CONTENT ANALYSIS OF TEXTBOOKS

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doi: 10.18355/PG.2024.13.1.5

Abstract
The paper presents the results of the content analysis of the teaching text. We analyzed two text samples selected from textbooks - "Biology 1 for grammar schools" (textbook 2) and "Biology for the 2nd year of grammar schools and the 6th year of grammar schools with an eight-year study" (textbook 1). Both of these textbooks are used in teaching subject Biology in Slovakia. When analyzing both teaching texts, we tried to find out whether the texts, in terms of content complexity, are processed appropriately for the 1st grade students at the gymnasium. As part of the content analysis, we focused on syntactic difficulty (Ts) and conceptual difficulty (Tp) and overall difficulty (T), for which we used the T measure (the innovative Nestlerová – Průcha – Pluskal measure). This measure was modified for the analysis of not only Czech, but also Slovak textbooks. Based on this measure, we came to the conclusion that textbook 1 is processed more demandingly and its degree of difficulty reached the value of 55.28 compared to textbook 2, which degree of difficulty reached the value of 52.10. In addition to the statistical difficulty of the text of both textbooks, we tried to analyze the text in terms of the occupation of individual topics, the basic and supplementary text and the overall visual and graphic processing of the textbooks.

Key words
Textbook, Learning text, Content analysis, Syntactic difficulty, Conceptual difficulty

Introduction

In accordance with Art. 2 letters a) directive no. 1/2022 on educational publications, a textbook is understood as "an educational publication in which the child and pupil do not write their notes and which contains professionally and didactically processed curriculum in accordance with the principles and goals of education and the relevant state educational program, and supports the learning of children and pupils and the development of their knowledge, skills and competences, is the primary source of information for children and pupils; the textbook is also an integrated textbook with a workbook."

Textbooks and Content Analysis of Textbook

In order for the textbook to be a full-fledged educational tool, or a didactic aid, it should fulfill certain functions. Petlak (2016) mentions the following functions in his publication:

1. motivational – a well-made textbook arouses interest, the learner reaches for it with interest;

2. communicative - develops vocabulary, the learner "works" with the book - underlines the text, completes it, adapts it;
3. regulatory – the curriculum is divided into parts according to logical continuity;
4. application - contains topics for using the subject matter in practice, gives examples from life;
5. integrative – it is not limited to its own subject, but also refers to other subjects – between subject relationships, leads to a more complex knowledge of subjects and phenomena;
6. innovative - presents the latest knowledge of science and technology, but given that these are increasing rapidly and for economic and technical reasons it is not possible to publish new textbooks and books immediately, it is the teacher's task to constantly update the content;
7. controlling and guiding – the learner uses the text, control questions and tasks for self-control, this is feedback, he finds out what he understood and what he didn't, he repeats the curriculum again;
8. developing and educational - the text helps the pupil - learner to develop skills, create attitudes, etc.).

Content analysis of texts is a method that is used in all research procedures in which words are used (analysis of questionnaires, interview transcripts, observation protocols, etc.). However, it also represents a special research method for the analysis of textual documents. Analogous to the content analysis of the verbal side of the text, there is also the analysis of non-verbal products - images, diagrams, graphs, etc. (Gavora, 1999).

The content analysis of the text has a wide application in various fields - linguistics, journalism, sociology, psychology. In the field of pedagogical research, content analysis of a wide range of texts is current: curricula, teaching texts, pupils' written tasks, written preparation of teachers for teaching, minutes, reports and activity records, legislative materials, statistical outputs, media reports (Proksa et al., 2008).

One of the variants of content analysis is determining the difficulty of the text, which is one of the most important didactic parameters. Any text has certain content and formal features that make it more or less suitable for communication with certain subjects. When we start reading certain texts, we intuitively feel whether the texts are easy, simple, easily comprehensible, or whether they are difficult, complex or even incomprehensible. This intuitive evaluation of the text by the subject is a reflection of the objectively existing communicative properties of the text. The difficulty of a textbook text can be understood as an objective property that is determined by its specific characteristics. The fact that it is a property independent of the subject allows this property to be detected and evaluated by objective procedures (Průcha, 1997).

The difficulty of the text can be determined by estimates made by experts or users of the text (teachers, students). Questionnaires or assessment scales are often used, on which respondents evaluate individual aspects of the text.

(Průcha, 1998; Gavora, 1999). In another way of determining difficulty, students are given tasks for: selection of information, arrangement of information, completion of missing words in the text, etc. and compare their results for each text. According to the results, the difficulty of the text is determined. A different way of determining the difficulty of a text is based on objective parameters of the text and is independent of assessors or students. These parameters are usually the length of the sentence, the complexity of the sentence, the number and difficulty of concepts, the degree of repeatability of concepts, etc. The difficulty of a certain text for the reader is thus influenced by lexical as well as syntactic factors. These are included in the so-called formulas for calculating text difficulty. The individual indicators are then included in a formula, into which the data from the text is inserted and with the help of which the difficulty of the text is calculated (Gavora, 1999).

Prokša et al. (2008) in his publication presents several formulas with which it is possible to analyze the content of the text in terms of difficulty. A very simple universal text difficulty formula is the **LIX formula**, developed by the Swede C.H. Björnsson.

The difficulty of the textbook text is calculated according to the formula:

LIX = Lm + Lo,

where: Lm – average sentence length expressed by the number of words in a set of 200 sentences,

Lo – average length of words with more than 6 letters in a set of 2000 words. Sets of sentences (syntactic factor) are created from 20 samples of 10 sentences selected systematically from different parts of the textbook. Word sets (lexical factor) are created from 20 samples of 100 words each. The LIX measure is equipped with a severity scale where:

LIX = 20-30 points ..... very easy texts
LIX = 30-40 points ..... moderately difficult texts
LIX = 40-50 points ..... very difficult texts
LIX = 50-60 points ..... extremely difficult texts.

As he further states, this measure is considered too simple because it only works with two text parameters and is therefore not fully valid. We present it as a demonstration of the possibility to establish difficulty criteria for individual age levels of pupils that should be met by didactic texts in the relevant year of school (Björnsson, 1968).

Another useful formula is the **Mistrík difficulty formula**, which incorporates three text parameters: V – average sentence length (is a symptom of the complexity of expressing ideas), S – average length of words expressed by the number of syllables (is a symptom of the conceptual load of the text), I – word repetition index (is a characteristic of the text's lexical variability). Mistrik scale uses a scale of difficulty with values between 0-50 points, in which the easiest texts have 40-50 points and the most difficult 0-10 points. The formula has the following form:

R = 50 – V . S / I

where I = N / L whereas: N – number of all lexical units of the text, L – number of different lexical units. The advantage of Mistrík's formula is that it also includes the lexical variability of the text. In the case of school textbooks, it is an indicator of the use of different words in the text, which is

directly related to the range of vocabulary of pupils of a certain age. However, this formula also has a drawback. It does not include the measurement of the qualitative side of the lexicon and syntax of the text. For the reader who tries to understand the read text, not only the quantitative scope of the text's lexicon is relevant, but also its qualitative parameters - whether, for example, technical terms used in the text and how often they are repeated. Similarly, in the syntactic factor, not only the length of the sentences is relevant, but also how complex the sentence constructions are, e.g. whether it is a sentence with a larger or smaller number of propositions (sentence sections). Another disadvantage of the mentioned formula (as well as the formula *LIX*) is that it does not allow us to find out at which student's level the analyzed text is (Skorecova – Zelenicky – Teleki, 2014).

As another formula for analyzing the difficulty of a text, he mentions Nestler's formula (the author is the German psychologist Kathrin Nestler), which was also modified for Czech and Slovak texts, and which is used for a more complex analysis of the difficulty of a text. parameters, which includes measure T are shown in figure no. 1.

This measure meets three basic requirements: 1. is sufficiently complex (also includes semantic aspects of the text), 2. is sufficiently operative (can be applied relatively easily), 3. is sufficiently valid (i.e. with a verified correlation to the cognitive abilities of school-age pupils). Currently, the innovative Nestler–Průcha–Pluskal measure is used in practice, which is abbreviated as the T level – the symbol T indicates the degree of difficulty of the text. The difficulty of the text is measured based on the formula:

T = TS + TP

where: Ts (syntactic difficulty) Tp (conceptual, semantic-lexical difficulty).

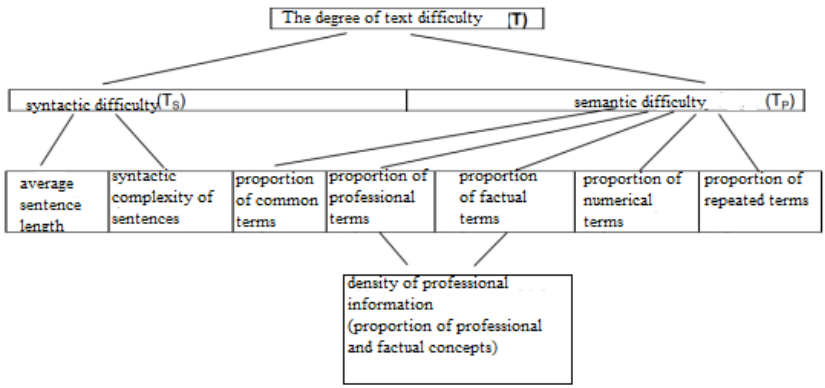

Figure 1: Parameters of measure T (Proksa et al., 2008)

In the case of determining the degree of difficulty of the text, Turek (2014) in his publication also mentions other parameters that can be determined on the basis of the detected variables. These parameters are the numerical data density coefficient and the proportion of repeated terms.

Other methods of text analysis

A special test to determine the understanding of a specific text is the Cloze-test. Its form is simple: it is a continuous text in which some words are omitted. The student's task is to complete the words by writing the correct expression in the gaps, which is either the original word or its synonym. Performance is assessed according to the number of completed words (Gavora – Srajerova, 2008/09). If students fail to fill in at least 13 missing words, the text is considered difficult for students (Turek, 2014). To determine the degree of readability of the text, the so-called Gunning Fox Index (FOG index) is used. (Swieczkowski – Kułacz, 2021). To calculate the fog index score, three parameters need to be known: average sentence length; the percentage of long words present in the text and the sum of the average sentence length and the percentage of long words. The higher the value of this index, the harder the text is to read (CFI, 2023). Fog index should have a value of approximately 12. In good textbooks, its value is 11 or less (Turek, 2014).

Fog index represents the number of years of study required to read, i.e. understand, the text of a textbook. The lower the value of this index, the more accessible the textbook is to students. The value of the haziness index can be reduced mainly by shortening sentences and using simple vocabulary (Turek, 2014). Flesch and Kincaid developed a measure that analyzes text and assigns values to individual grades. It is a type of measure that we plan to adapt to the Slovak language. In order to make the measure suitable for determining readability suitable for our conditions, it is possible to adjust the constants in Flesch - Kincaid Grade Level for the Slovak language or to create a measure based on a similar principle, but with other variables. Skorecova – Zelenicky – Teleki, 2014). There are several dozens of formulas for calculating text difficulty, which differ in emphasizing or, on the contrary, suppressing some text parameters. They are e.g. the formulas of Flesch, Challa, Mikko, Pisarek, Mistrík and others. Nestler's formula, is also used in a modified form by J. Prucha (Gavora, 1999), is the most widespread formula in our country.

The determined values of the difficulty of the text (T) and the coefficients of the density of professional information are can be interpreted for different purposes of evaluation and comparison, namely:

1) mutual comparison of textbooks: comparing textbooks of different subjects in the same year, comparing textbooks of the same subject in individual grades of the school, comparison of textbooks of a certain subject in different types of schools, comparison of textbooks of the same subjects published by different publishers, comparison of textbooks of the same subjects in historical development (e.g. the difficulty of geography textbooks from the last century to the present, comparison of textbooks of the same subjects in different countries (eg history textbooks in Slovak, Czech, German, French and other schools).

2) detailed clarification of the characteristics of a specific textbook: It concerns the main identification of the reasons why a certain textbook is excessively difficult and what needs to be corrected in the text of the

textbook. In this way, it is possible to arrive at specific recommendations for reducing the excessive burden of the textbook text (Proksa et al., 2008)

Content Analysis of Biology Textbooks

The aim of the research of this work is the analysis of the content complexity of the teaching text of selected biology textbooks intended for secondary school students, focused on the biology of the cell - the cell as a structural functional unit of organisms, its chemical composition, basic cell structures and the basic division of the cell by type (simple prokaryotic and complex eukaryotic, which is further distinguished between plant, animal (including human) and fungal cells). We carried out the analysis on the basis of various aspects of the selected text samples, e.g.:

- number of words;
- number of sentences;
- length of sentences.

As part of the analysis focused on content difficulty, we used the innovative Nestler - Prucha - Pluskal measure, known as the T-measure, which analyzes Slovak and Czech texts.

In terms of content complexity, we focused on:

- syntactic difficulty of the text Ts;
- conceptual – semantic difficulty of the text Tp;
- overall difficulty of the text;
- density coefficient of professional information (i, h).

The first step of the analysis was to determine the total number of pages of the selected textbooks. The second step was to find out the number of pages devoted to the topic Biology of the cell, i.e. its composition, basic cell structures, cell types, life processes at the cell level and within ontogenesis, cell division (cell cycle). Subsequently, the percentage of the total content dedicated to cell biology was determined from this data (Zupko, 2022):

$$\text{proportion of cell biology content} = \frac{\text{number of pages devoted to cell biology}}{\text{total number of textbook pages}} \times 100$$

In the next step, we determined the total number of words in both analyzed samples. As a word we considered every expression [verbal (eukaryotic cell), numerical (3/7), symbolic (%)] separated by graphic spaces or graphic separators (punctuation, etc.). After determining the number of words, the number of verbs found in the samples in question was determined. All verbs were marked in red in the text. We considered all words that expressed any action to be verbs. Within them, we also looked for verb forms, either simple or compound, definite and indefinite - e.g. are located, provides, is not separated, contains, arises, runs out, division ....

From the given data, we determined the average sentence length (V) according to the formula: $\mathbf{V = \Sigma N / \Sigma V}$ where: ➢ΣN represents the total number of words that make up the individual sentences of the analyzed

sample of the teaching text; ➢ΣV represents the total number of sentences from which the analyzed samples of the teaching text were composed. To calculate the length of the sentence section (U), we used the formula: in which: ➢ΣN again represents the total number of words that make up the individual sentences of the analyzed sample of the teaching text; ➢ΣU represents the total number of verbs listed in the teaching text samples. After obtaining the above-mentioned variables, we proceeded to calculate the syntactic difficulty (Ts). We calculated it according to the formula: **TS = 0.1xVxU** From the given data, we calculated the syntactic difficulty of both mentioned textbooks. In order to determine the syntactic difficulty of the text, we first had to find out the average sentence length (V) and the length of sentence segments (U).

After calculating the syntactic difficulty of the text, we continued with the calculation of the semantic difficulty of the text. We first searched for all nouns from the analyzed text, which we then divided into categories: ➢ common terms P1; ➢ technical terms P2; U = ΣN/ΣU, ➢ numerical terms P3; ➢ factual terms P4; ➢ repeated terms P5.

We have distinguished these concepts from each other by color, as can be seen in the following example:

Golgiho aparát je stálou, ale veľmi dynamickou membránovou súčasťou rastlinných a živočíšnych buniek. Tvoria ho všetky **diktyozómy** (gr. *dictyon* – sieť, soma – *teleso*) prítomné v bunke. Diktyozómy tvorí súbor (3 - 7) cisterien – kanálikov, ktoré sú na protiľahlých koncoch rozšírené a oddeľujú sa nich vezikuly. Často je lokalizovaný v blízkosti jadra a endoplazmatického retikula. Jeho úloha v bunke je **syntetická** (produkcia enzýmov, tvorba pektínov – látok povahy cukrov, ktoré sa využívajú na stavbu bunkových stien a **sekrečná** (úprava látok do takej podoby, aby mohli byť vylúčené von z bunky, produkcia slizu v koreňovej čiapočke). V živočíšnych bunkách sa podieľa na tvorbe lyzozómov a ich hydrolytických enzýmov (obr. 13). (Višňovská a kol., 2013).

Figure 2: Teaching text sample

All scientifical terms that apply as technical terms in the field of biology have been highlighted in orange. Common concepts were distinguished in yellow, that is, concepts that pupils/students have already encountered. As mentioned above, all verbs were highlighted in red. The green color distinguished factual terms, among which we advised all the abbreviations found in the text (e.g., etc., fig. ...), abbreviations of the names of nucleic acids forming the genetic information of cells (RNA, DNA, r-RNA... .). Numerical terms consisted of all the numbers found in the text (3-7, which expressed the number of channels that make up dictyosomes, serial numbers of images) and were marked in purple. From the sample above it follows that it contains 16 common terms (P1), 18 specialist terms (P2), 3 numerical terms (P3), 5 factual terms (P4) and 4 repeated terms (P5 – dictyosomes, creation, substances , cell). In this way, we analyzed both samples of teaching aunt, or

their parts dealing with cell structure. After the analysis of both text samples, we inserted the individual values into the following formula:

$$Tp = \frac{100 \times \sum P}{\frac{\sum Nx\ (\sum P1 + 3\sum P2 + 2\sum P3 + 2\sum P4 + \sum P5)}{\sum N}}$$

We calculated the total difficulty of the analyzed text according to the formula: **T = TS + TP**

In addition to the difficulty of the text, we investigated, respectively determined the coefficients of the density of professional information, where:

➢ coefficient i indicates the proportion of terms carrying professional information in the total number of words,

➢ coefficient h indicates the proportion of technical terms in the total number of terms, based on formulas:

$$\mathbf{i} = \frac{100\ x\ (\sum P2 + \sum P3 + \sum P4)}{\sum N},\ \mathbf{h} = \frac{100\ x\ (\sum P2 + \sum P3 + \sum P4)}{\sum P}$$

We prepared a comparison of the textbooks for the thematic unit of the cell, which was treated as a topic in both textbooks.

After determining the percentage of content devoted to cell biology in both textbooks, we continued by determining the total number of words (∑N) and the total number of sentences (∑V), which comprised the analyzed text samples of both textbooks. The total number of words (∑N) of which the analyzed text of textbook 1 consisted was determined by the number of 1014 words. The analyzed text sample of textbook 2 consisted of a total of 1212 words. After determining the number of words, we determined the total number of sentences (∑V), which were organized into a continuous text of the textbooks. The text of textbook 1 consisted of 79 sentences and the text of textbook 2 of 80 sentences. Within each sentence, we subsequently determined the number of verbs (∑U). While in textbook 1 we found 130 verbs, in textbook 2 there were 148 verbs in the text. Having determined the values of ∑N, ∑V and ∑U, we continued with the calculation of the average sentence length (V). the obtained values are shown in Table no. 1, from which it can be seen that the average length of sentences in the text sample of textbook 1 was smaller compared to the average length of sentences in textbook text 2, and thus the syntactic difficulty value was also lower.

	V	U	Ts
Textbook 1	12,80	7,80	9,98
Textbook 2	15,15	8,19	12,40

Figure 3: Values of V, U and Ts of the analyzed text samples of both textbooks

We determined the total number of concepts (∑N) (figure no. 3 and no. 4), within which we further distinguished and compared the number of: ➢

common terms (P1); ➢ professional terms (P2); ➢ numerical terms (P3); ➢ factual terms (P4); ➢ repeated terms (P5),

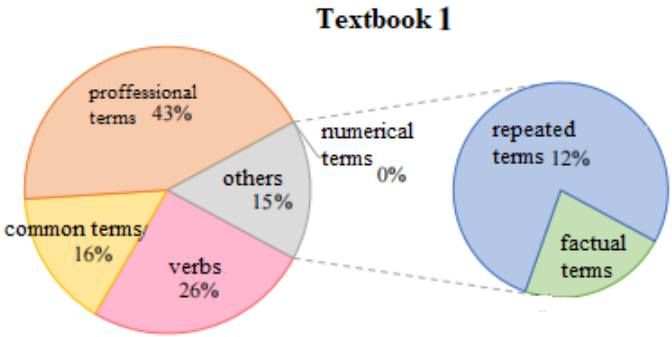

Figure 4: Percentage representation of terms of category P1, P2, P3, P4, P5 in the analyzed text sample of textbook 1

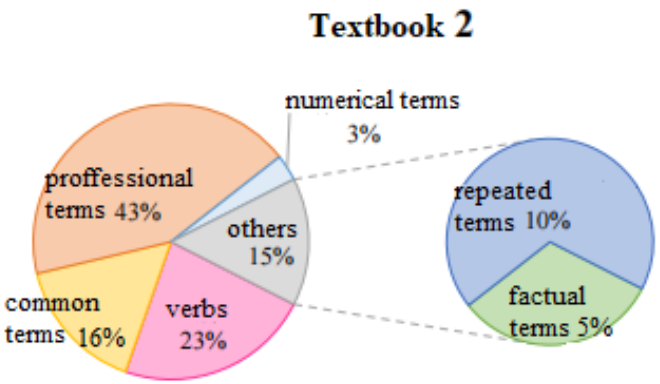

Figure 5: Percentage representation of terms of category P1, P2, P3, P4, P5 in the analyzed text sample of textbook 2

It is clear from the graphs that the representation of common terms (16%) and specialist terms (43%) is the same in both textbooks. The same representation in the text is also made up of factual terms and repeated terms (a total of 15% of the analyzed text sample in both textbooks).

	T	Ts	Tp	V
Textbook 1	55,28	9,98	45,30	12,80
Textbook 2	52,10	12,40	39,70	15,15

Figure 6: Comparison of the difficulty of textbook 1 with the difficulty of textbook 2

We can see that textbook 1 is processed in terms of difficulty more demanding than textbook 2, while in textbook 2 the source of this difficulty is syntactic difficulty, while in textbook 1 it is a high semantic difficulty. The syntactic difficulty of the mentioned text arises from the disproportionately high value of the average sentence length. Based on these facts, it can be concluded that the future correction of the text of textbook 1 should be aimed at reducing the density of professional information in the text, while the correction of textbook 2 should aim at reducing the syntactic difficulty of the sentences.
The value of the average difficulty of the text of textbooks for the 1st year of grammar schools is 40.6p.

Comparison of density, or the share of professional information in the analyzed samples of the teaching text of both textbooks is presented in Figure no. 7, which indicates that textbook 1 and textbook 2 were processed at the level of university textbooks intended for medical faculties.

	i	**h**
Textbook 1	23,37	62,67
Textbook 2	26,40	74,00
University textbook	8,0 - 37,1	23,9 – 81,8

Figure 7: Comparison of the share of professional information in textbook 1 and textbook 2 with textbooks intended for medical faculties

Discussion

The use of textbooks and the choice of a textbook depends mainly on the teacher. For each teacher something different is important and prefer different content or graphic processing. In our postscript, we analyzed one more complex whole of the teaching text focused on the biology of the cell, more precisely the chapter "Body structure and organization of the body of organisms", which was mainly devoted to basic information about the cell, especially the structural composition of cells. Pluskal (1966) states in his publication that "during the analysis of textbooks from the point of view of their content complexity carried out in the years 1985-1993, the authors of the analyzes repeatedly pointed to the phenomenon in which the textbooks of some elementary school subjects were, by their degree of difficulty, at the level of texts intended for schools and even came close to the texts of university textbooks." From the obtained data of our analysis, we also lean toward this phenomenon. The suitability of using textbook 1 - "Biology for the 2nd year of grammar school and the 6th year of grammar school with an eight-year study" was processed in her study by Páleníková (2016), in which she monitored the state of use of this textbook. Only 18 teachers from a total of 246 gymnasiums participated in the survey. Analyzing the suitability of this textbook, she presented questions to teachers from various perspectives and found the following:

- In biology lessons, up to 27.8% of teachers use the textbook in each lesson. 33.3% said that they use it only sometimes or rarely, and only 5.6% of teachers do not use it at all.

- Up to 66.7% of teachers use the textbook in various parts of the biology lesson. Only 11.0% of teachers use it in all parts of the lesson and 16.7% use it in only one part of the lesson.
- In the question monitoring the way the textbook is used in biology classes, 55.6% of teachers said that they use it to work with students during the entire lesson. The largest representation was the work of the textbook in the home preparation of students, which is used in this way by up to 77.8% of teachers. Only two teachers stated that they do not use the textbook in question in class, but neither do the students work with it.

From the results, we came to the conclusion that the processing of both biology textbooks is disproportionate to the age of the pupils for whom it is intended. From the analysis, it follows that the texts are processed very difficult in terms of difficulty, which reminds them of the texts of university textbooks, and thus puts a burden on the students. The amount of text in both textbooks is approximately the same and appropriate to the age of the students and the knowledge they should have after completing the given grade. We observe certain differences in the processing of the content of both textbooks. The first is that the subject matter in Textbook 1 occurs several times. Pupils repeatedly return to information that they have already learned. As an example, we can cite the life manifestations of organisms that are not part of it text analysis, but we encountered this element during the overall evaluation of textbooks. On the one hand, the textbook deals with life manifestations at the level of animals, within which it describes individual systems, and subsequently returns to them when describing these systems in humans.

Conclusion

It can be concluded that textbook 1, as well as textbook 2, is processed according to the state educational program, on the basis of which students should master the knowledge derived from the textbook after graduating from the relevant year. Textbook 2 is prepared in several parts with a logical sequence and continuity of individual concepts and processes.

In conclusion, it can be concluded that textbook 2 is more demanding compared to textbook 1, which was also reflected in the coefficients of the density of professional information, but it brings a greater amount of new insights and knowledge from the field of biology, which the students will use in their further studies.

Bibliographic references

Berelson, B. (1952). Content Analysis in Communication Research. New York: Free Press

Björnsson, C. H. (1968). Pedagogisskt Utvecklingsarbete vid Stockholms Skolor.6., Läsbarhet, Libert.

Dvorakova, I. (2010). Obsahova analyza/formalni obsahová analyza/ kvantitatívni obsahova analyza. V ANTROPOWEBZIN, 2.

http://www.antropoweb.cz/cs/obsahova-analyza-formalni-obsahova-analyza-kvantitativniobsahova-analyza
Ganajova, M. & Starosta, V. (2017). Hodnotenie kvality ucebnic. In Zborník vedeckých prác ZOPPO. 28(2)
GavorA, P. (2015). Obsahová analyza v pedagogickom vyskume. Pohlad na jej sucasne podoby. In Pedagogicka orientace [online], 25(3), [cit. 2023-03-04]. https://journals.muni.cz/pedor/article/view/3670/pdf_gavora doi: 10.5817/ PedOr2015-3- 345
Gavora, P. **(**1999). Uvod do pedagogickeho vyskumu. Bratislava: Univerzita Komenského. ISBN 80-223-1342-4
Gavora, P. & Srajerova, H. 2008/2009. Porozumenie textu zistovane clozetestom vzhladom k obtaznosti ucebneho textu. In Slovensky jazyk a literatura v skole 7-8 [cit. 2023 – 04 – 07].
Krippendorff, K. (2004). Content analysis: An introduction to its methodology. 2nd ed. Thousand Oaks, CA: Sage Publications. 413 p. ISBN 0761915451
Luo, A. **(**2019). Content Analysis | Guide, Methods & Examples. In Scribbr [online]. [cit. 2023-03-05] https://www.scribbr.com/methodology/content-analysis/
Petlak, E. **(**2016). Vseobecna didaktika. IRIS, ISBN 978-80-8153- 064-7
Pluskal, M. (1996). Zdokonaleni metody pro mereni obtíznosti didaktických textu. Pedagogika, 46,(1), 62-76.
Proksa, M. et al. (2008). Metodologia pedagogickeho vyskumu a jeho aplikacia v didaktikach prirodnych vied. Bratislava : Univerzita Komenskeho v Bratislave, ISBN 978-80-223-2562-2
Prucha, J. (1997). Moderni pedagogika. Praha: Portal. ISBN 80-7178-170-3
Prucha, J. (1998). Ucebnice: Teorie a analyzy edukacniho media. Brno: Paido, ISBN 80-85931-49-4
Rehus, M. (2016). Zviazane ucebnice (komentaár). V Institut vzdelavacej politiky in Ministerstvo skolstva, vedy, vyskumu a sportu SR. 1. [cit. 2023 – 03 – 29]. https://www.minedu.sk/data/att/9641.pdf
Rottensteinser, S. (2010). Structure, function and readability of new textbooks in relation to comprehension. In Procedia Social and Behavioral Sciences [online]. (2) [cit. 2023-03-04] https://www.sciencedirect.com/science/article/pii/S1877042810006518
Swieczkowski, D. & Kułacz, S**. (**2021). The use of the Gunning Fog Index to evaluate the readability of Polish and English drug leaflets in the context of Health Literacy challenges in Medical Linguistics: An exploratory study. In Cardiology Journal. 28(4). [online]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8277010/. DOI: 10.5603/CJ.a2020.0142
Skorecova, I., Zelenicky, L. & Teleki, A. (2014). Analyza citatelnosti textu. V Tvorivy ucitel fyziky VII. [online] [cit. 2023 – 04 – 03]. https://ufv.science.upjs.sk/_projekty/smolenice/pdf_14/31_skorecova.pdf
Smernica č. 1/2022 o edukacnych publikaciach [cit. 2023 – 04 – 03] 21797.docx (live.com)
Turek, I. (2014). Didaktika. Bratislava: Wolters Kluwer, s.r.o., 618 p. ISBN 978 – 80 – 8168 – 004 – 5

Usakova, K. et al. (2003). Biologia pre gymnazia 1. Bratislava: SPN, ISBN 800 – 80 – 3518 – 8
Visnovska, J. et al. (2012). Biologia pre 2. rocnik gymnazia a 6. rocnik gymnazia s osemrocnym studiom. Bratislava: SPN – Mlade leta. ISBN 978-8010-0228-61
Zujev, D. D. (1986). Ako tvorit ucebnice. Bratislava: SPN.
Zupko, J. (2022). Analyza tematu bunecna biologie v ceských ucebnicich prirodopisu: diplomová práca. Praha: Univerzita Karlova, 132 p.

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