Methodology For Critical Examination of Physic Phenomena in Legends and Myths

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ABSTRACT

This article presents a comprehensive analysis of physical phenomena depicted in legends and myths through cognitive and critical inquiry methods. The primary aim of the study is to identify ways to develop students' critical thinking skills and enhance their cognitive engagement by providing scientific explanations for natural phenomena described in mythological texts. The research employed comparative analysis, content analysis, and interdisciplinary integration methods. The findings demonstrate that incorporating the study of physical phenomena in legends into the learning process not only broadens students' worldview but also fosters a deeper understanding of scientific laws. The conclusion substantiates that organizing dialogue-based interaction between mythological and scientific perspectives can serve as an effective methodological tool in education.

Keywords: legends, myths, physical phenomena, cognitive engagement, critical thinking, interdisciplinary connection, scientific worldview

INTRODUCTION

In the contemporary educational landscape, interdisciplinary integration, the development of critical thinking, and the enhancement of students' cognitive engagement have become priority directions. Innovative methodological approaches situated at the intersection of science and the humanities enable a deeper learning process, facilitate the comprehension of complex concepts, and allow for a holistic understanding of the world. One such interdisciplinary research approach involves re-examining the natural and physical phenomena described in mythological and legendary texts from a scientific perspective. This approach, on the one hand, broadens the historical and cultural horizon of understanding, and on the other, offers new opportunities for explaining and teaching the natural sciences [8].

Legends and myths are cultural phenomena that occupy a special place in the cognitive evolution of humankind. They emerged as forms of interpreting nature, survival practices, and various phenomena in ancient societies. Although myth is a pre-scientific form of knowledge, it often contains elements of an astronomical, geophysical, meteorological, acoustic, or mechanical nature, which can be regarded as reflections of real physical phenomena. Therefore, myths should be regarded not only as literary or folklore works but also as historical sources that represent the scientific worldview of a particular era [5].

For example, in Kazakh mythology, images such as «the dragon swallowing the sun» «the monster devouring the moon» or «the wrath of the blue sky deity» serve as symbolic depictions of natural phenomena — solar and lunar eclipses, lightning, earthquakes, or storms. Such mythological narratives reveal the ancient peoples' attempts to explain physical laws through figurative language. Studying these texts alongside modern physics not only increases students' cognitive interest but also develops their scientific and critical thinking skills.

In the 21st century, education must go beyond delivering content; it must teach learners to analyze, compare, interpret, and connect knowledge to real-life contexts. From this perspective, exploring the continuity between myth and science is a powerful tool that encourages students to discover knowledge independently rather than passively receiving it. In this regard, analyzing mythological texts from a physical standpoint offers an effective way to explain complex scientific concepts through symbolic and cultural frameworks.

According to researchers, in order to enhance students' cognitive engagement, educational content must be rich from emotional, aesthetic, and scientific perspectives. Since myths and legends possess such qualities, their use in physics lessons is regarded as a method of humanizing science — that is, bringing it closer to the learner. Furthermore, this approach contributes to the development of students' research skills, as well as improving their abilities in scientific observation and logical reasoning [6].

A review of the history of science reveals that many physical laws have their origins in mythological or religious conceptions. For example, the moment of immersion in water that led to the discovery of Archimedes' principle, or Newton's understanding of gravity through the fall of an apple, are both rooted in a certain symbolism. Thus, mythological thinking can be considered the primordial foundation of scientific thought. In this regard, applying a scientific perspective to mythological sources in the school curriculum or research projects immerses young scholars in the history of science and fosters multifaceted thinking.

In the era of globalization, it is necessary not only to provide students with specific subject knowledge but also to expand their cultural awareness. In this context, mythology serves science by becoming a unique platform where physics establishes a connection with cultural heritage. Such a connection helps students perceive physics not as an «abstract formula» but as an integral part of life and human history.

The relevance of this research topic is determined by several factors:

1. **The importance of interdisciplinary integration** – Linking subjects in education broadens students' intellectual horizons. Combining mythology and physics is a concrete example of such integration.

2. **The necessity of critical thinking skills** – For the modern individual, the ability to evaluate information critically and work with evidence is essential. Scientific analysis of mythological texts fosters these competencies.

3. **Increasing interest in science** – Physics is often perceived as one of the most challenging subjects. Explaining it through mythological narratives captures students' attention and facilitates the comprehension of complex concepts.

4. **Preservation and development of cultural codes** – Legends preserve the cultural memory of a people. Teaching them in connection with modern science ensures continuity between tradition and scientific knowledge.

Previous studies have largely focused on the literary, folkloric, or historical analysis of mythological material. In contrast, works that seek to identify physical phenomena within mythic texts and compare them with specific scientific concepts are extremely limited. Addressing this gap constitutes the main foundation of the present research [4].

For instance, researchers such as Roland Barthes and Carlo Ginzburg have examined myth as a cultural semiotic system, while Kurt H. Freytag (Freidman) analyzed it as an initial stage of cognition. Moreover, the works of Karl Popper and Thomas Kuhn, who investigated the logic of scientific knowledge, provided a philosophical justification for the developmental continuity between myth and science. Building upon these works, it becomes necessary to advance the study of the relationship between myths and physical phenomena in a pedagogical-practical direction.

In this study, a methodological model is proposed for identifying physical content within legends and myths and subjecting it to cognitive and critical analysis. This model is designed to enhance students' ability to work with scientific texts, conduct logical comparisons, and draw creative conclusions.

Based on the above, this research aims to determine how scientific knowledge has evolved within its historical and cultural context and how it can be effectively applied in the modern educational system. The article is not merely an attempt to «translate» myths into the language of science, but rather an effort to construct a bridge between science and culture through an innovative methodological approach [1] [2] [5].

The Cognitive Nature of Physical Phenomena in Legends and Myths

Legends and myths represent the earliest forms of human cognition. They arose as a means of explaining the causes of natural phenomena and sought to convey scientific reasoning in symbolic form. The relationship of ancient humans with nature unfolded not through rational observation, but through figurative and metaphorical perception. Accordingly, the physical phenomena reflected in mythological texts should be regarded as an archaic form of scientific knowledge.

In Kazakh mythology, depicting a solar eclipse as «a dragon swallowing the sun» or lightning as «the wrath of Tengri» reflects an intuitive attempt to explain these phenomena. Although such descriptions do not align with the categories of modern science, they emerged as the result of observations grounded in folk experience.

As an example, in the fairy tale *Er Tostik*, the anthropomorphization of natural forces such as wind, sun, moon, fire, and water is notable. These elements are portrayed as independent characters and perceived as forces influencing human daily life. Similar legendary images are closely connected with the core content of physics (for instance, energy, motion, gravity, waves, mass, etc.).

The mythical interpretation of physical phenomena functions as a cumulative form of ancient peoples' observations of the surrounding world. For example, the nomads' awareness of seasonal changes, wind directions, and the movement of stars provided early data on astronomical and meteorological phenomena. Such knowledge was transmitted orally and eventually transformed into legends and fairy tales [3].

Critical Thinking and the Scientific Interpretation of Myths

Explaining myths in physical terms is a distinctive methodology that prompts students toward critical reasoning. Here, the learner does not merely retell the text but analyzes its imagery and reinterprets it through a scientific framework. For instance, asking the student, «What does the dragon swallowing the sun mean?» requires them to explain the phenomenon of a solar eclipse. In this process, the student engages in logical comparison, replacing metaphorical imagery with concrete concepts, and establishing cause-and-effect relationships.

Critical thinking is an essential component of the modern educational paradigm. It enables students to be seen not as passive recipients of information, but as active constructors of knowledge. Reinterpreting myths in the language of science can be an especially effective method for fostering this mode of thinking.

Interdisciplinary Connection: The Convergence of Physics and Literature

Using myths to explain physical phenomena is an approach that erases the boundaries between literature and physics. This method is grounded in interdisciplinary integration. Employing literary texts in physics lessons facilitates students' understanding of scientific concepts, as information presented through imagery is retained longer in memory and stimulates cognitive interest.

For example, the legend of «Zhelayaq» (Swift-Footed) can be linked to the concept of motion speed in physics, while the myths of the «Sky-Supporting Tree» or «Tengri Mountain» can be analyzed in connection with gravity, the Earth's mass, or pressure laws. In this way, the student builds a bridge between artistic text and scientific language, understanding complex theories through a cultural foundation.

Methodological Model for Using Myths in the Learning Process

Within the scope of the study, the following methodological structure is proposed:

1. Reading the myth text – e.g., «The Battle of the Sun and Moon» or «The Legend of the Ox Holding the Earth».

2. Identifying the physical phenomenon in the myth – e.g., the alternation of day and night as the Earth's rotation; earthquakes as tectonic movements.

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3. Comparing and explaining in scientific terms – students rewrite the myth using scientific terminology: «When the dragon swallows the sun, a solar eclipse occurs as the Moon passes in front of the Sun…»

4. Creating comparative tables, diagrams, or charts – visually representing similarities and differences between myth and scientific reality.

5. Conclusion, analysis, and presentation – drawing conclusions through group work.

The introduction of this methodology increases students' interest, engagement, and memory retention. It also adapts them to research activities while fostering respect and trust in science.

– Practical Study: Teaching Physical Phenomena Through Myths. The research was based on lessons conducted with students in grades 7–9, where each mythological text was accompanied by a scientific-physical explanation. Example – «The Ox Holding the Earth»

– Myth content: In Kazakh legends, the Earth rests on the shoulders of a giant ox, and when the ox moves, an earthquake occurs.

– Scientific explanation: Earthquakes are caused by the movement of tectonic plates, which occurs due to lithospheric shifts and underground tremors.

Classroom task:

– Students read the myth.

– They draw the ox and Earth as depicted in the myth.

– They compare this image to a modern tectonic plate map.

– They describe the earthquake mechanism in their own words and list similarities and differences between the two explanations.

Outcome: Students not only acquire an understanding of earthquakes but also develop the skill of transitioning from figurative thinking to scientific reasoning.

Lesson Visualization Tools. Several visual aids were used during the study:

– Graphic schemes of phenomena described in myths,

– Comparative tables of scientific concepts and mythic images,

– The «Speak in the Language of Physics» task – translating the content of a myth into scientific exposition.

Example:

Mythic Image	**Scientific Explanation**
Dragon swallows the Sun	Solar eclipse (the Moon passes in front of the Sun)
Tengri's lightning	Electrical discharges – an atmospheric phenomenon

Through such exercises, students develop both figurative thinking and scientific logic.

Scientific Conclusions: Mythology as a Figurative Model of Physics

The research led to several important pedagogical-scientific conclusions:

1. **Myths as the earliest representation of science** – Mythological texts can be seen as pre-scientific models. They are not merely symbols but schematic systems used to depict real phenomena. For example, the Indian myth of «the turtle supporting the Earth» is a figurative image symbolizing the Earth's stable yet dynamic foundation.

2. **Enhancing cognitive engagement** – Teaching through myths involves students in a process of «thinking» rather than mere «memorizing». They independently analyze, compare, and justify ideas. This aligns with the higher levels of Bloom's taxonomy – «analysis», «evaluation» and «creation».

3. **Bringing physics to life** – Many students view physics as abstract and unengaging. By using myths, they can connect physical laws to life and culture. For example, introducing Archimedes' principle through a myth about a water spirit makes the concept more relatable.

4. **Facilitating intercultural dialogue** – Similar myths across Japanese, Greek, Kazakh, Indian, and Slavic traditions reveal a shared human cognitive response to physical phenomena. Understanding these parallels fosters cultural awareness, tolerance, and multidimensional thinking.

Specific Research Outcomes

Indicator	**Initial Level**	**Post-Research Level**
Student interest in physics	47%	83%
Critical thinking skills	Medium	High
Understanding of interdisciplinary links	Low	High
Use of scientific terminology	32%	76%

(Results are based on a practical study involving 90 students.)

Analysis and Summary

The use of myths in physics lessons is not a simple technique but a complex pedagogical model that:

1. Presents subject content in figurative form,
2. Transforms the student from a passive recipient into an active researcher,
3. Builds a bridge between cultural-historical memory and modern science,
4. Translates complex physical concepts into accessible forms,
5. Enhances the emotional, symbolic, and intellectual depth of lesson content.

Cognitive and critical examination of physical phenomena depicted in myths and legends is not merely a tool for teaching natural sciences, but also a powerful pedagogical approach for fostering the holistic development of students' personalities. The research demonstrated that the connection between myth and science can transcend a purely formal relationship, revealing methodological and conceptual depth and shaping a new integrative model in the educational space [7].

The scientific interpretation of mythological texts not only facilitates the mastery of physical laws but also significantly contributes to students' cultural-historical worldview, philosophical reasoning, and logical thinking skills.

The findings indicate that incorporating myths into physics lessons:

1. Increases students' learning motivation,

2. Strengthens interdisciplinary connections,

3. Develops critical and logical thinking abilities.

Enables the comprehension of abstract scientific concepts in concrete and figurative form. Furthermore, the convergence of myth and science changes students' perceptions of physics: they begin to see it not as a mere set of formulas and theories, but as a living and meaningful system closely connected with human culture and life. This fully aligns with one of the primary objectives of modern education – linking science with personal, cultural, and life contexts.

In conclusion, myths – in addition to being the cultural code of ancient civilizations – can be effectively used in the educational process as figurative, student-centered models of modern physics. Their cognitive and critical exploration enriches students' scientific worldview and fosters a fresh perspective on science. This approach is not only an example of interdisciplinary harmony but also represents a new pedagogical paradigm that unites the humanitarian and natural science foundations of education.

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