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Quantitative analysis of students' errors in the interpretation of hydronyms: linguocognitive difficulties in learning the hydronymic system of Western Kazakhstan

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This study presents a quantitative analysis of errors in the perception and interpretation of hydronyms by university students in Western Kazakhstan. The aim of the study is to identify the types of errors that occur when students interpret hydronymic units and to reveal the cognitive difficulties underlying these errors. The study involved 120 university students who had previously completed courses in linguistics, cognitive onomastics, and regional geography. The main attention is paid to the analysis of errors in the perception of hydronyms in four analytical aspects: similarity of hydronyms, contextual perception of hydronyms, perceptual errors, and incorrect associative interpretations of hydronyms. Errors are classified into three types: inattentive errors, cognitive errors, and interpretative errors. The results showed that most of the errors are related to cognitive difficulties in interpreting the meanings of hydronyms and perceiving them in context. Problems also arise due to the inattention of students, which leads to errors in the analysis of similar hydronyms and their combinations. The greatest number of errors is observed in the perception of hydronyms with different origins, historical context and cultural significance. It is important that students have a clear understanding of both procedural and conceptual knowledge in order to successfully interpret hydronyms and use them correctly in context. Recommendations for teachers include the need to focus on the accuracy of the perception and interpretation of hydronyms, as well as on the prevention of errors that may disrupt the correct understanding of the cultural and historical significance of hydronyms in the educational process. The findings contribute to a deeper understanding of how students cognitively process hydronymic information and provide pedagogical insights for improving onomastic education in higher education.

KEYWORDS

cognitive linguistics, error analysis, hydronyms, linguocognitive perception, onomastics, toponymy

1 Introduction

Proper names, including hydronyms, play an important role in shaping the linguistic and cultural picture of the world and are an integral part of the cognitive space of a person. Hydronyms reflect not only geographical features but also elements of historical, cultural, and social memory preserved in the linguistic traditions of a community (Ulugbekovna, 2025). In the modern world, growing attention to local identity and regional place names highlights the importance of studying how such names are perceived and interpreted. Onomastic space, including hydronyms, is a key component in understanding cultural and linguistic heritage (Sadullaeva and Bakhtiyorova, 2021). Its analysis through the prism of cognitive linguistics makes it possible to identify which concepts, meanings and associations are formed by native speakers when perceiving toponymic names. This research is especially relevant in an educational environment, where the process of forming linguistic and cognitive structures is still ongoing and can be guided by pedagogical means. In the conditions of Western Kazakhstan, which has a rich onomastic landscape, analysing how university students perceive hydronyms constitutes an important research task, as it provides insights into the cognitive processes involved in interpreting place names and their role in understanding regional linguistic and cultural identity (Konyratbayeva et al., 2024). However, many students have difficulty interpreting and comprehending local names, especially if they are not directly related to their personal experiences or are not represented in educational materials. These difficulties may result from a fragmentary knowledge of the region's history, lack of linguistic and cultural training, and limited vocabulary in the field of toponymy (Tort-Donada and López-Leiva, 2023).

In the context of Western Kazakhstan, hydronyms such as Zhaiyk, Tobol, Irtysh, and Tengiz represent important elements of the regional linguistic landscape. These names are associated not only with geographical objects but also with historical events, cultural traditions, and ethnolinguistic meanings. For example, the hydronym Zhaiyk (historically known as the Ural River) reflects both geographical identity and historical narratives connected with the settlement of the region. Similarly, the hydronym Tengiz originates from the Turkic word meaning “sea” and is widely used in the naming of large lakes in Kazakhstan. When students encounter such hydronyms, they must interpret not only their geographical reference but also their linguistic origin and cultural significance. However, previous observations in higher education indicate that students often rely on superficial phonetic similarity or incomplete contextual knowledge, which may lead to misinterpretation of hydronymic units.

Another important factor influencing the interpretation of hydronyms is their historical depth. Many hydronyms in Kazakhstan were formed in different historical periods and reflect several linguistic layers, including ancient Turkic, Iranian, and later Slavic influences. In some cases, the origin of hydronyms dates back several centuries or even millennia, which makes their etymological interpretation particularly complex. As a result, the semantic motivation of certain water names may no longer be transparent to modern speakers. This historical and linguistic stratification of hydronyms may also affect how

students perceive and interpret them, as the original meanings and cultural contexts of many hydronyms are not immediately evident without specialized linguistic or historical knowledge.

The process of learning about onomastics, including hydronyms, involves students actively engaging in the comprehension and interpretation of proper names, forming linguistic and cognitive structures reflecting their cultural and linguistic consciousness. This process requires students to have a combination of linguistic, cultural, and analytical abilities that allow them to connect onomastic units with geographical, historical, and ethnolinguistic contexts (Sanakulov, 2025). The formation of onomastic competence, especially regarding the perception of hydronyms, is important not only for understanding the structure of language, but also for developing interdisciplinary connections, including with geography, history and ethnology. Each onomastic knowledge plays a significant role in understanding broader linguistic and cultural concepts, forming students' holistic understanding of the region and its linguistic and cultural heritage (Nurdauletova et al., 2024). The success of mastering onomastic material depends on many factors. Research shows that students' positive attitude to their native language, as well as to regional culture, contributes to the formation of a sustained interest in the study of toponymy (Ayapbekova, 2020). At the same time, the level of cognitive motivation plays an important role, including awareness of the importance of hydronyms in building regional and ethnic identities. At the same time, there are also factors that make it difficult to master onomastic material. Among the internal factors, one can single out a limited lexical and semantic stock, weak comparative analysis skills, as well as underdeveloped associative thinking (Share, 2025). External factors include the lack of proper attention to onomastics in the educational program, insufficient methodological elaboration of the material, as well as a low level of onomastic visualization in the educational environment (for example, the lack of maps, visual hydronymic resources, interactive tasks, etc.) (Marieiev et al., 2024). These factors, taken together, can have a significant impact on the level of formation of students' onomastic competence.

At all levels of linguistic education, onomastics, including hydronymy, is a necessary foundation for the successful development of disciplines such as regional studies, cultural linguistics and ethnolinguistics (Rakhmetov et al., 2026). Hydronyms represent an especially significant category within the toponymic system because they are often among the most stable and historically persistent place names and are closely connected with geographical identity, historical memory, and ethnic identities, forming the basic categories of spatial and cultural thinking. Their study requires students to be able to abstract, conceptualize, and relate linguistic units to a specific territorial and cultural context. In the process of mastering abstract onomastic concepts, such as the internal division of hydronyms by origin or semantic type, students need to develop abstract thinking and strive to concretize knowledge through connection with real objects (Zulpykhar et al., 2025). In this regard, hydronyms perform an important cognitive function — they help to build associative connections between linguistic signs and real geographical objects, thereby reflecting culturally shared conceptualizations of geographical space and regional identity (Nenotek and Onyishi, 2025). On the other hand,

students often encounter the greatest difficulties when interpreting hydronyms, which leads to a higher frequency of errors in this area, especially among students who do not have a sufficient knowledge base about the toponymic system of the region. Insufficient understanding of the semantics, etymology, and historical and cultural context of hydronyms can hinder understanding of their meaning and reduce motivation for further study (Amirbekova et al., 2025). Students' misunderstandings of hydronyms may hinder their ability to relate onomastic knowledge to broader fields such as linguistics, geography, and cultural studies.

Hydronyms, like other onomastic units, are an important component of the linguistic picture of the world, requiring conscious comprehension rather than rote memorization. To successfully master the hydronymic material, students need not only to know the forms and meanings of reservoir names, but also to understand the concepts underlying them — etymology, semantic structure, and cultural and historical context (Rojas-Garcia, 2022). Only if there is a conceptual understanding can we talk about a full-fledged cognitive interpretation and the ability to construct a coherent linguistic and cultural representation of the regional space. If students lack awareness of basic onomastic principles, this may negatively affect their ability to perceive more complex aspects, such as the classification of hydronyms by origin (Turkic, Slavic, Arabic, etc.), their symbolic meaning, or integration into literary and folklore texts (Kanievna et al., 2024).

When comprehending and interpreting hydronyms, students need two interrelated levels of knowledge: procedural and conceptual. Procedural knowledge is manifested in the ability to reproduce and apply basic information about hydronyms — their shape, belonging to a specific toponymic category (river, lake, spring, etc.), knowledge of geographical location, etymology, and formal features such as word formation structure. This knowledge is usually based on memorization and mechanical reproduction of information without deep analysis (Langacker, 2008). Conceptual knowledge, on the contrary, is associated with understanding the inner meaning of hydronyms, their symbolic and cultural load, connection with the history of the region and the ideological attitudes of the people. Such knowledge includes awareness of the cognitive models underlying the naming of bodies of water, as well as the ability to interpret them in a broader cultural and linguistic context. It is important that during the learning process students not only assimilate hydronyms at the procedural level, but also develop a conceptual understanding that allows them to associate specific names with mental representations, cultural codes and regional identity. Only with the interaction of these two levels of perception can we speak of full-fledged onomastic competence and the ability to linguocognitive analysis of the toponymic space (Glukhova, 2021).

Many researchers (Amini et al., 2022; Bazarbekov et al., 2024) recognize that both procedural and conceptual knowledge is necessary for the full mastery of onomastic material and contribute to the deep perception of hydronyms. However, in practice, university teachers more often focus students' attention on reproducing rules or terms — that is, on the formal side of onomastic knowledge — instead of explaining why and how toponyms are formed, how they relate to the history, culture

and mentality of the region. In other words, the teaching process is often dominated by a procedural knowledge-based approach, while conceptual understanding is overshadowed. For example, students can repeatedly perform exercises to classify or memorize hydronyms without diving into their cultural and semantic content (Kulsharipova et al., 2023). As a result, they form only a superficial understanding, which does not allow them to effectively interpret onomastic units in a broader cognitive or interdisciplinary context. The lack of a conceptual level of perception prevents students from establishing connections between hydronyms and their cultural function, symbolism, mythological or ethnolinguistic components. This corresponds to the conclusions of previous studies (Ngonyani et al., 2024), which show that the process of understanding, explaining, and discussing both correct and erroneous interpretations of hydronyms is significantly more productive for achieving educational goals than simply focusing on the correct answers. The predominance of the procedural approach in teaching weakens the quality of material assimilation: students can quickly forget information and not realize their mistakes in interpreting onomastic units.

If there is a gap or misunderstanding in the process of forming onomastic knowledge, this can lead to errors in the interpretation of hydronyms. According to research (Lakoff and Johnson, 2003), in linguistics, as in other humanities, error is understood as a systematic or accidental deviation from an accepted or expected norm, which correlates with definitions in other fields, such as mathematics or pedagogy. In the framework of linguocognitive analysis, an error can be considered as a distortion of the conceptual model that occurs when there is a lack of knowledge, uncertainty in semantic interpretation, or an erroneous attribution of a name to a particular geographical category. Errors in the perception of hydronyms can manifest themselves in incorrect associations, confusion in etymological analysis, incorrect definition of the type of reservoir, as well as the inability to correlate the name with a specific region. Such deviations are often associated with individual learning styles, the level of general student training, or the lack of a cognitive connection between a language sign and its referent. These mistakes hinder the full mastery of onomastic material, as they prevent students from achieving their learning goals, in particular, from forming a holistic view of the cultural and linguistic landscape of the region. As noted in a number of works (de Villiers, 2022), the causes of errors can be diverse: from banal inattention and cognitive overload to stable perception stereotypes. Despite the fact that mistakes are not always repeated systematically, their occurrence is often associated with underdeveloped basic knowledge. However, it is important to note that the presence of errors in the learning process is not an obstacle, but a part of cognitive activity: comprehension and correction of errors allows students to improve their understanding and achieve a more accurate linguistic and cognitive perception of onomastic units.

Many researchers (Li et al. 2024, Nosirova, 2025, Radjabova, 2021, Zulpykhar et al., 2025) identify different types of errors from different theoretical positions. In relation to onomastics, in particular to the perception of hydronyms, students' mistakes can be classified on several grounds. In this study, based on the

generalization of existing approaches, the following types of errors were identified:

1. Errors of linguistic perception resulting from a lack of understanding of terminology, ignorance of the morphological or semantic structure of hydronyms, as well as misinterpretation of word-forming elements, especially in names borrowed from Turkic, Arabic or Slavic languages;
2. Procedural errors that occur when the analysis algorithm is violated: for example, when a hydronym is incorrectly classified, types of reservoirs are mixed, or the geographical location of the name is incorrectly determined;
3. Conceptual errors related to the lack of a deep understanding of the principles of the formation and functioning of hydronyms, the cultural and historical contexts in which they originated;
4. Application errors that occur when a student theoretically understands the meaning of a hydronym, but is unable to correctly interpret or use it in a specific communicative or analytical situation (for example, when compiling a toponymic map or interpreting a text with local vocabulary).

In addition, a number of authors (Croft and Cruse, 2004, Evans et al., 2007) also highlight:

- Inattentive errors caused by inattention, haste or a mechanical approach to the task;
- Interpretative errors that occur when misinterpreting historical and cultural information related to the hydronym;
- Cognitive errors, especially when working with little-known or extinct place names, whose names have been preserved only in oral tradition or fragments of archival sources.

This typologization of errors allows for a deeper understanding of students' cognitive difficulties and the development of effective pedagogical strategies to overcome them.

According to the research of Han (2023), error analysis is an important tool for identifying the causes of logical and cognitive impairments committed by students when performing tasks. In the context of onomastic education, this is especially relevant, as it helps teachers identify weaknesses in the perception and interpretation of hydronyms, identify problematic aspects of a topic, and adjust teaching methods to achieve a more accurate and in-depth understanding by students.

In addition, error analysis allows not only to record typical deviations in the interpretation of hydronyms, but also to use this data for feedback, the development of compensatory strategies and improving the effectiveness of the educational process. As S. Choo notes (Choo, 2023), the study of students' written works (including workbooks, essays, and tests) contributes to a more complete understanding of how the conceptual perception of toponymic units is formed, and which stages cause difficulties. It is extremely important to create conditions under which students can repeatedly practice the

analysis of hydronyms, return to the already studied material and rethink it from the standpoint of a linguocognitive approach. This makes it possible to check the level of assimilation and achievement of planned learning outcomes. At the same time, error analysis helps students develop the ability to learn independently: they learn to recognize difficulties, identify where misunderstandings arise, and choose strategies for more accurate interpretation of onomastic data. Mistakes are inevitable in the process of performing tasks related to the analysis of the toponymic space, but it is their systematic identification and comprehension on the part of the teacher and the student himself that contributes to a more solid and conscious assimilation of the material (Kobuljonova, 2024).

Since hydronyms are a fundamental component of the onomastic space of a region, they reflect culturally embedded conceptualizations of geographical space, historical experience, and community values, it is important to identify typical errors that occur in their perception and interpretation. The present study aims to obtain answers to the following questions:

- 1) What are the typical mistakes students make when interpreting hydronyms in terms of their etymological nature, associative connections, geographical location, and cultural and historical context?
- 2) What types of errors — inattentive, cognitive, or interpretative — are most common among students when analyzing hydronyms?

The main contribution of this article is that the identification and classification of errors are carried out in detail according to the main aspects of the analysis: etymological, semantic, cultural and cognitive. This allows teachers to more accurately identify problem areas in learning the material and build effective learning strategies. The results of the study can be useful for identifying difficulties affecting the formation of students' linguistic and cognitive competence in the field of onomastics. In this regard, the authors of this article focused on the analysis and classification of errors in the perception of hydronyms made by students when completing assignments and working with educational texts.

1.1 Theoretical framework of linguocognitive perception of hydronyms

Hydronym perception refers to the cognitive process through which individuals recognize and identify the name of a water body and associate it with its geographical, linguistic, or cultural characteristics. Hydronym interpretation, in turn, involves a deeper analytical process in which the meaning, origin, historical context, and cultural significance of the hydronym are explained or inferred by the learner. In the educational context, these two processes are closely related, as correct interpretation requires not only recognition of the name but also an understanding of the conceptual and cultural knowledge embedded in the hydronym.

From the perspective of cognitive linguistics, the perception and interpretation of proper names are not limited to the recognition of linguistic forms but involve complex processes of

conceptualization and semantic integration within the individual's cognitive system. Hydronyms, as a category of toponyms, function as linguistic signs that encode geographical, historical and cultural knowledge, which must be activated and interpreted by the speaker.

In this study, cognitive perception of hydronyms is understood as a mental process through which individuals recognize, categorize, and associate hydronymic units with their semantic, geographical, and cultural meanings within the cognitive representation of space. This process involves the interaction of linguistic knowledge, cultural memory, and associative mechanisms that shape the understanding of place names.

The semantic interpretation of hydronyms refers to the ability to decode the conceptual content embedded in a hydronym, including its etymological origin, historical context, and symbolic meaning. According to cognitive linguistic theory, semantic interpretation is based on the activation of conceptual schemas and frames that connect linguistic forms with culturally structured knowledge about geographical objects and landscapes.

Errors in this process can be interpreted within the framework of cognitive error theory in learning, where a linguistic error is considered a deviation from the expected conceptual mapping between a linguistic sign and its referent. Such deviations may occur due to incomplete knowledge structures, insufficient contextual information, or the activation of incorrect associative patterns.

In the context of learning, the interpretation of hydronyms also depends on the interaction between procedural and conceptual knowledge. Procedural knowledge involves the ability to identify and classify hydronyms according to formal linguistic or geographical criteria, while conceptual knowledge relates to a deeper understanding of the semantic, cultural, and historical meanings encoded in these names. Contemporary theories of conceptual learning suggest that meaningful understanding emerges when learners integrate these two types of knowledge within a coherent cognitive structure.

Thus, the linguocognitive perception of hydronyms can be conceptualized as a multi-level process that includes recognition of linguistic form, semantic interpretation, and integration of cultural and geographical knowledge. Difficulties in any of these stages may lead to different types of errors in the perception and interpretation of hydronyms.

2 Methods and materials

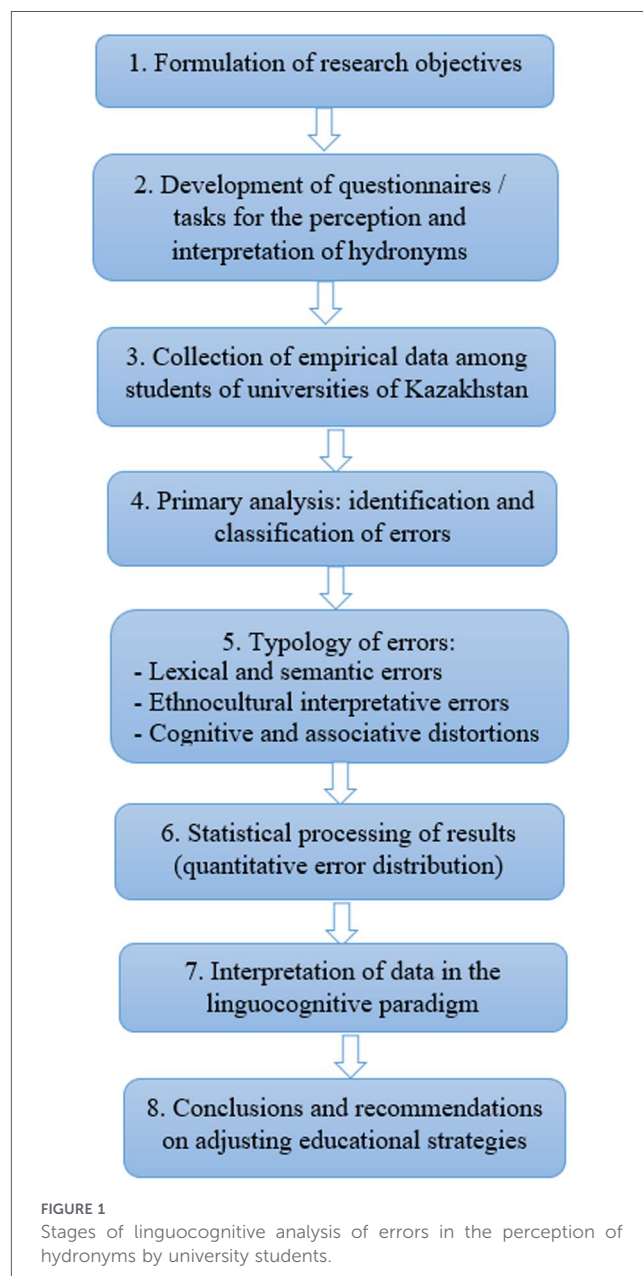
2.1 Research design

The present study is based on a quantitative approach aimed at identifying and classifying errors in the perception and interpretation of hydronyms by university students. Understanding the mechanisms of cognitive processing of onomastic information is a prerequisite for the formation of full-fledged linguistic and cognitive competence of students. In this regard, error analysis allows not only to diagnose difficulties, but also to suggest effective ways to correct the educational process, as well as to improve the efficiency of learning at a higher level of training (Zulpykhar et al., 2023). The use of a quantitative approach in research makes it

possible to ensure the objectivity of the analysis, the measurability of the results and the possibility of further comparison with similar data. The general outline of the methodology used in this study is shown in Figure 1.

2.2 Selection

The study involved 120 undergraduate students enrolled in higher education institutions in Western Kazakhstan. The participants were aged between 18 and 22 years ($M = 19.6$), including 68 females and 52 males. All students were enrolled in humanities or philological programs and had previously completed introductory courses in linguistics, cognitive onomastics, and regional geography. The respondents were selected based on their prior familiarity with hydronyms and the basic principles of the regional toponymic system. Participation



in the study was voluntary and all responses were anonymized in accordance with ethical research standards.

2.3 Data collection

For the linguistic and cognitive analysis, students' written works were collected, including assignments on interpretation and classification of hydronyms of Western Kazakhstan. The tasks included both closed (true/false, multiple choice) and open-ended questions aimed at identifying the level of understanding of the semantics, structure, and cognitive significance of hydronyms. The examples of tasks covered the identification of types of hydronyms, the interpretation of their linguistic and cultural motivation, correlation with geographical objects, as well as the assessment of their emotional and associative load.

To illustrate the procedure of error analysis, several examples of diagnostic tasks and typical student responses are presented in [Table 1](#). These examples demonstrate how hydronym interpretation tasks were structured and how incorrect answers were identified and classified according to the proposed typology of errors.

The diagnostic tasks consisted of 15 items designed to evaluate students' understanding of hydronyms from different perspectives. The tasks were divided into three groups: (1) identification of hydronym types and geographical references, (2) interpretation of semantic and etymological meanings, and (3) associative comparison of hydronyms in different linguistic and cultural contexts. Closed questions required students to choose the correct interpretation from several options, while open-ended questions required them to explain the meaning or origin of a hydronym. The tasks were developed on the basis of

regional hydronymic material commonly used in linguistic and geographical education in Kazakhstan.

The validity of the tasks was ensured through expert evaluation. Two specialists in onomastics and one expert in cognitive linguistics reviewed the assignments to confirm their relevance, clarity, and alignment with the research objectives. Minor revisions were introduced following expert feedback in order to eliminate ambiguity in the wording of several tasks.

The mistakes made by the students were systematized and classified into three types:

- Inattentive mistakes — due to lack of concentration or haste in completing tasks;
- cognitive errors — arising from an incomplete understanding of the conceptual nature of hydronyms or their cultural and linguistic contexts;
- Interpretative errors — errors related to incorrect interpretation of the meaning, origin, or function of a hydronym.

Semi-structured interviews were conducted with individual students to substantiate errors that differ from the general trend. Their goal was to find out the reasons for the erroneous perception or understanding of specific hydronyms. The explanations received were used in the discussion section to support the results of the analysis [Table 2](#).

2.4 Data analysis

This study uses a quantitative approach to analyze and classify errors in the perception of hydronyms. Errors related to the

TABLE 1 Examples of diagnostic tasks and student responses.

Task example	Correct interpretation	Example of student response	Type of error
Explain the origin and meaning of the hydronym Tengiz.	The name derives from the Turkic word meaning “sea” and refers to a large lake in Kazakhstan.	The student claims that the name refers to a river because of its phonetic similarity to other hydronyms.	Cognitive error
Identify whether the hydronyms Zhaiyk and Ural refer to the same river.	They refer to the same river; Zhaiyk is the Kazakh name and Ural is the Russian name.	The student states that they are different rivers because the names are different.	Interpretative error
Determine whether Karasai and Karagai can be considered similar hydronyms.	They share phonetic similarity but refer to different geographical objects.	The student considers them identical due to phonetic similarity.	Inattentive error

TABLE 2 Classification of errors in the interpretation of hydronyms.

Type of error	Description	Error example
An inattentive mistake	Occurs when completing a task carelessly or hastily	The student refers the Ural to artificial reservoirs, without reading the wording of the assignment
Cognitive error	It is associated with a lack or distorted understanding of linguistic and cognitive foundations (etymology, functions, imagery)	The student believes that the hydronym “Zhaiyk” is not related to the historical and cultural context of the region.
Interpretative error	It manifests itself in a misinterpretation of the meaning or function of the hydronym	When explaining the name “Shezhinka”, the student claims that it is related to shezhira of the genus, whereas the origin is different.

perception of hydronyms are collected for each aspect of their perception in the onomastic space of Western Kazakhstan. To analyze the perception of hydronyms, seven typical errors are identified, designated as GD1–GD7, which are classified as misinterpretations, perceptual errors, or cognitive perception errors, as shown in Table 3. Of these, two errors are related to misinterpretation, two errors are related to perceptual errors, and three are related to cognitive perception errors. For each type of error, the percentage of students who gave an incorrect answer is calculated.

The classification of responses as correct or erroneous was based on predefined analytical criteria. A response was considered erroneous if the student incorrectly identified the hydronym type, misinterpreted its semantic or cultural meaning, or established an incorrect associative relationship with other hydronyms. During the analysis, students' answers were first coded independently according to these criteria and then grouped into broader categories of errors. The typology of inattentive, cognitive, and interpretative errors was derived from the recurring patterns identified in the students' responses during the coding process.

As shown in Table 3, the GD1 error lies in the fact that students believed that two hydronyms, for example, “Karasai” and “Karagai”, refer to different geographical features, and therefore mistakenly concluded that these hydronyms do not have common features. Secondly, the mistake of GD2 is that students believed that if hydronyms have different origins or etymologies, then they cannot be identical. Thirdly, the mistake of GD3 is that students mistakenly believed that two hydronyms could not be similar if they referred to different types of bodies of water, such as rivers and lakes. Fourth, the mistake of GD4 was that the students, considering the hydronyms “Tengiz” and “Tengis” similar, proceeded only from the general sound, not taking into account the differences in the context of use and origin of these hydronyms.

Further, the mistake of GD5 is that students believed that two hydronyms referring to different types of bodies of water, for example, “Caspian” (lake) and “Zhaiyk” (river), could not be

similar, despite having common cultural and historical ties. The sixth mistake, GD6, shows that students considered hydronyms similar if they belong to the same geographical region or have similar lexical forms, even if the context of their use is different. This causes confusion among students as to whether two hydronyms can be considered similar or not. Finally, the mistake of GD7 is that students paid attention only to the sound similarity of hydronyms, without taking into account their origin or semantic meaning, and for this reason mistakenly concluded that the two hydronyms are similar.

Descriptive statistical analysis was used to calculate the frequency and percentage distribution of each type of error across the collected responses.

In addition to descriptive statistics, correlation analysis was conducted to examine the relationships between different categories of hydronym perception errors. The purpose of this analysis was to identify potential associations between inattentive, cognitive, and interpretative errors across the analyzed aspects of hydronym perception. Pearson correlation coefficients were calculated to determine whether the occurrence of one type of error was related to the occurrence of another. This approach allowed us to obtain a deeper analytical understanding of the cognitive patterns underlying students' difficulties in interpreting hydronyms.

3 Results and discussion

3.1 Results

To further explore the relationships between different categories of errors, a correlation analysis was performed. The results showed a moderate positive correlation between cognitive errors and interpretative errors ($r = 0.46$), indicating that students who experienced difficulties in conceptual understanding of hydronyms were also more likely to misinterpret their semantic or cultural meanings. A weaker correlation was observed between inattentive and cognitive

TABLE 3 Types of errors in the perception of hydronyms in the onomastic space of Kazakhstan.

Type of error	Mistakes	Code	Example of errors
An inattentive mistake	Hydronyms with the same sound, but used in different contexts	GD1	The students believe that “Kaspiy” and “Zhaiyk” are not similar hydronyms
	Hydronyms with different origins are perceived as different	GD2	Students believe that “Tengiz” and “Tengis” are not similar hydronyms
Cognitive error	Hydronyms with different geographical areas are not perceived as similar	GD3	Students believe that “Irtysh” and “Shagalaly” are not similar hydronyms
	Hydronyms with different historical meanings are not perceived as similar	GD4	Students believe that “Ural” and “Zhaiyk” are not similar hydronyms due to different stories
Interpretative error	Hydronyms with similar lexical forms but different contexts are mistakenly not considered similar	GD5	Students believe that “Karasai” and “Karagai” are not similar hydronyms
	Hydronyms with different cultural meanings are perceived as different	GD6	Students believe that “Arkalyk” and “Tarkhan” are not similar hydronyms due to cultural differences
	Hydronyms with the same root but different variants are mistakenly perceived as different	GD7	Students believe that “Tobol” and “Turan” are not similar hydronyms

errors ($r = 0.28$), suggesting that while inattention contributes to mistakes, deeper conceptual misunderstandings play a more significant role in students' perception of hydronyms.

Based on the work of students collected from notebooks, the number of students who made mistakes is recorded for each incorrect answer indicated in Table 4. Then, for each topic related to the perception of hydronyms in the onomastic space of Western Kazakhstan, the percentage of incorrect answers from the total number of students is calculated in three categories of errors: inattentive error, cognitive error and an interpretative error. The average percentages of incorrect answers for each topic, classified by three types of errors, are shown in Table 4.

3.2 Discussion

Table 4 shows that the main cause of student errors in the perception of hydronyms are cognitive errors, which are most often manifested in the interpretation of the meanings of hydronyms, as well as in the process of their perception in context. At the same time, students often demonstrate inattentive processing of hydronymic information, which leads to inattentive mistakes, especially when analyzing similar hydronyms and combining them. The description and analysis of errors in the perception of hydronyms in the onomastic space of Western Kazakhstan can be divided into several key aspects based on the data in the table.

3.2.1 Topic 1: the similarity of hydronyms

As shown in Table 4, the error of perception of similar hydronyms is observed in students in two forms. 6.5% of students made inattentive mistakes, confusing the hydronyms GD1 and GD2, while not taking into account the nuances of their lexical and phonetic similarity. This is a typical inattentive mistake, which may be due to insufficient attention to detail when perceiving place names.

18.3% of students made cognitive mistakes, confusing the hydronyms GD3 and GD4, due to incorrect interpretation of their etymology and cultural and historical context. These errors

often occur when students perceive hydronyms as similar based on superficial features such as shape or phonetic sound, without taking into account the depth of historical and cultural differences.

In addition, 5.1% of students made interpretative errors when perceiving the hydronyms GD5, GD6 and GD7. The errors consist in incorrect interpretation of the semantics and origin of these hydronyms, which is confirmed by insufficient awareness of local and ethnographic aspects.

3.2.2 Topic 2: perception of hydronyms by context

In the perception of hydronyms in the context, 5.2% of students made inattentive mistakes when analyzing the hydronyms GD1 and GD2, not taking into account their specific meaning in a certain geographical context. Errors of this kind are often associated with insufficient attention to different interpretations of hydronyms depending on the context.

Cognitive errors account for 12.7% of students who incorrectly perceived the hydronym GD3, ignoring the specifics of its use in specific cultural and historical conditions. These errors indicate an underestimation of the importance of context in the analysis of hydronyms.

1.1% of students made interpretative mistakes when perceiving the hydronym GD4, misinterpreting its meaning, which is also due to limited knowledge of local features.

3.2.3 Topic 3: errors in the perception of hydronyms

5.6% of students made inattentive mistakes when perceiving the hydronyms GD1, GD2 and GD3, which indicates a superficial approach to the perception of toponyms when students do not pay due attention to the differences in the contexts and meanings of these hydronyms.

13.2% of students made cognitive errors when perceiving the hydronym GD4, which also indicates problems with understanding the depth of meanings and historical and cultural aspects associated with these hydronyms.

TABLE 4 Average percentage of student errors in the perception of hydronyms in western Kazakhstan.

№	The topic of hydronyms	Mistakes	Type of error	Percentage of incorrect answers
1	The similarity of hydronyms	GD1, GD2	An inattentive mistake	6.5%
		GD3, GD4	Cognitive error	18.3%
		GD5, GD6, GD7	Interpretative error	5.1%
2	Perception of hydronyms by context	GD1, GD2	An inattentive mistake	5.2%
		GD3	Cognitive error	12.7%
		GD4	Interpretative error	1.1%
3	Errors in the perception of hydronyms	GD1, GD2, GD3	An inattentive mistake	5.6%
		GD4	Cognitive error	13.2%
4	Incorrect association of hydronyms	GD1	An inattentive mistake	15.2%
		GD2, GD3, GD4	Cognitive error	7.4%
		GD5	Interpretative error	1.0%

3.2.4 Topic 4: incorrect association of hydronyms

15.2% of students mistakenly combined the hydronyms of GD1, considering them similar, without taking into account their geographical and cultural differences. This is a typical inattentive mistake, which shows the importance of a more careful approach to distinguishing even hydronyms that are similar in sound and form.

7.4% of students made cognitive errors when combining the hydronyms GD2, GD3 and GD4, which indicates a lack of understanding of the differences between hydronyms based on their semantics and origin.

Interpretative errors account for 1.0% of students when analyzing the hydronym GD5, which is due to a misinterpretation of the cultural context and historical significance of this hydronym.

It should be noted that for successful interpretation and analysis of hydronyms in the onomastic space of Western Kazakhstan, students need a clear understanding of both procedural and conceptual knowledge. Students should be able to recognize the semantic and structural similarities between hydronyms in order to accurately perceive their meanings, historical context, and cultural significance. In addition, they should have a prior understanding of the linguistic principles involved in interpreting both the positive and negative connotations of certain hydronyms in various contexts. These cognitive factors have a significant impact on teachers, who must take into account the need for accuracy in teaching the recognition and interpretation of hydronyms. It is important that teachers are aware of potential errors in perception and misunderstandings that can lead to misinterpretation of the true meaning of the hydronym or its incorrect use in context. This highlights the importance of early detection and correction of errors in the learning process, so that students do not develop erroneous cognitive schemas and incorrect interpretations that may interfere with their correct understanding of the cultural and historical significance of hydronyms.

The correlation analysis further supports the interpretation that cognitive difficulties in understanding the conceptual structure of hydronyms are closely connected with interpretative errors in semantic and cultural analysis. This finding highlights the importance of strengthening conceptual learning strategies in the teaching of onomastics.

Beyond the quantitative distribution of errors, the findings can be interpreted within a broader linguocognitive and cultural framework. Hydronyms function not only as geographical identifiers but also as carriers of cultural memory and historical knowledge embedded in the linguistic landscape of a region. In this sense, students' cognitive errors may reflect not only gaps in linguistic knowledge but also a limited integration of cultural and territorial schemas that structure the interpretation of place names.

From the perspective of cognitive linguistics, the understanding of hydronyms is mediated through conceptual schemas and associative networks that connect linguistic forms with culturally shared knowledge about landscapes, historical events, and regional identity. When these conceptual schemas are weak or fragmented, students tend to rely on superficial features such as phonetic similarity or lexical form, which explains the prevalence of cognitive errors identified in the study. Thus, the interpretation

of hydronyms requires the activation of both linguistic competence and cultural memory related to the geographical space in which these names emerged.

The results also highlight the role of higher education in developing students' interpretative competence in the field of onomastics. University education should not be limited to memorizing lists of toponyms or their etymologies but should foster the ability to interpret place names within broader cultural, historical, and geographical contexts. This requires integrating interdisciplinary perspectives from linguistics, regional studies, cultural history, and geography.

From a pedagogical perspective, several strategies can support the development of students' linguocognitive competence in the interpretation of hydronyms. First, the use of contextualized learning tasks that connect hydronyms with regional history, folklore, and geographical narratives can strengthen conceptual understanding. Second, project-based activities such as the creation of student-generated toponymic maps or digital hydronym databases can promote deeper engagement with local linguistic landscapes. Third, comparative analysis of hydronyms from different linguistic and cultural traditions can help students develop more flexible cognitive schemas for interpreting place names.

Such pedagogical approaches may contribute to the development of a more integrated interpretative competence, allowing students not only to recognize hydronyms as linguistic units but also to understand their role in shaping cultural identity and regional memory. In this sense, the analysis of students' errors should be viewed not merely as a diagnostic tool but also as a foundation for designing more effective educational practices in the field of onomastics and cognitive linguistics.

3.3 Limitations of the study

This study has several limitations that should be acknowledged. First, the sample was limited to students from universities in Western Kazakhstan, which may restrict the generalizability of the findings to other educational contexts. Second, the analysis focused primarily on written tasks, while oral interpretations of hydronyms were not examined. Future research may expand the sample and include additional qualitative methods to obtain a deeper understanding of students' cognitive processing of hydronymic information. Although correlation analysis provided additional insights into relationships between error types, further research using larger samples and more advanced statistical models could provide a deeper understanding of the cognitive mechanisms underlying hydronym perception.

4 Conclusion

The present study examined the linguocognitive perception of hydronyms among university students in Western Kazakhstan and identified the most common types of errors occurring during their interpretation. The analysis revealed that students' difficulties are primarily associated with cognitive misunderstandings related to the semantic structure, cultural background, and historical

context of hydronyms. While inattentive and interpretative errors were also identified, cognitive errors represented the most significant category, indicating that many students rely on superficial linguistic cues rather than deeper conceptual understanding when interpreting hydronymic units.

From a theoretical perspective, this study contributes to the field of cognitive onomastics by demonstrating that the perception of hydronyms is closely connected with conceptual schemas and cultural memory embedded in the linguistic landscape. The findings support the idea that place names function not only as geographical identifiers but also as cognitive units that reflect historical experience, regional identity, and culturally shared knowledge about space.

From a pedagogical perspective, the results highlight the importance of integrating linguocognitive approaches into the teaching of onomastics and regional linguistics. Educational practices should move beyond memorization of hydronymic forms and instead emphasize the interpretation of place names within broader cultural, geographical, and historical contexts. Teaching strategies such as contextualized learning tasks, project-based mapping of regional hydronyms, and interdisciplinary collaboration with geography and history courses may significantly enhance students' interpretative competence.

Overall, the findings suggest that errors in hydronym perception are not merely linguistic inaccuracies but indicators of deeper cognitive and cultural gaps in students' understanding of regional linguistic landscapes. Addressing these gaps through targeted pedagogical strategies may contribute to the development of a more integrated linguocognitive competence in higher education.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving humans were approved by Kh. Dosmukhamedov Atyrau University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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