Analysis of the effectiveness of teaching materials: a study of the appropriateness of terms to the age and linguistic development of students

K.Z. Zhunis*[1], Zh. Zharkymbayeva[1], S.K. Omarov[1]
[1]Republican Scientific and Practical Center for Educational Content Expertise
Astana, Republic of Kazakhstan
Correspondence: zhunusovakz@mail.ru

Abstract. The study is relevant because it addresses the need to improve the quality of school textbooks in natural and mathematical subjects. Modern textbooks often contain ambiguous or vague definitions of terms, which makes it difficult for students to understand them and negatively affects the educational process. The problem of systematization and standardization of the conceptual and terminological apparatus in school textbooks has become especially urgent in the conditions of the transition to the updated content of education. The purpose of the study is to assess the appropriateness of terms in textbooks with the age and linguistic requirements of students and to identify the main problems and patterns associated with the use of terminology. The article presents the results of a questionnaire survey among teachers of natural-mathematical subjects, conducts a statistical analysis of the collected data, and develops recommendations to improve the systematization and unification of terminology in textbooks. The study includes a correlation and cluster analysis of the data conducted among teachers. The focus is on identifying problems with terminology in textbooks, understanding the relationship between responses to various questions, and identifying groups with similar perceptions.

Key words: terminology, conceptual apparatus, terminological apparatus, school textbooks, natural subjects, mathematical subjects, questionnaire, statistical analysis.

Introduction

This work is aimed at investigating the main terminological problems of school textbooks in order to improve the quality of educational publications and, as a result, the effectiveness of the educational process. The choice of the research problem is due to a number of factors.

A preliminary study of domestic experience revealed key terminological issues in school textbooks:

- Lack of conceptual and terminological review for consistency in terms and concepts.
- Random term creation and use of inadequate language equivalents.
- Permitted term instability (excessive synonyms).
- Repeated use of the same terms with different meanings.

Due to differences in the understanding of terms, there is often an erroneous

assessment of the actual situation. It is also established that the experience of national term-formation using native Kazakh words, the basis of which was laid at the beginning of the last century by famous Kazakh educators, led by A. Baitursynov, has been lost [1]. For many years, term formation in the Kazakh language was under the pressure of Soviet ideology and was based solely on preserving the original of borrowed words or forms of Russian word formation. Despite this pressure, the Kazakh intelligentsia did not lose the desire to streamline the formation of terms using native Kazakh words even in the Soviet period.

In the 1990s, the government closely addressed the development of terminology. Furthermore, in the 1990s, the government of the country paid close attention to the development of terminology and term formation [2]. In response, a state-level commission was established to study the challenges of terminology formation and the development of terminological dictionaries. The study of international experience has led to the conclusion that a number of foreign researchers of the problem of terminology formation have analyzed technical, medical, and mathematical vocabulary. At the same time, they accompanied their research with recommendations on the use of certain terms for the integration of various branches of science [3; 4; 5; 6]. Moreover, it is known that in Russia, Great Britain, India, Turkey and a number of other countries, terminological dictionaries for various purposes are used.

Studies on terminology formation have also been conducted in Kazakhstan [7; 8; 9; 10; 11; 12; 13]. However, most authors limit themselves mainly to the study of lexical word formation. At the same time, despite the obvious achievements in in the above-mentioned problems, there are still a large number of poorly studied issues that require close attention at the present stage. One of them is the lack of works on comprehensive solution of the main terminological problems of school textbooks.

Analyzing the practice of using terms in school textbooks Sh. Kurmanbayuly has clearly demonstrated the existing terminological problems that have become widespread in educational publications [9].

Most of the terms translated and formed in recent years have not been widely used. Since many were artificial terms and did not meet the requirements of the principles of terminology formation, with the support of the Head of State and the Kazakh society, the issue of returning the former names of terms previously translated into Kazakh language has been repeatedly raised. This problem has reflected in the problem of terminology continuity in existing textbooks, especially in alternative textbooks of various publishers in primary and high schools as a result of problems of general terminology.

The relevance of this topic is due to the need to adapt teaching materials to modern requirements and standards of education, as well as the needs of students and teachers. Modern curricula require the use of accurate and understandable terminology, which contributes to better assimilation of the material and improvement of the quality of education.

The research problem is the insufficient systematization and unification of terms used in textbooks on natural and mathematical subjects, which can lead to difficulties in understanding and assimilation of the material by students. This article investigates how the terms in textbooks meet the requirements of unambiguity, consistency, linguistic correctness, etc.

The purpose of the study is to evaluate the compliance of terms in textbooks with the requirements to them and to identify the main problems associated with the use of terminology.

The objectives of the study include:

· conducting a survey among teachers to collect data on problems related to the use of terminology in textbooks of the natural and mathematical subjects;

· analysis of the collected data using statistical methods;

· identification of the main problems

and patterns associated with the use of terminology;

- development of recommendations to improve the systematization and unification of terminology in textbooks.

The object of the research is teaching materials on natural and mathematical subjects, and the subject of the research is the terminology used in them.

Materials and methods

1. Data collection. A questionnaire was conducted among teachers to evaluate various aspects of teaching materials. The questionnaire questions covered the following areas:

- appropriateness of terms for age and language development;

- difficulties with pronunciation and use of terms;

- matching terms to their conceptual meaning;

- explanation of the etymology of borrowed terms;

- effectiveness of assignments and illustrations.

2. Preprocessing data. The data was extracted from the questionnaires and prepared for analysis. Each question of the questionnaire was analyzed for the distribution of answers, and a preliminary check was carried out for omissions and anomalies.

3. Basic statistical processing. The main statistical indicators are calculated: Mean, Median and Mode.

4. Correlation analysis. The analysis of correlations between the answers to various questions was performed to identify the relationships between them.

5. Cluster analysis. The K-means method is used to cluster responses and identify groups with similar response characteristics.

Results

Modern educational materials play a key role in the formation of knowledge and skills among students. A special place is occupied by the use of terms that are tools for the transfer of scientific information and the development of linguistic competencies. However, the terminology of textbooks often causes difficulties for students related to their understanding, use and interpretation. This study is aimed at analyzing the correspondence of terms in textbooks to the age and language characteristics of students, identifying problems of terminological literacy and suggestions for their solution. The study is based on a survey of respondents, where aspects related to terminological literacy, the quality of terms, as well as methodological support for their development were considered. The basis for the analysis was the data presented in the form of diagrams and tables reflecting the opinion of respondents on key issues.

In order to unify textbook terms and expert assessment of subject teachers on quantitative and qualitative analysis of the terminological apparatus of school subjects, a large-scale online survey was conducted among teachers of mathematics, computer science, chemistry, biology, physics, geography, natural sciences on the topic «school terminology: modern problems and systematization». The survey involved 1,916 respondents.

Preprocessed data, including the content of the questionnaire, number of respondents, and percentages, are shown in Figures 1, 2, and Table 1.

The survey results allow us to identify the strengths and weaknesses of existing educational materials, which contributes to the development of recommendations for their improvement. Special attention is paid to the following aspects:

1. The correspondence of terms to the age and level of linguistic development of students.

2. The clarity of terms, including their

pronunciation and semantic clarity.

3. The effectiveness of assignments and illustrations for working with terms.

4. Compliance with didactic requirements and educational goals.

Figure 1 illustrates the transmission of educational information through the use of terms in textbooks. Based on the data presented in the diagram (respondents' responses), a quantitative analysis of opinions covering 10 key issues was carried out. This analysis made it possible to identify the main trends in the perception of terminology by respondents and identify problematic aspects of its use in educational materials.

1. The correspondence of terms to age and level of language development. The majority of respondents (66.3%) believe that the terms in textbooks are adequate to the level of development of students. This indicates a sufficient level of study of materials for the appropriate age groups. However, 20.1% of respondents indicate episodic problems that are probably related to individual topics, and 13.6% indicate inconsistency of terms, which may be caused by the complexity of individual disciplines or overloaded material.

2. The difficulty of pronunciation of terms. Almost half of the respondents (47.3%) reported difficulties with pronunciation of terms, which is especially typical for loanwords. Partial problems with pronunciation were noted by a significant proportion of respondents (27.6%). Only 25.1% of the respondents did not encounter such difficulties, which confirms the need to adapt the terminology.
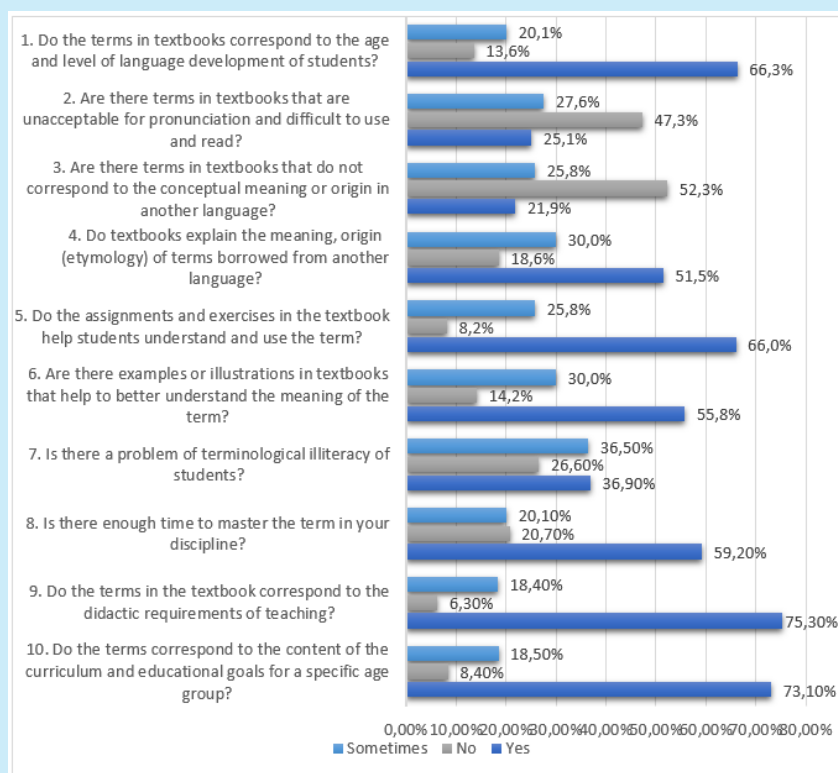

Figure 1. Transmission of educational information through terms in school textbooks

3. The correspondence of the meanings of the terms to their conceptual meaning. 52.3% of respondents confirmed that the terms correspond to their conceptual meanings, which indicates sufficient lexical accuracy. 25.8% chose the answer «Sometimes» and more than 20% of respondents indicated a discrepancy, indicating the need for additional explanations.

4. Explanation of the origin of the terms. According to respondents, only 30% of textbooks contain etymological explanations. This confirms that the potential for in-depth study of terms is not being used enough. The majority of respondents noted «Sometimes» (51.5%), the partial presence of such explanations, which suggests the need to systematize this aspect. Lack of explanation is less common (18.6%), but it remains a problem.

5. The role of tasks in the development of terms. Most of the respondents (66%) believe that exercises help to master the terms. This highlights the importance of interactive teaching methods. 25.8% of the respondents answered «Sometimes». The effectiveness of tasks is evaluated ambiguously, which may indicate differences in the approaches of textbook authors. Only a small number of respondents (8.2%) answered «No».

6. The role of illustrations and examples in the development of terms. More than half of the respondents (55.8%) noted that illustrations contribute to a better understanding. This indicates the need to enhance the visual component. The answer «Sometimes» and «No» was indicated by 30% and 14.2%, respectively, which also confirms the different level of visualization in textbooks.

7. Terminological illiteracy. 36.9% of respondents indicated the existence of a problem related to terminological illiteracy, which requires attention from methodologists and teachers. The same number of respondents answered «Sometimes» (36.5%): partial terminological illiteracy may also be associated with insufficient training of students, and 26.6% of respondents do not see a problem.

8. Sufficient time to master the terms. The answers of the respondents: «Yes» - 59.2%. They consider the time sufficient, which is a positive signal. «Sometimes» - 20.7% and «No» - 20.1%. The problem of lack of time still affects a significant number of students.

9. Compliance with didactic requirements. To the question «Does the terms in the textbook meet the didactic requirements of learning?» 75.3% answered «Yes». A high percentage of positive responses confirms the quality of the terms in terms of methodological standards. The answers are «Sometimes» (18.4%) and «No» (6.3%): a small proportion of respondents indicated problems.

10. Compliance with educational goals. The respondents' answers to the question «Do the terms correspond to the content of the curriculum and educational goals for a specific age group?»:

- «Yes» (73.1%). A high level of agreement indicates the targeted orientation of the terms in textbooks.
- «Sometimes» (18.5%). Partial inconsistencies remain rare.
- «No» (8.4%). A small number of respondents noted the discrepancy.

These data emphasize the need to adjust some aspects, such as the accessibility of pronunciation of terms, explanation of their etymology and strengthening of illustrative material, which could significantly increase their educational potential.

The results of the survey on the question «What is your attitude to the translation of foreign terms into Kazakh?» are shown in Figure 2.

Figure 2. Teachers' attitude to translating foreign language terms into Kazakh

Other responses of the respondents are as follows:

- "Not all of them, but there are terms that need to be translated between them. There is no need to use a Russian translation, it is better to use in the original or Kazakh version».

- «It is necessary to translate, but write in parentheses in the same dictionary, because in most cases completely different words are exchanged».

- «Borrowed pronunciation words do not translate».

- «Terms borrowed from Latin and Western European languages do not need to be translated».

- «If there is a meaning in the Kazakh language, then it is not necessary».

- «The main thing is that the meaning is not lost».

- «It is enough to give an explanation, it is not necessary to translate».

- «Terms that are used in a new way should not be translated».

- «Partial, i.e. the most common ones are better not translated».

- «If there is one for sure. I don't think it's necessary to translate if it sounds awkward or has multiple meanings».

- «When translating, you need to translate so that the person understands that these are not different words».

- «The foreign term is borrowed, so it is not subject to translation».

- «I do not agree that everything should be translated into Kazakh language».

Based on the analysis of the data of the question «What is your attitude to the translation of foreign terms into Kazakh?», it can be concluded that the respondents' opinions on the translation of foreign terms into Kazakh were almost equally divided. Slightly more than half (49.80%) believe that translation is not required, which indicates a certain degree of acceptance and integration of foreign terms into the educational context. At the same time, a significant part of the respondents (44.50%) insist on the need for translation, which underlines the importance of preserving the national language and culture in the educational environment. Other answers (5.61%) contain various nuances and suggestions, which indicates the complexity

and layering of the question.

The reasons for the problems of terminological illiteracy of students may be different and depend on various factors. The data from table 1 represent the distribution of respondents' responses to questions concerning the definition of the causes of terminological illiteracy of students.

Table 1. Determining the causes of terminological illiteracy of students

Answer options	Quantity	%
Decreased interest in reading	395	20,6
Unwillingness to work with terms	160	8,4
Misunderstanding of the meaning of the learner in relation to his or her preparation	265	13,8
The formulated definition of the term in the textbook is too complicated (verbose, confusing, different notation)	300	15,7
Increasing the academic load	78	4,1
The quality of the textbook content	108	5,6
The impact of the virtual world	123	6,4
Problems of language development	49	2,6
Low vocabulary	204	10,6
Providing too many terms to master	103	5,4
Low reading skills	91	4,7
Other answers	40	2,1
Total respondents	1916	100

Other responses of the respondents are as follows:

- «The students I teach have not experienced such difficulties»;
- «The terms are clear»;
- «Enough information»;
- «Naming difficult complex terms»;
- «All of the above».

The results of the survey show that the most significant factors influencing terminological illiteracy are a decrease in interest in reading (20.6%) and difficulty in formulating definitions of terms (15.7%). This indicates the need to improve the motivation of students to read and revise approaches to the formulation of terms in textbooks. Misunderstanding of the meaning of students due to their unpreparedness (13.8%) and low vocabulary (10.6%) are also significant factors requiring attention. The influence of the virtual world (6.4%) and the reluctance to work with terms (8.4%) emphasize the importance of adapting educational materials to modern realities and increasing interest in studying terminology. 2.1% of the respondents gave other answers.

Discussion

The mathematical processing of the survey data was carried out, including the calculation of basic statistical indicators such as Mean, Median and Mode for:

1. Determining general trends in the data. The average value helps to identify the overall level of agreement or disagreement of respondents with certain statements of the questionnaire. For example, a high average on the issue of matching terms to age characteristics indicates predominantly positive feedback.

2. Estimates of the distribution of responses. The median, as an indicator of the central trend, allows you to understand which responses are most often in the center of the distribution, excluding the influence of extreme values. For example, if the median is high, it indicates that the majority of respondents agree with the statement, despite rare cases of disagreement.

3. Identification of the most frequent responses. Fashion shows which answer is most common. This is important for evaluating the most popular opinion of the respondents. For example, if the fashion on the issue of the complexity of terms corresponds to the meaning of "Yes", it emphasizes that the problem is the most relevant.

4. Comparisons of different groups of responses. Consideration of averages, medians and modes on various issues allows for a comparative analysis. For example, it is possible to compare the perception of terms in terms of their age adequacy and difficulty of pronunciation.

5. Justification of adjustments of educational materials. The results of statistical processing help to objectively assess which aspects of terminology require improvement. If the median or mode shows significant disagreement, this indicates the need to revise the relevant element of the training material.

Thus, the mathematical processing of the survey data is a key stage of the analysis, which allows you to structure the data, identify patterns and draw informed conclusions. The results of the processing serve as the basis for the development of recommendations to improve the quality of educational materials and increase their compliance with the needs of students and teachers.

Consider the main statistical indicators of the results of the survey on the transfer of educational information through terms in textbooks.

Means, Medians and Modes for the questionnaire questions.

• *Age appropriateness of terms: Mean = 0.51, Median = 0.59, Mode = 0.66.*

• *Pronunciation difficulties: Mean = 2.72, Median = 0.47, Mode = 0.47.*

• *Relevance to conceptual meaning: Mean = 0.24, Median = 0.25, Mode = 0.20.*

2. Correlation analysis

The correlation matrix showed the following results:

• Yes vs No had an average positive correlation (0.45), indicating some relationship between these responses. Yes vs Sometimes: Low positive correlation (0.25).

• No vs Sometimes: Low positive correlation (0.35).

3. Cluster analysis

Cluster analysis has identified three main clusters:

• Cluster 1: High values of «Yes» and low values of «No».

• Cluster 2: Moderate values of «No» and «Sometimes».

• Cluster 3: High values of «No».

The analysis showed that the average value for the question of the correspondence of terms to age is 0.51, which indicates a moderate agreement that the terms in textbooks correspond to the level of linguistic development of students. The central value - the Median (0.59) confirms that the

majority of responses are closer to positive estimates. The Mod (0.66) also confirms this assessment, that the most frequent response among respondents shows a high level of satisfaction with terminology, which indicates a positive assessment of a significant proportion of educational materials. These indicators confirm that most of the terms (66.3%) correspond to the age and language characteristics of the students. However, data on inconsistencies (13.6%) and occasional problems (20.1%) indicate the need to improve some terms. This may mean that many terms in textbooks are either too complex or not adapted to the current level of knowledge of students, which leads to difficulties in understanding and applying them.

The average value for pronunciation difficulties was 2.72, which indicates a fairly high degree of pronunciation problems among the respondents. The Median of 0.47 and the Mode of 0.47 may indicate that problems with pronunciation of terms are common, but not always critical. This highlights the need for revision and correction of pronunciation norms in textbooks in order to avoid confusion and difficulties for students.

The data obtained show that almost half of the respondents (47.3%) face difficulties in pronouncing terms, which is especially pronounced for loanwords. These difficulties may be related to the lack of phonetic adaptation of terms or the difficulty of integrating them into the local linguistic context. Partial problems (27.6%) indicate that these difficulties are not systemic, but still require attention. The proportion of respondents who do not experience difficulties (25.1%) indicates that terminology adapted to pronunciation is perceived easier. This highlights the importance of phonetic adaptation of terms. According to the author [14], the adaptation of new terms to the educational system requires taking into account lexico-semantic and conceptual-logical connections.

The average value for the correspondence of the term to the conceptual meaning was 0.24, which indicates a relatively low agreement that the terms correctly reflect their conceptual content. The values Median = 0.25, Mode = 0.20 also indicate that the inconsistency of terms with their conceptual meaning is a regular problem for a significant part of respondents. This may indicate problems with the accuracy and clarity of the concepts presented, which makes it difficult for students to understand and assimilate the material. The author emphasizes that concepts and terms should be logically structured in order to eliminate the ambiguity of their interpretation [14]. This is consistent with our conclusion about the need to improve the clarity of the conceptual meaning of the terms, where 20% of respondents noted their inconsistency.

Explanations and their interpretations are presented to discuss the results of correlation and cluster analysis. Correlation analysis helps to identify the degree of relationship between variables. In this case, correlations between the answers "Yes", "No" and "Sometimes" to various questions were considered.

Table 2. The correlation matrix

	Yes	No	Sometimes
Yes	1.00	0.45	0.25
No	0.45	1.00	0.35
Sometimes	0.25	0.35	1.00

The correlation analysis showed moderate correlations between the answers to the questions:

- Yes vs No: The average positive correlation (0.45) indicates that respondents who note high compliance with age requirements also often believe that the terms are adequate.

- Yes vs Sometimes: A low positive correlation (0.25) may indicate that among the respondents who consider the terms appropriate, there are a small number of those who find it difficult to use certain terms.

- No vs Sometimes: The low positive correlation (0.35) confirms that respondents who notice problems may also face partial difficulties, but this is not the main indicator of the problem.

These results highlight the need for a deeper analysis of the relationships between different aspects of terminology in order to better understand exactly which problems are most acute and how they can be solved.

Cluster analysis allows you to identify groups (clusters) with similar responses. Using the K-means method, the data was divided into 3 clusters. The results are presented in Table 3.

Table 3. Results of cluster analysis

Index	Yes	No	Sometimes	Cluster
0	0.66	0.13	0.20	1
1	0.25	0.47	0.27	2
2	0.21	0.52	0.25	2
3	0.51	0.18	0.30	1
4	0.66	0.14	0.30	1
5	0.55	8.20	0.25	3
6	0.73	8.40	0.18	3
7	0.75	6.30	0.18	3
8	0.59	0.20	0.20	1
9	0.36	0.26	0.36	2

The cluster analysis revealed three main groups of respondents:

- Cluster 1: Contains responses with high values of «Yes» and low values of «No», which indicates their satisfaction with the age and understanding of the terms.

- Cluster 2: Contains responses with moderate values of «No» and «Sometimes», which may indicate that they are facing some problems, but do not consider them critical.

- Cluster 3: Contains answers with high values of «No», which indicates significant problems with terminology in textbooks.

These groups show a variety of perceptions and satisfaction, which can help in further analysis and adjustment of educational materials aimed at different types of teachers and students.

Based on the data obtained, the following recommendations are offered:

- Educational materials should align with students' age and language development. It is recommended to review and correct complex terms so that they are understandable and accessible to the target audience.

- The inclusion of additional explanations, illustrations and examples for difficult terms can help students better understand and assimilate the material.

- It is recommended to conduct additional research to better understand the problems and identify the most effective methods of correcting educational materials.

- It is necessary to take into account both the need to preserve national culture and the integration of international terms. It is recommended to develop flexible approaches that take into account the opinions of different groups of respondents and ensure a balance between translation and preservation of original terms.

- To improve terminological literacy, measures should be taken to increase students' interest in reading, improve the quality of the formulation of terms and increase vocabulary. It is recommended to revise the content of textbooks, making the definitions of terms more understandable and accessible, as well as to introduce interactive and motivating teaching methods.

Conclusion

As a result of the conducted research, it was revealed that many terms in educational materials do not fully correspond to the age and language characteristics of students, which causes problems in their understanding and use. Correlation and cluster analyses offered insights into terminology issues and identified respondent groups with varying perceptions.

To improve the quality of educational materials, it is recommended to revise terminology, add explanations and illustrations, and continue research to ensure that textbooks better meet the needs of students. The results of this study emphasize the importance of considering the opinions of students when making decisions about the translation of foreign terms and developing strategies to improve terminological literacy. The elimination of the identified causes of terminological illiteracy requires a comprehensive approach, including improving the quality of textbooks, increasing interest in reading and adapting the educational process to modern realities.

Bibliography

1. Постановление Правительства Республики Казахстан от 21 апреля 2004 года № 444 «О Концепции государственной терминологической работы в Республике Казахстан» [Электронный ресурс]. URL: https://adilet.zan.kz/rus/docs/P040000444_

2. **Байтұрсынұлы, А.** Алты томдық шығармалар жинағы. Әліппелер мен мақалалар жинағы. (Төте жазудағы тұңғыш әліппелер және ұлттық баспасөзде жарияланған көсемсөздер) [Мәтін]. – Алматы: Ел-шежіре, 2013. – Б. 4. – 384 б.

3. **Дж. Дэрилл Эванс.** Технические термины, используемые в школьных учебниках по биологии человека [Электронный ресурс]. – 2010. URL: https://doi.org/10.1080/00219266.1975.9654013

4. **Монахов, С. И., Турчаненко, В. В., Федюкова, Е.А., Чердаков, Д. Н.** Изучение терминологических подсистем современных школьных учебников на русском языке с помощью модели анализа семантики естественных языков word2vec // Журнал прикладной лингвистики и лексикографии. 2020. №2. [Электронный ресурс]. URL: https://doi.org/10.33910/2687-0215-2020-2-2-118-146

5. **Josip Slisko, Dewey I. Dykstra, Jr.** The Role of Scientific Terminology in Research and Teaching: Is Something Important Missing? J Res Sci Teach. – 1997. – Vol. 34, no. 6. pp. 655–660.

6. **Takuma Asaishi.** An analysis of the terminological structure of index terms in textbooks. Procedia - Social and Behavioral Sciences. 2011. Vol. 27. pp. 209–217. https://doi.org/10.1016/j.sbspro.2011.10.600

7. **Аккошкаров, Е. А.** Педагогические аспекты казахской терминологии при изучении естественно-математических дисциплин в общеобразовательной школе [Текст]: дис. ...канд. пед. наук: 13.00.01. – 1985.

8. **Бисенгали, А. З.** Процесс терминообразования в казахском и турецком языках // Международный журнал экспериментального образования. – 2017. – № 6 – С. 96-99.

9. **Құрманбайұлы, Ш.** Оқулықтарға енетін терминдерді іріктеу мен қолдану мәселесі // «Білім беру ресурстарын жетілдіру: тәжірибе және болашағы» халықаралық ғылыми-практикалық конференция жинағы. – Нұр-Сұлтан, 18-19 қазан 2019 ж. – Б. 329-338.

10. **Айтбайұлы, Ө.** Основы казахской терминологии / Ө. Айтбайұлы. – Алматы: Абзал-Ай, 2014. – С. 384.

11. **Bekmanova, G., Sharipbay, A., Kabdylova, D., Amangeldy, N., Sairanbekova, A., Omarbekova, A., Zulkhazhav, A.** Electronic Dictionary System of Terminology for School Textbooks with Speech Synthesis Function. J. Electrical Systems 20-4s (2024):912-921. https://doi.org/10.52783/jes.2132

12. **Кеңес, Б. Е., Кочак, М., Есполова, Ж. Е.** Информатика саласына қатысты мектеп оқулықтарында терминдердің қолданылуы [Мәтін] // «Білім» ғылыми-педагогикалық журналы. – Астана: Ы. Алтынсарин атындағы Ұлттық білім академиясы, 2024. – № 1. – Б. 19-28.

13. **Амирхамзин, А.** Развитие терминологии казахского языка [Электронный ресурс]. – 2022. URL: https://www.neotech.kz/state_language/development/

14. **Полонский, В.М.** Понятийно-терминологический аппарат педагогики и образования. Научный результат. Педагогика и психология образования. – Том 3. – № 2. – С. 54-60. DOI: 10.18413/2313-8971-2017-3-2-54-60

References

1. Postanovlenie Pravitel'stva Respubliki Kazahstan ot 21 aprelya 2004 goda № 444 «O Koncepcii gosudarstvennoj terminologicheskoj raboty v Respublike Kazahstan» [About the Concept of state terminological work in the Republic of Kazakhstan] [Elektronnyj resurs]. URL: https://adilet.zan.kz/rus/docs/P040000444_

2. **Baïtürsynūly, A.** Alty tomdyq şyğarmalar jinağy. Älıppeler men maqalalar jinağy. (Tòte jazudağy tūñğyş älıppeler jäne ülttyq baspasözde jarialanğan kösemsözder) [Collection of works in six volumes. Collection of alphabets and articles. (The first alphabets in shortcuts and prepositions published in the National Press)] [Tekst] / A. Baïtürsynūly. – Almaty: El-şejıre, 2013. – 384 b.

3. **Evans, J. D.** Technical Terms Used in Human Biology Textbooks [Electronic resource] / J. D. Evans. – 2010. – URL: https://doi.org/10.1080/00219266.1975.9654013

4. **Monahov, S. I.** Izuchenie terminologicheskih podsystem sovremennyh shkol'nyh uchebnikov na russkom yazyke s pomoshch'yu modeli analiza semantiki estestvennyh yazykov word2vec [Studying terminological subsystems of modern school textbooks in Russian using the word2vec natural language semantics analysis model] [Tekst] / S. I. Monahov, V. V. Turchanenko, E. A. Fedyukova, D. N. Cherdakov // Zhurnal prikladnoj lingvistiki i leksikografii. – 2020. – № 2. – URL: https://doi.org/10.33910/2687-0215-2020-2-2-118-146

5. **Slisko, J., Dykstra Jr, D. I.** The Role of Scientific Terminology in Research and Teaching: Is Something Important Missing? [Text] // J. Res. Sci. Teach. – 1997. – Vol. 34, no. 6. – Pp. 655–660.

6. **Asaishi, T.** An Analysis of the Terminological Structure of Index Terms in Textbooks [Text] // Procedia - Social and Behavioral Sciences. – 2011. – Vol. 27. – Pp. 209–217. URL: https://doi.org/10.1016/j.sbspro.2011.10.600

7. **Akqoshqarov, E. A.** Pedagogicheskie aspekty kazahskoj terminologii pri izuchenii estestvenno-matematicheskih disciplin v obshcheobrazovatel'noj shkole [Pedagogical aspects of Kazakh terminology in the study of natural sciences and mathematics in secondary schools] [Tekst]: dis. ... kand. ped. nauk: 13.00.01 / E. A. Akqoshqarov. – 1985. – 190 s.

8. **Bısengali, A. Z.** Process terminoobrazovaniya v kazahskom i tureckom yazykah [The process of terminology formation in Kazakh and Turkish languages] [Tekst] / A. Z. Bısengali // Mezhdunarodnyj zhurnal eksperimental'nogo obrazovaniya. – 2017. – № 6. – S. 96–99.

9. **Qūrmanbaıūly, Sh.** Oqūlyqtarga enetın terminlerdı ırıktew men qoldanw mäselesı [The problem of selection and use of terms included in textbooks] [Tekst] / Sh. Qūrmanbaıūly // «Bılım berw reswrstaryn jetıldırw: täjırıbe jäne bolaşagy» halyqaralyq gylymı-praktikalyq konferencııa jinagy. – Nur-Sūltan, 2019. – 18–19 qazan. – B. 329–338.

10. **Aıytbaıūly, Ö.** Osnovy kazahskoj terminologii [Fundamentals of Kazakh terminology] [Tekst] / Ö. Aıytbaıūly. – Almaty: Abzal-Aı, 2014. – 384 s.

11. **Bekmanova, G., Sharipbay, A., Kabdylova, D., Amangeldy, N., Sairanbekova, A., Omarbekova, A., Zulkhazhav, A.** Electronic Dictionary System of Terminology for School Textbooks with Speech Synthesis Function [Text] // J. Electrical Systems. – 2024. – Vol. 20-4s. – Pp. 912–921. URL: https://doi.org/10.52783/jes.2132

12. **Keńes, B. E.** Informatika salasyna qatıstı mektep oqūlyqtarynda terminlerdı qoldanw [The use of terms in school textbooks related to the field of Computer Science] [Tekst] / B. E. Keńes, M. Kochak, Zh. E. Espolova // «Bılım» gylymı-pedagogikalyq jwrnaly. – Astana: Y. Altynsarin atyndagy U'lttyq bılım akademııasy, 2024. – № 1. – B. 19–28.

13. **Amırhamzın, A.** Razvitie terminologii kazahskogo yazyka [Development of terminology of the Kazakh language] [Elektronnyj resurs] / A. Amırhamzın. – 2022. – URL: https://www.neotech.kz/state_language/development/

14. **Polonskij, V. M.** Ponyatiyno-terminologicheskij apparat pedagogiki i obrazovaniya [Conceptual and terminological apparatus of pedagogy and

Анализ эффективности учебных материалов: исследование соответствия терминов возрасту и языковому развитию учащихся

К.З. Жунус[1], Ж. Жаркынбаева[1], С.К. Омаров[1]
[1]Республиканский научно-практический центр экспертизы содержания образования
г. Астана, Республика Казахстан

Аннотация. Актуальность исследования обусловлена необходимостью улучшения качества школьных учебников в естественно-математическом направлении. Современные учебники часто содержат неоднозначные или расплывчатые определения терминов, что затрудняет их понимание учащимися и негативно влияет на образовательный процесс. Проблема систематизации и стандартизации понятийно-терминологического аппарата в школьных учебниках стала особенно актуальной в условиях перехода к обновленному содержанию образования. Цель исследования заключается в оценке соответствия терминов в учебниках возрастным и языковым требованиям учащихся и выявлении основных проблем и закономерностей, связанных с использованием терминологии. В статье представлены результаты анкетирования среди педагогов естественно-математического направления, проведен статистический анализ собранных данных и разработаны рекомендации по улучшению систематизации и унификации терминологии в учебниках. Исследование включает корреляционный и кластерный анализ данных анкетирования, проведенного среди учителей. Основное внимание уделяется выявлению проблем с терминологией в учебниках, пониманию связи между ответами на различные вопросы и выявлению групп с похожими восприятиями.

Ключевые слова: терминология, понятийно-терминологический аппарат, школьные учебники, естественно-математические дисциплины, анкетирование, статистический анализ.

Оқу материалдарының тиімділігін талдау: терминдердің оқушылардың жасына және тілдік дамуына сәйкестігін зерттеу

К.З. Жүніс[1], Ж. Жаркынбаева[1], С.К. Омаров[1]
[1]Респубикалық ғылыми-практикалық білім мазмұнын сараптау орталығы
Астана қ., Қазақстан Республикасы

Аңдатпа. Зерттеудің өзектілігі жаратылыстану-математикалық бағыттағы мектеп оқулықтарының сапасын жақсарту қажеттілігіне байланысты. Қазіргі оқулықтарда терминдердің түсініксіз анықтамалары жиі кездеседі, бұл оларды оқушылардың түсінуін қиындатады және оқу процесіне теріс әсер етеді. Мектеп оқулықтарындағы тұжырымдамалық-терминологиялық аппаратты жүйелеу және стандарттау мәселесі жаңартылған білім беру мазмұнына көшу жағдайында ерекше өзекті

болды. Зерттеудің мақсаты оқулықтардағы терминдердің оқушылардың жас және тіл талаптарына сәйкестігін бағалау және терминологияны қолданумен байланысты негізгі мәселелер мен заңдылықтарды анықтау болып табылады. Мақалада жаратылыстану-математикалық бағыттағы педагогтар арасында сауалнама нәтижелері ұсынылған, жиналған деректерге статистикалық талдау жүргізілген және оқулықтардағы терминологияны жүйелеу мен біріздендіруді жақсарту бойынша ұсыныстар әзірленген. Зерттеу мұғалімдер арасында жүргізілген сауалнама деректерінің корреляциялық және кластерлік талдауын қамтиды. Оқулықтардағы терминология мәселелерін анықтауға, әртүрлі сұрақтарға жауаптар арасындағы байланысты түсінуге және ұқсас қабылдаулары бар топтарды анықтауға баса назар аударылады.