to return to the steppe after winter.

Beskonak - rainy days before Nauryz (from March 17 to March 21). This name is widespread in the west of the country, but it is practically unknown in the southern regions.

Alasapyran – unfavorable days for the farm. Early spring, slush in March, and sometimes in April.

Kyzyr Kamshysy is the first April lightning.

Tobylgy jargan – In the last days of April, a cold wind blows, lasting two or three days. This means that the meadow buds have blossomed, that is, the plants have taken root, and the first greenery has appeared.

Kyzyl zhumyrtka is the first decade of May when steppe birds begin to hatch chicks. As a rule, short-term frosts are observed at this time (1-2 days).

Kuralaydyn salkyny is a cold wind at the end of May. During this time, all saigas have time to calve.

Urkerdin batu is the disappearance of the Pleiades in early June. Sometimes they said that the Pleiades fall to the ground. That was considered the beginning of summer. "The earth will not get warm without a nesting of the Pleiades," people say.

Kyryk kun shilde – the heat in June and July, which lasts 40 days.

Urkerdin tolgagi is a comfortable period for cattle. It begins in mid-July when the ground dries up and the grass begins to turn yellow.

Tarazyn tuyy is the time when it gets cooler in the middle of August, the first signs of autumn begin to appear.

Mizam shuak is a warm period that occurs in the second decade of September.

Sumbilenin tuuy is the time when you can see the star Sumbule (Sirius).

Karashanyn kaytuy is a time when the sun warms weaker and weaker.

Kyrbastyn kyzyly – the first frosts in early December.

Tekenin burkagi is a time of severe snowstorms and frosts in the last decade of December.

Kys shildesi – the last days of January – the time when winter came into its own.

Bori syrgak – severe February frosts, when you can see icy lumps of snow.

Thus, the ability to foresee unfavorable natural processes and take measures to reduce their negative consequences has developed as a result of long observations of natural phenomena, particular household arrangements, safe housekeeping, and the transfer of this experience from generation to generation over a long period. The centuries-long experience of nomads should also be used, which has been tested and proved for centuries and centuries.

It was the nomadic cattle breeding economy of the Kazakh people that became the basis of the amazing knowledge of the climate of their territories and their use in practice. "Nomadism should be perceived as a specific form of human adaptation in special environmental conditions, as a way of social functioning in certain ecological niches through nomadic cattle breeding and the corresponding mode of production," and also "Potentially nomadic areas include ecosystems characterized by aridity and continentality of natural and climatic conditions, seasonal productivity, sparsity of vegetation cover." wrote in his work, historian Masanov (2011), who considered the problem of nomadism in Kazakhstan.

The media wants to show the "last nomads" in another video. However, the reality of their way of life, their perception of the environment, and the richness of knowledge and skills developed for survival in natural conditions are unknown to us. Nomads have a deep knowledge of territories, plan routes, and rely on complex inventions and unique ways of being. Even after the unsuccessful experiment of settlement in Soviet times, the practices of nomads seem to some Indigenous peoples as a fundamental element of their culture, a way of life that ensures their stability and autonomy" writes the French researchers (Ferret & Thorez 2013).

The geographical position of Kazakhstan – in the central part of Eurasia in the belt of temperate latitudes - determined the features and nature of natural and climatic conditions resulting from the interaction of the underlying surface, solar radiation, and atmospheric circulation. The duration of sunshine on the territory of Kazakhstan is very long and averages from 2000 to 3000 hours per year. Since the magnitude of the influx of solar radiation varies in the direction from north to south, as well as by seasons, the natural result of this is intense overheating of the earth's surface in the summer, when the amount of total radiation in the south is more than four times the amount of radiation in the winter months (Gorbunov 2008)

The consequence of the intracontinental position of Kazakhstan is the continental regime of climatic conditions, characterized by sharp daily, seasonal, and annual fluctuations in air temperature. The continentality of the climate in Kazakhstan is increasing in the direction from west to east. The greatest continentality takes place in the north-east of Kazakhstan, where the difference in average temperatures in January and July reaches 41 ^{0}C. As we move southward in most of the flat territory, the annual amplitudes of fluctuations in average monthly temperatures are 37-39^0, except in the extreme southern part, where they decrease to 30-35^0.

The daily fluctuations in air temperature are also very large, which in summer average 12-16^0 (25-40% of all days) and often reach 25-30^0, and in winter - from 4 to 12^0 (50-70% of all days), sometimes reaching 16-20^0. The greatest average daily amplitudes of air fluctuations are observed in the north of Kazakhstan in June and July (13-15^0), and in the south - in August and September (18-20^0) (Vilesov et al., 2009).

Another feature of the climate of Kazakhstan is a pronounced aridity. Relative humidity in the north of Kazakhstan is 50-30% and, naturally decreasing towards the south, does not exceed 5% in the desert zone. In the steppe zone located north of 50^0 northern latitudes and comprising more than 20% of its territory, the amount of

precipitation is 200-300mm. In the semi-desert zone located north of 48^0 northern latitudes and comprising more than 20% of its territory, the annual amount of precipitation varies in the range of 160-220mm. In the desert zone (south of $47\text{-}48^0$ northern latitude), occupying more than 40% of the territory of Kazakhstan, precipitation decreases to 180-80 mm per year (Abdimanapov 2012; Kaimuldinova 2010; Vilesov et al., 2009).

Geophysical and climatic conditions determine the diversity of landscapes on the territory of Kazakhstan, grouped into four natural landscape zones (Vilesov et al., 2009). In the northern part, mainly in flat areas, there is a forest-steppe landscape zone characterized by a harsh and continental climate, The maximum average thickness of the snow cover is 30-50 cm and the duration of its occurrence is 150-160 days.

A significant part of the territory of Kazakhstan is occupied by the steppe zone, stretching for 2 200 km from the northern part of the Caspian lowland to the Altai. The climate of the steppe zone is characterized by a dry continental climate, where most of the precipitation (about 50% of the annual norm) falls in the summer. The maximum average thickness of the snow cover is 30-40 cm, and its duration is 140-160 days.

Due to the uneven distribution of snow cover and winter thaws, with the subsequent sharp cooling, the soil in the steppe zone sometimes freezes by 150-220 mm, and prolonged ice sets in.

The semi-desert zone is characterized by a sharply continental, arid climate, hot summers, and harsh winters. The maximum average thickness of the snow cover does not exceed 20-30 cm, and in the east of the zone – 40-60 cm, the duration of its occurrence is 80-180 days. The duration of dry periods without precipitation varies in the summer period in the range of 41-65 days.

Most of plain Kazakhstan is occupied by a desert zone characterized by prolonged hot summers, very cold winters for these latitudes, low precipitation, aridity, significant daily, seasonal, and annual fluctuations in air and soil temperature, lack of surface runoff, accumulation of salts in the upper horizons of the soil, large sandy massifs (Vilesov et al., 2009).

Discussion. Nomads managed to master geographical spaces in the best way, mainly in the process of conducting a year-round economic cycle on different seasonal pastures.

In general, successfully mastering the natural environment, the nomads tried not to cause much harm. Traditional folk knowledge in general and knowledge in the field of biological rhythms, in particular, contributed to the careful treatment of such natural resources by people. Hunters who were relatively better oriented in the landscape of the area, who had a good idea of climatic fluctuations, about the habits of individual animal species, subtly felt it.

Since ancient times, people have understood the peculiarities of nature and managed to adapt to it. The proof is the system of national weather forecasting. Thanks to the formed knowledge about the climate, on a moonless night they could find their way by the positions of the stars, in an impenetrable blizzard they determined the terrain by the grass, predicted the weather by the behavior of animals and birds, and thereby prepared in advance for the habits of nature.

For any Shepherd-Nomad, the priority issue is to have a limited knowledge about the peculiarities of the environment, and the nature of natural and climatic conditions (Lacaze & Thorez 2013).

Names describing the state of the atmosphere such as shape, kempirkosak, kun, ai, and rauan. Accordingly, the names associated with the actions of the people during such processes as the crossing of the paths of celestial bodies, the beginning of cold weather, the freezing of water, the end of winter, and the time of the roe deer, these are tokyrau, togam, togys, the names of months and the names of constellations (Gorbunov 2008).

These signs are the most important psychological category when naming geographical objects. It motivates the choice of a name and explains the reason for the appearance of a toponym. The Kazakh lexicon is unusually rich in description. The manifestation of spiritual culture through oral speech gives the basis for the significance of the word. In a society where oral culture is characteristic, the semantic structure of the word is used as a means of storing and delivering important information.

The ethnic peculiarity of the Kazakh people can be called the art of speaking with a subtext, abstract thinking, embellishment, image, and memorization of what was heard. "Kyrgyz (Kazakhs) can leave cultured people far behind with their ability to remember the environment, people, and terrain." These qualities made it possible to develop a special type of dissemination of dispersed information and preserve the heritage of spiritual culture (Kaimuldinova 2001).

Conclusion. In the conditions of a nomadic lifestyle, people perceived themself in unity with nature and formed a special model of worldview. In general terms, the toponymic system consists of basic characteristics as 1) spatial model; 2) location of a geographical object; 3) basic parameters; and 4) economic assessment.

From this point of view, the steady preservation of Kazakh toponyms suggests that they were a special kind of information. We can be convinced of this by the example of toponyms reflecting hydrometeorological factors and climatic conditions

- Toponyms denoting comfortable climate conditions: Zhylykol (warm lake), Zhylybulak (warm spring), Zhylyadyr (pass in Burabai), Zhylysai (sai ravine, village of Rayymbeksky district), Kungei, Kuntobe, Kunshuak, Kuntugan (Kun - sun), Kalkalykon (wind barrier), Katpasbulak (non-freezing spring),

- Toponyms denoting uncomfortable climate conditions: Kuytinkara (cold mountain), Kishisyrganak (slippery, the pass in hr. Tarbagatai), Karasuyk (severe dry cold, Pavlodar region), Muzbel (ice pass), Muzdykol (Pavlodar region), Salkyntau, Salkynbel, Suykzhal (cool), Taiganak (slippery), Shandy (dusty), Salkynshoky (cool hill), Samalzhota (ridge with light wind), Suyksay (cold gorge), Tastai (cold as a stone).

- Anemonyms (the proper name of natural disasters, including hurricanes, cyclones, typhoons - Wiktionary): Batys zhelder, Zhelsay (windy gorge), Zhelkindik, Zheltal, Zhalgyztobe zheli, Zhelkara, Kagyl, Okpek, Saikan, Uytkyma.

- Meteorological names: Alakar, Karlibulak, Karkure, Karamuzdak (black glacier), Katu (severe), Kyrauly (frost), Sarykar.

Climatic conditions and natural phenomena are reflected in the oronyms, perhaps they are associated with the changeable climate of the mountainous area: Espe (weak wind), Eskeksai (gorge where a light, weak wind blows), Zheldi (windy), Zheldikezen (windy pass), Zheldikara (windy hill). These toponyms may indicate intensive snowstorm transport and large values of wind speed.

All geographical names have a spatial reference and often reflect the nature of the landscape. Toponyms carry information about climatic conditions, and therefore the rich toponymic system of the Kazakh people can be used as knowledge about the environment. Firstly, they show the peculiarities of the Kazakh attitude. Secondly, they carry (address) information in the spatial plan. The Kazakh people put a lot of meaning into the meaning of the word. Through the descriptive component, we can find out the characteristics of the climate or landscape. Since the nomadic society with their a special economy, to survive, had to be very well-oriented in their environment and competently possess knowledge about the climate.

We were convinced that the knowledge is very deep and it is important for us not to lose it. Because there is a threat of destruction of ecosystems. The impact of human activity changes the dynamics of ecosystem processes and services, and some of these effects can manifest themselves in space. Working with indigenous and local knowledge (ILK) is vital for an inclusive assessment of nature and its connections with people (Hill *et al., 2020)*. We claim that Education, including traditional knowledge about the environment, will make a significant contribution to solving this problem. Currently, many countries and organizations have adopted laws and regulations designed to stop the destruction of ecosystems. However, these laws and regulations have not been able to stop the deterioration of ecosystems. Ecosystems are being lost and degraded on a global scale.

Eco-civilization education means that teachers integrate the concept of teaching the creation of ecological civilization into classroom teaching by the requirements of sustainable development in the learning process. Consequently, students can fully understand the relevant content of environmental education, thereby helping students to create an ecological civilizational society.

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CHARACTERISTICS OF FOSTERING AN INNOVATIVE MINDSET IN THE PEDAGOGICAL ABILITIES OF A BIOLOGIST

Abstract

The article explores the potential applications of incorporating elements aimed at fostering an innovative approach within the pedagogical expertise of biologists. This involves honing diverse skills and paying particular attention to seminars, especially when preparing students in the field of biology for pedagogical proficiency. Given the contemporary landscape of digital education, there exists a plethora of opportunities for autonomously addressing developmental needs and requirements.

Adhering to modern demands, it becomes significantly crucial to impart the utilization of innovative methodologies during technology-oriented lessons that strive to impart knowledge of superior quality to society. In pursuit of this objective, the article concludes by studying methods devised by students during seminar sessions. Throughout the lesson, students concentrate on exploring and assessing the extent to which filler words are employed, devising strategies to eliminate them, comparing week-to-week outcomes, and presenting these findings according to a set schedule.

To substantiate these matters with concrete evidence, the article suggests documenting students' efforts throughout several sessions. This documentation encompasses scenarios involving collaborative work, the reinforcement of skills within seminar settings through diverse techniques, drawing attention to the development of focus from the outset of experiments, employing a collection of stickers for reflective analysis, and evaluating the