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Text Comprehension and Text Readability: Findings on Lower Secondary School Pupils in Slovakia

This paper focuses on pupils' text comprehension as viewed through the perspective of text readability. Reading comprehension is a topic which is anchored in three disciplines: didactics, linguistics, and the theory of learning from text. Each of these disciplines contributes to the topic in a specific way. However, all of them aim at exploring the characteristics and processes needed by the reader in text comprehension.

Text comprehension is the most important result of text reading. In fact, reading a text without understanding it is a meaningless activity. In school, schoolbook text comprehension is of key importance. If the pupil understands the text well, its instructional content is properly integrated with the pupil's prior knowledge and remains longer in the memory of the pupil.

As concerns the instruction, it is the important for the teacher to assess how the pupil understood the text which was in the focus of instruction. Understanding text well is not only one of the major instructional objectives but it is also a precondition for the follow-up (after-reading) activities with the subject matter that the text contains. Therefore, the teacher should possess professional knowledge of how the process of reading comprehension proceeds, how it can be diagnosed and how the result of text comprehending can be objectively assessed. The teacher should possess knowledge of both strength and weakness of individual pupils in learning a text and he/she must make decisions of how these strengths can be utilized and how the weaknesses can be reduced.

Defining Text Comprehension

In the general term, text comprehension is **subjective interpretation** of meaning of the content of the text by the reader. This interpretation is subjective because every reader interprets the text uniquely. There is not such a thing that all people understand the same text identically. This is not possible because of their cognitive, social and cultural backgrounds that play an important role in text comprehension.

Text comprehension is a **constructive process** [Armbruster, 1993]. It is not a straightforward extraction of information the text contains, rather it is a creation of individual version of the text by the reader. This principle has utmost importance for instructional practices. Pupils differ in their knowledge of the world, experiences, values and attitudes. Therefore, they may produce different comprehension of the same test they had read.

Text comprehension runs in three levels. These are relationships:

- among text elements (words, phrases, sentences),
- between text elements and elements of objective reality that are described in the text,
- between text elements and elements of the cognitive structure of the reader [Gavora, 1992].

The text comprehension is efficient only if these three levels of relationships take place, i.e., if the reader understands the elements of the text, links them to his/her world knowledge and, in turn, associates them with his/her own cognitive structure.

Text comprehension falls into a broader category called **text learning** (learning from text). In addition to text comprehension, text learning includes remembering the information that a text contains. The outputs of text learning are also affective characteristics of a learner: changes in pupil's attitudes, motives and values. All these qualities are important in school instruction because they make pupils' learning complex and valuable.

It should be pointed out that throughout this article we concentrate on **expository texts** of textbooks only, and we neglect other text forms, especially the artistic texts, such as novels, short stories, poems, or drama which are used in the instruction. Expository texts bring the subject matter to be learned by pupils, and are usually supplemented with assignments, tasks, questions to be answered by pupils, or exercises.

Assessing Text Comprehension

There are several methods which serve the purposes of assessing the pupil's understanding the text. Many of them are those which are typically used by teachers, and they are also utilized by researchers. The most frequent methods to assess comprehension of expository texts are as follows:

- Text retelling. Retelling the content of the text either in detail (typically in rote learning) or paraphrasing it. However, rote learning does not secure text comprehension; therefore literal retelling of the text content is not a valid instrument to assess understanding.
- Questioning – answering close ended or open ended questions asked by the teacher or included textbook. An alternative form is self-questioning by the pupil.
- Text summarising. Text summary is a gist of the text. Expressing the text summary by pupils helps the teacher to assess how the pupil identified the text macrostructure. A similar, though less valid method, is to invent a title for the text, or headings for text paragraphs.
- Tests are frequent instruments to assess text comprehension. They can concentrate on specific elements or levels of the text and information processing. Good examples of professionally designed tests are those used in international surveys of reading literacy PIRLS and PISA. They use multiple-choice or fill in test items.

• Cloze test is a special form of test to measure comprehension. Because we used cloze tests in the research described in this article, we shall characterize the cloze test in more detail in the section Methods.

Some comprehension assessment methods are used solely by researchers; for teachers they are unnecessarily intricate:

• Eye movement of the reader detection reader while reading the text [Rayner, 1983].
• Think-aloud procedure – while reading the reader describes the thought processes [Kucan, Beck, 1997].
• Sentence verification technique [Royer, Greene, Sinatra, 1987] – a special technique to assess sensitivity of subjects to judge semantic differences in passages.

Cloze Test

Cloze test is a text passage from which some words are missing and the pupil's task is to fill in the appropriate words. Words may be deleted from the text either mechanically (every nth word) or selectively, depending on what aspect the test is intended to assess the pupil is scored on how many words were filled in properly. As the proper words to be filled can be objectively stated, cloze test is considered to be an objective measuring instrument. Most studies confirmed rather good reliability of cloze tests [Brown, 2002].

Cloze test first appeared in the work of Wilson Taylor [1953] who studied the effectiveness of cloze as an instrument for assessing the relative readability of written materials for school children in the United States [Brown, 2002]. Later it was used as a test of passage comprehension and even later as a measure of (foreign) language proficiency.

The name of the test as well as the theory behind it draws on the Gestalt concept of wholeness in psychology. Gestalt theory views phenomena as organized structures, or wholes, rather than as combinations of separate units. It reflects the tendency of people to complete incomplete figures such as rectangles or circles. In a cloze test the testee must concentrate to extract the meanings of larger chunks of the text rather than to concentrate on details. Cloze tests rests on understanding of the context of a given passage.

Very soon after its „invention", cloze tests gained much popularity. It was because they are easy to construct – any text can be converted to cloze by deleting appropriate number of words and asking subjects to fill in the blanks). Cloze tests are also easy to score by counting the number of correctly filled in words.

The leading principles of cloze tests construction were summarized as early as in the 1960's [Bormuth, 1967]:

• The span between two blank places must be kept equal throughout the test.
• Blanks spaces must be of uniform length.
• The frequency of deletions is usually the 4th, 5th, 6th or 7th word – the larger the interval, the more difficult is the cloze.
• The testees must not see the text prior to the cloze test administration.
• The testees must be instructed on how the test will be scored – exact words only or synonyms as well. (However, exact word scoring method yields the most valid results)
• Word misspellings do not affect the scoring unless they change the meaning of the filled in word.

Text Readability

Readability is one of the most important text properties that affect the text comprehension. Usually it is defined as **the ease In which text can be read and understood**. In the literature this text attribute has also other names, e.g., text difficulty, text comprehensibility or text complexity. They are considered to be synonyms, that is, words with similar though not identical meanings. Text difficulty is, however, antonym of text readability. In this article we shall consistently use the word readability, and only in specific situations we shall refer to the term text difficulty.

Readability is a linguistic concept covering several grammatical and lexical parameters that are important in text processing by the reader. They are related to the ease with which the reader can understand and remember the information the text contains. Readability can be assessed either in a subjective way or by objective measures.

Subjective assessment of readability relies on judgments of text specialists (researchers) or readers on specific properties of the text. In the educational context, texts are judged by their users: teachers and pupils. They are asked to assess text qualities by means of scales, questionnaires or interviews [cf. Mikk, 2000].

Objective assessment of readability relies on exact linguistic measurement. Usually, a combination of the following text parameters is used:
- Word length in syllables – short words are more frequent, are easier to understand, long words are less frequent [Mistrík, 1969]. Long words are usually abstract expressions and are less known by the young reader.
- Length of sentences – short sentences are easier to understand than long sentences. Long sentences express complex ideas.
- Word iteration – this brings redundancy, which is very helpful in text understanding.
- Proportion of verbs to substantives – substantives are usually more difficult than verbs, verbs are „action words".
- Concrete words vs. abstract words – regardless of word category, concrete words are more frequent in everyday speech, and are easier to understand.

Most of these text parameters are used in **readability formulae** designed by researchers. They are mathematical expressions that combine several aforementioned text characteristics to compute an overall index of readability. It is estimated that there exist over 200 text formulae for many languages.

The pioneer of text formulae design was R. Flesch who published his Reading Ease formula in 1948. His formula is as follows:

Reading Ease score = 206.835 – (1.015 x ASL) – (84.6 x ASW,)
Where: ASL = average sentence length (number of words divided by number of sentences),
ASW = average word length in syllables (number of syllables divided by number of words).

In Poland, the readability formula for the Polish language was designed by W. Pisarek [1966, 1969]. In Sweden the author of readability formula is C.H. Björnsson. R. Bamberger and E. Vanecek or K. Nestler are authors of the German text readability formulae. In Slovakia it was the linguist J. Mistrík who designed the formula for the Slovak texts [Mistrík, 1982].

In the section Methods we shall deal in detail with two formulae used in our research, i.e., the Nestler formula [as adapted for the Czech and Slovak languages by Průcha, 1987; 1998 and Pluskal, 1996], and the Mistrík formula [1969; 1982].

Research

The purpose of this research was twofold. First, the aim was to identify how the pupils' scores in text comprehension relate to pupil characteristics. The characteristics we chose are those that are considered to be basic data of pupils: year of schooling (school grade), gender and school locality. School year reflects the developmental aspects of children, gender relates both to biological, cognitive and social maturing of the child, and locality represents social and cultural factors of the particular school and community.

Second, the aim was to relate the pupil's scores in text comprehension to text readability. Text readability, or easiness of the text to understand, is one of the fundamental qualities that determines the learning of the text. In fact, it affects the magnitude of cognitive efforts the pupil must devote to the text processing.

We formed four **hypotheses**: three of them concern the performance of pupils in text comprehension, and the fourth predicts the relationship between the text comprehension score and text readability.

H1. The higher the year of schooling, the better the scores of pupils on cloze test.
H2. Girls outperform boys on cloze tests scores.
H3. Pupils from a city (Bratislava) outperform pupils from a small town (Senec) on cloze test.
H4. The higher scores in cloze test, the better the readability of the text that served as a basis to create the cloze test.

Methods

Texts Used. For the purpose of research we chose three geography expository texts of about 200 words long. The texts were written in the native language of pupils in this sample (Slovak). The first text was called „Movement of the Earth", the second „The Solar System", and the third was entitled „Earth Rotation". In the following sections the texts will be labelled as text No. 1, No. 2, and No. 3.

We considered it to be important that the texts were not identical to those used in instruction of pupils in this sample. The aim was to concentrate on comprehension rather than on assessing the knowledge by pupils. Therefore, two texts were adopted from older geography textbooks for year 5 that were not in use any more, and the third one was adapted from an upper secondary school textbook the pupils did not have access to.

Measures of Readability. Two measures were used to ascertain how easy were the texts to understand, i.e., the Nestler formula and the Mistrík formula.

The Nestler formula. This formula was developed by the German linguist Käte Nestler [1982]. Later it was adapted to be used in the Czech and Slovak educational environment by J. Průcha [1984; 1989], and even later it was slightly modified by M. Pluskal

[1996]. This formula has been extensively used in the Czech and Slovak educational research to measure reading „difficulty" of textbooks. In these countries it has been considered to be a standard instrument for measuring readability of expository texts. Such as, it served in evaluation of many primary and secondary school textbooks as a part of analyses of their quality [e.g., Průcha, 1989; Hrabí, 2004; Janoušková, 2009]. Based on these measurements, many important recommendations were developed on how to improve the expository parts of primary and secondary school textbooks.

The readability index of texts according to this formula may range from 1 to 100. To assess the readability of a text, first its syntactical and semantic properties must be determined. The formula is $T = T_s + T_p$, where T_s represents syntactical difficulty and T_p represents semantic difficulty of the text. The larger the T, the more difficult is the text to understand. The syntactical and semantic difficulty is calculated by the formula:

$$T_s = 0{,}1 \cdot V \cdot U$$

where   V is the average length of sentences,
        U is the average length of predicate propositions, i.e., number of words divided by number of verbs in the sentence.
    The semantic difficulty is computed with the formula:

$$T_p = 100 \cdot \frac{\Sigma P}{\Sigma N} \cdot \frac{\Sigma P_1 + 3\Sigma P_2 + 2\Sigma P_3 + 2\Sigma P_4 + \Sigma P_5}{\Sigma N}$$

where   N is the number of words,
        P_1 is the number of common concepts,
        P_2 is the number of special concepts (e.g., concepts of geography, biology, etc.),
        P_3 is the number of factual information (proper names, names of institutions, geographical names)
        P_4 is the number of numerals,
        P_5 is the number of recurrent concepts of P_1 through P_4.
    To measure the difficulty of a textbook, ten segments of approximately 200 words must be analyzed and the average T for these segments must be calculated.

The Mistrík formula. This formula was developed by Jozef Mistrík [1982], a renowned Slovak linguist. The advantage of this formula is in its simplicity. Only three parameters are needed to compute the text readability. The formula R (R for readability) is as follows:

$$R = 50 - \frac{\lambda_s \cdot \lambda_v}{I_0}$$

where λ_s is the average length of words in number of syllables,
        λ_v is the semantic difficulty as expressed by the average length of sentences in number of words,
        I_0 is the variability of words which is calculated as the proportion of all words to the number of different words.

The elements of this formula are based on these considerations: the length of a word is an important factor in readability – the longer the word, the more difficult is its semantic meaning. The longest words in a sentence are usually scientific concepts. Likewise, the longer the sentence, the more difficult to understand it. Complex ideas are usually expressed in long sentences. Variability of words is the index of repeated words. The more words re-occur, the easier the text is to understand because of its redundancy.

As concern the scoring, contrary to the Nestler formula, in this formula the higher R, the easier the text.

To measure text comprehension we converted the three texts to **cloze tests**. Each of them had every sixth word omitted.[1] We used mechanical omission, i.e., the sixth word was deleted regardless of its linguistic or content characteristics. The number of blanks was 31 or 32, gave the maximum scores of either 31 or 32. The scoring criteria were exact words or synonyms inserted by pupils. The first two or three sentences of test were intact to provide context for the reader.

The sample consisted of 289 pupils who attended years 5-9 (average ages 11 to 15 years). Out of them 139 were girls and 150 were boys. They attended schools in two localities that differed as concerns magnitude – Bratislava with population of 500,000 and Senec with population of 15,000. Both towns are located in western Slovakia.[2]

First, we shall present the **results** of pupils in **the cloze tests**. The scores of pupils on each of the cloze test are in Table 1. Because the three cloze tests have different scores (as we have mentioned, the maximum score was either 31 or 32), to equalize the scores we converted the scores to percentages, i.e., the maximum possible score was 100. As it can be noticed, the pupils' scores on three tests varied. The highest score was on Cloze No. 2, and the lowest score was on Cloze No. 3.

Table 1. Adjusted scores on three cloze tests

	M	SD
Cloze No. 1	56,9	17,9
Cloze No. 2	62,4	16,1
Cloze No. 3	33,7	16,0
Cloze total	50,9	14,8

M = mean
SD = standard deviation

The average score on the three test was 50,9 points. This means that in average the pupils filled little bit more than half of the blanks in the texts. The question is how to interpret this result. Because of their variability, cloze test is not standardized and

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[1] In the preparatory phases to this research we used the deletion of the fifth word. Such cloze texts were too difficult for pupils in the 5th year we extended the interval to use the omission of the sixth word.

[2] The data in schools were gathered by Hana Šrajerová as a part of her master's thesis under the guidance of the author.

there are no norms for it. However, according to M. Dupuis [1980, quoted by Greger, 2005] the score of 40 or higher should be considered optimal if the method of scoring is exact words. If synonyms are accepted then the optimal score is 48 or higher. This was our case. However, R.G. Chattel [2001, p. 4] set the acceptable score with synonyms higher – 70 points. If pupils' score bellow 70, the text is probably too difficult or the pupils' skill to comprehend the text is weak, or both.

As concerns the performance on each cloze test, the pupils exceeded the level of 40 points in two cloze tests and failed to reach this level on Cloze No. 3. This indicates that Cloze No. 3 was more difficult than the two remaining tests.

Cloze Scores in Different Years of Schooling

As concerns the years of schooling, the hypothesis H1 stated that the higher the year of schooling, the higher the scores of pupils. Increase in performance in text comprehension during years is attributed to length of practice and to wider range of text content used in school and outside the school.

Fig. 1 shows that, with slight fluctuations between years 6 and 7 on Cloze No. 2 and No. 3, this hypothesis was confirmed. In each year the performance of pupils was better than that in the previous year.

This indicates two things. First, text comprehension relates to years of schooling because each year pupils expand their experiences with texts and improve the reading skills. Pupils read more (in and outside the school), they expand their vocabulary, and they read texts with a wider range of contents and contexts. Second, the results show that cloze tests do not assess knowledge of the subject matter. The geography topics that were in the tests were taught in year 5 but since that year on the scores on the tests increased though pupils might forget the subject matter they had learned in year 5. This documents that cloze tests are measures of text comprehension rather than tests of geography knowledge.
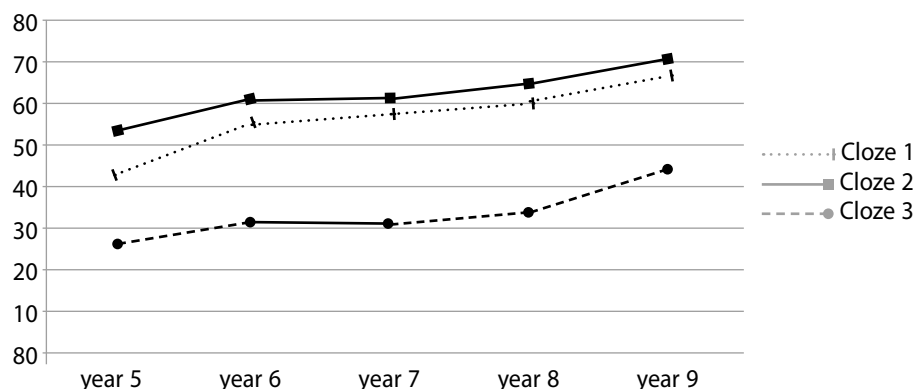

Fig. 1. Scores on cloze tests according to years of schooling

Differences between Genders

As concerns, the gender, we hypothesized that girls would outperform boys on cloze tests. The literature consistently presents evidence that girls perform better than

boys in verbal tests. The international studies of reading literacy PIRLS and PISA bring convincing data about the gender differences in favour of girls in many countries. The explanation of the difference is simple: Girls have larger interest in reading and have larger reading experience than boys have. They are also more accelerated in cognitive development than boys in the same age group. As concerns the cloze tests research, the findings of Karrafová [2006] in year 6 in Slovakia and Greger [2005] in years 7-9 in the Czech Republic proved the between-gender differences.

Our findings are in Table 2. Girls outperformed boys in all cloze tests; however, the statistical difference was only on Cloze No. 1 and in the total score. On Cloze No. 2 the difference in favour of girls was at the borderline of statistical significance. The hypothesis H2 was confirmed only with Cloze No. 1 and the total score.

Table 2. Differences between girls and boys on cloze tests

	N	Cloze No. 1	Cloze No. 2	Cloze No. 3	Cloze total
Girls	139	59,5	64	35,6	52,8
Boys	150	54,6	61	32	49,1
p (ANOVA)		0,020+	0,111-	0,054-	0,035+

N = number of pupils; p = statistical significance
+ = significance at the 5 % level; - = non-significant

Differences between Localities

Pupils of two localities participated in this research. They come either from a city of 500.000 inhabitants (Bratislava, the capital of Slovakia), or a small town of 15.000 inhabitants. We hypothesized that pupils from Bratislava will outperform pupils from the small town. This hypothesis was based on the notion that verbal characteristics are strongly affected by cultural and social environment of subjects. We expected that schools in a big city provide better educational, cultural and social opportunities and this, in result, will lead to higher scores on cloze tests. As seen in Table 3, the hypothesis H3 was refused; there was no statistical difference between the localities. Obviously, the size of the locality is a robust factor and it may not influence pupils in a way we had expected. In addition, the small town lies in the vicinity of Bratislava and schools and many families make use of cultural and social facilities of this city.

Table 3. Differences between scores on cloze tests in two localities

	N	Cloze No. 1	Cloze No. 2	Cloze No. 3	Cloze total
Bratislava	184	56,3	62,1	32,7	50,5
Senec	105	58,1	62,9	35,5	52,1
p (ANOVA)		0,515-	0,732-	0,365-	0,440-

N = number of pupils; p = statistical significance
- = non-significant

Cloze Tests Scores and Text Readability

As early as in 1950's Taylor, the originator of the cloze test, found that cloze tests scores ranked the texts in the same order the readability formulas ranked them [Taylor, 1953]. This resulted in the belief that text readability and cloze tests scores correlate. If a cloze test is used for a passage, then the mean score of pupils on the cloze test is the measure of the passage readability. Our hypothesis followed Taylor's dictum. The hypothesis H4 stated that the higher scores in the cloze test, the better readability.

To remind the reader, texts Nos. 1, 2, and 3 were identical with Cloze Nos. 1, 2 and 3. The only difference was that in cloze tests every sixths word was omitted to be filled in by pupils. As described in the section Methods, two measures of assessing text readability were used, the Nestler formula and the Mistrík formula.

According to **the Nestler formula**, the three texts used in this research had the following readability levels:

- text No. 1: T = 29,4
- text No. 2: T = 41,4
- text No. 3: T = 45,2

As we see, the easiest was the first text and the most difficult was the third one. It is worthwhile to compare our results with those in the research of Prucha [1998]. In Czech geography textbooks for years 5 through 9 he found T ranging from 33,1 (year 5) to 51,5 (year 6), with average T of 40,2. Our texts fall within the range of Prucha's findings and can be said to be appropriate for this age group of pupils.[3]

According to **the Mistrík formula**, readability of the texts is as follows:

- text No. 1: R = 35,1
- text No. 2: R = 37,1
- text No. 3: R = 13,3

By the formula, the easiest was text No. 2 and the most difficult was text No. 3 (The higher R, the easier the text). How to interpret these data? In contrast to the Nestler formula, which has been extensively used in this country and there are many data on readability of textbook passages based on this formula, the Mistrík formula has been used rarely. In fact, we found only one research which used this formula to assess readability. Greger [2005] calculated the Mistrík R for four history textbooks for years 7-9 of schooling. The Rs in these four texts were: 27,9 (The easiest text), 24,7; 23,1 and 13,8 (The most difficult text). To compare, our texts were somewhat easier than his texts.

To sum up the readability calculations, the two formulas did not yield identical results as concerns the **order of readability** of the texts used.

Our further aim was to compare theses results with those of cloze scores of pupils. In fact, with this procedure we validated the results of readability formulae. The formula which corresponds best with close test results has the best validity as concerns the readability. Table 5 shows ranking of cloze tests and readability as calculated by the Nestler and the Mistrík formulae.

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[3] To compare, according to calculations of E. Janoušková [2009]. readability of upper secondary school geography textbooks ranges from 35,2 to 49,2. She analyzed 15 textbooks published by three Czech publishers.

Table 5. Cloze test scores as compared to ranking of readability of the texts used

	Ranking of cloze scores	Ranking of T (Nestler)	Ranking of R (Mistrík)
Text No. 1	2	1	2
Text No. 2	1	2	1
Text No. 3	3	3	3

As the table shows, it is readability according the Mistrík formula which corresponds best with the cloze test results. Readability of all the three texts follows the trend of results of the cloze tests. The easiest text (text No. 2) had the highest score, followed by text No. 1, and text No. 3. The Nestler formula failed to follow this order and it differs in texts Nos. 1 and 2 from the order of results on cloze tests. Thus, the Mistrík readability formula in this research proved better validity as concerns the assessment of text readability when compared with pupils' scores on cloze tests. It is this formula which confirmed our hypothesis H4: the better scores on the cloze test, the higher the readability of the text that served as a basis to create the cloze test.

Discussion

In this research we concentrated on assessing pupils' achievement on cloze tests with geography topics. The results confirmed the original assumption of the cloze test's „inventor", W. Taylor, that this test concentrates on text comprehension rather than on pupils' knowledge of the specific content. In other words, it is more a test of skills rather than of memory. Furthermore, cloze test is a good measure of overall comprehension rather than comprehension of individual elements of the text. The testee must consider the broad linguistic context of the test when filling in the blank spaces in the cloze test. But cloze test is not only a language test. The testee must use broad knowledge of the world when doing the test – without it he/she would not know what is the test's content about.

We obtained findings about three pupil variables related to cloze test scores – year of schooling, gender and locality. Out of them, locality seems to be the weakest variable. In spite of the different magnitude of localities, the scores of pupil on cloze test did not differ. This can be attributed to the vicinity of the small town to the city, and to the cultural and social influence of the city on the small town. As concerns the years of schooling, the best fit with hypothesis H1 was in cloze No. 2. Interestingly, this test had the highest readability according to the Mistrík formula, which, again, proves the validity of this formula for text readability assessment. As concerns the gender differences on cloze tests, hypothesis H2 was confirmed in the total score, and on cloze test No. 1. On cloze test No. 2 was the difference in favour of girls only slightly bellow the statistical significance level.

The readability formulae that we used helped to interpret the data and to test the hypothesis H4. The Mistrík formula proved to be somewhat more valid than the Nestler formula. However, it should be noted that these formulae are not without bias. Though they were designed on professional knowledge of text properties by their authors, they were never fully validated with Czech or Slovak educational texts. Though they are considered to be objective instruments to measure text qualities, using them

sometimes requires subjective judgement. This is true especially about the Nestler formula which calls for judgement which word is a common concept (or P1 in its notation) and which is a special concept (P2). Also, the coefficients by which P1, P2, P3, P4 and P5 are multiplied to calibrate their difficulty are somewhat arbitrary. Greger [2005] sums up a long discussion about this problem in the Czech Republic. The Mistrík formula requires fewer subjective judgments and therefore in this research proved to be more valid. This is because counting the number of syllables, sentences and word iteration is more objective.

The findings contribute to the discussion on what properties should instructional texts have and how they should be written. However, the findings are confined to the size and properties of the sample taken in this research and must not be broadly generalized. We concentrated on geography texts which have peculiarities of their own – the peculiarities that differ from texts with, for instance, biology, mathematics or literature topics. This, too, restricts the power of our findings.

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