NATURAL SCIENCE TEXTBOOKS FOR THE FIFTH GRADE AND THEIR TEXT DIFFICULTY

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Abstract
This article presents knowledge of the text difficulty evaluation of six current Czech natural science textbooks for the fifth grade. The text analysis was carried out by Průcha’s modified method. Results indicate that text difficulty is similar in four studied textbooks (28 points). They are books of these publishing companies – Alter, Fortuna, Prodos, SPN, which can be used in fifth grade of education.

Key words
Natural science textbooks, syntactic factor, semantic factor, text difficulty.

Introduction
In our country there are many publishing companies, which produce a large range of books and textbooks. Natural science textbooks are published by six or more companies in the Czech Republic. There are not many pedagogical
research workers, who are interested in a complex research of textbooks (Pluskal 1996). One of the most important things is to distinguish basic content from expanding content of the curriculum. Basic content of the curriculum presents a smaller part of expanding text in textbooks.

It is possible to study textbooks from different points of view – analyses of the text difficulty, tasks, sources of nonverbal information and others. Some text analyses have been realized by these authors – Hrabi 2003, 2005, 2009, Olechowski 1995, Ottich – Kowalczyk 1992, Průcha 1984, 1997, Shepardson – Pizzini 1991, Schmidt 1991. At this time is not such research widespread.

That is why the aim of this article is to bring results of some textbook evaluations.

**Material and methods**

Text difficulty was examined out in six natural science textbooks for the fifth grade. Natural science textbooks of the publishing companies Alter (1996, 1997), Fortuna (2001), Nová škola (2004), Prodos (1997), Scientia (1997) and SPN (2004) were examined. Ten samples of text from each textbook were examined according to Průcha’s modified method (Hrabi 2005) by random sample. Each sample consisted of 100 or more words (ΣN). Particular characteristics, their symbols, definitions, ways of calculation are written as follows:

\[ T - text\ difficulty; T = T_s + T_p \text{ (points)}, \]

\[ T_s - syntactic factor; T_s = 0.1 \times \bar{V} \times \bar{U} \text{ (points)}, \]

\[ \bar{V} - average\ length\ of\ sentence\ (number\ of\ words), \]

\[ \bar{U} - syntactic\ complexity\ of\ sentence\ (number\ of\ words), \]

\[ T_p = 100 \times \sum_{N} P \times \sum_{P} P_1 + 2 \sum_{P} P_2 + 3 \sum_{P} P_3 \text{ (points)} \]

\[ \bar{V} = \frac{\sum_{N} N}{\sum_{V}} \]

\[ \bar{U} = \frac{\sum_{N} N}{\sum_{U}} \]
Results

The most important characteristics of the text difficulty are written in Table 1. The total number of analysed words varies from 1006 to 1062 in the studied natural science textbooks. They form from 87 to 95 sentences. The average length of one sentence is about 11–12 words. Syntactic complexity of one sentence achieves only 7 or 8 words. The total number of common terms is quite different in the studied textbooks and achieves from 58 to 120 terms. The total number of scientific terms is very different and varies from 163 to 271. The number of factual terms achieves from 0 to 42. Values of the syntactic factor reach from 7.88 to 9.66 points. The lowest value is characteristic for the textbook of Scientia publishing company. It shows that this book contains short sentences and has a low complexity of one sentence. Values of the semantic factor vary from 15.29 to 24.30 points. According to this study it is possible to mention that the textbook of Scientia publishing company does not contain many substantives in sentences. In contrast, the textbook of Nová škola publishing company has many substantives in each sentence.

Coefficients of density of scientific and factual information (i) achieve from 18.29 % to 29.32 %, and coefficients of scientific and factual information (h) fluctuate between 60.53 % and 73.27 %. This shows that studied natural science textbooks contain various density of scientific and factual information.
Obtained results of the text difficulty evaluation show that majority of studied natural science textbooks have texts of similar difficulty – about 28 points. They are textbooks of these publishing companies – Alter, Fortuna, Prodos, SPN. In contrast, the textbook of Scientia publishing company has a text of low difficulty – 23 points, and the textbook of Nová škola publishing company has a text of high difficulty – 34 points.

Main components of the text difficulty are given in Graph 1. Received values of the syntactic factor (Ts) show similar complexity of sentences. Values of the semantic factor (Tp) are similar in majority of studied textbooks. Values of the text difficulty are very near in four textbooks.

**Table 1** Main characteristics of the text difficulty in natural science textbooks for fifth grade (studied by Průcha’s modified method)

| Characteristic | Alter | Fortuna | Nová škola | Prodos | Scientia | SPN |
|---------------|-------|---------|------------|--------|----------|-----|
| ΣN            | 1059  | 1062    | 1047       | 1015   | 1006     | 1048|
| ΣV            | 92    | 95      | 93         | 89     | 95       | 87  |
| ΣU            | 143   | 127     | 122        | 133    | 135      | 132 |
| V             | 11.5  | 11.18   | 11.26      | 11.40  | 10.59    | 12.00|
| U             | 7.46  | 8.36    | 8.58       | 7.63   | 7.45     | 7.94|
| ΣP₁           | 98    | 74      | 65         | 80     | 120      | 58  |
| ΣP₂           | 211   | 271     | 270        | 232    | 163      | 239 |
| ΣP₃           | 42    | 0       | 37         | 26     | 21       | 31  |
| ΣP            | 351   | 345     | 372        | 338    | 304      | 328 |
| Ts            | 8.58  | 9.35    | 9.66       | 8.69   | 7.88     | 9.53|
| Tp            | 20.22 | 18.84   | 24.30      | 19.55  | 15.29    | 18.78|
| T             | 28.8  | 28.19   | 33.96      | 28.24  | 23.17    | 28.31|
| i             | 23.89 | 25.52   | 29.32      | 25.42  | 18.29    | 25.76|
| h             | 64.05 | 70.57   | 73.27      | 65.98  | 60.53    | 71.81|
Conclusion

This paper presents findings about evaluation of the text difficulty in six natural science textbooks for the fifth grade. Results indicate that text difficulty is similar in four studied textbooks (28.19–28.8 points). They are books of these publishing companies – Alter, Fortuna, Prodos and SPN. The above-named textbooks can be used in educational process. The text difficulty is very low in the book of Scientia publishing company (23.17 points) and the most difficult text is in the book of Nová škola publishing company (33.96 points). The average value of the text difficulty achieves 28.45 points. The textbooks of Scientia publishing company and Nová škola publishing company could not be used in fifth grade.

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