NATURAL SCIENCE TEXTBOOKS FOR THE FIFTH GRADE AND THEIR TEXT DIFFICULTY

Libuše Hrabí

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.

Učebnice přírodovědy pro pátý ročník a jejich obtížnost

Abstrakt

V článku jsou obsaženy poznatky o hodnocení obtížnosti textu v šesti současných českých učebnicích přírodovědy pro pátý ročník základní školy. Analýzy textů byly provedeny modifikovanou metodou dle Průchy. Dosažené výsledky ukazují, že náročnost textu je obdobná ve čtyřech studovaných učebnicích (28 bodů). Jsou to knihy těchto nakladatelství – Alter, Fortuna, Prodos, SPN, jež mohou být používány v pátém ročníku.

Klíčová slova

Učebnice přírodovědy, syntaktický faktor**,** sémantický faktor, obtížnost textu.

Introduction

In our country there are many publishing companies, which produce a large range of books and textbooks. Natural scince 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, surces of nonverbal information and others. Some text analyses have been realized by these authors – Hrabí 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 (Hrabí 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; $T = T_s + T_p$ (points),

T_s – syntactic factor; $T_s = 0.1 \times \overline{V} \times \overline{U}$ (points),

$\overline{V}$ – average length of sentence (number of words),

$\overline{U}$ – syntactic complexity of sentence (number of words),

T_p – semantic factor,

$$T_p = 100 \times \frac{\sum P}{\sum N} \times \frac{\sum P_1 + 2\sum P_2 + 3\sum P_3}{\sum N} \text{ (points)}$$

$$\overline{V} = \frac{\sum N}{\sum V}$$

$$\overline{U} = \frac{\sum N}{\sum U}$$

ΣN – number of words
ΣV – number of sentences
ΣU – number of regular verbs
ΣP – number of substantives
ΣP_1 – number of common terms
ΣP_2 – number of scientific terms
ΣP_3 – number of factual terms

$$i = 100 \times \frac{\sum P_2 + \sum P_3}{\sum N}$$ – coefficient of density of scientific and factual information (%)

$$h = 100 \times \frac{\sum P_2 + \sum P_3}{\sum P}$$ – coefficient of density of scientific and factual information (%)

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.

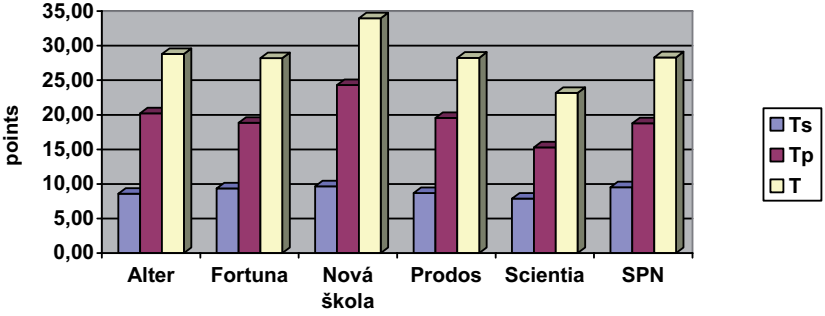
Obtained results of the text difficulty evaluation show that majority of studied natural science textbooks have texts of similar difficulty – about 28 points. They are textbooks of these publishing companies – Alter, Fortuna, Prodos, SPN. In contrast, the textbook of Scientia publishing company has a 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)

	Publishing companies					
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
$\overline{V}$	11.5	11.18	11.26	11.40	10.59	12.00
$\overline{U}$	7.46	8.36	8.58	7.63	7.45	7.94
ΣP_1	98	74	65	80	120	58
ΣP_2	211	271	270	232	163	239
ΣP_3	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

Graph 1 Values of the text difficulty (T), syntactic factor (Ts) and semantic factor (Tp) in studied textbooks



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.

Literature

- HRABÍ, L. Zhodnocení obtížnosti výkladového textu současných českých učebnic přírodopisu pro 6. až 9. ročník ZŠ. *e-Pedagogium* (on-line), 2003, č. 1. Dostupné na www: http://epedagog.upol.cz/eped1.2003/clanek03.htm
- HRABÍ, L. *Hodnocení obtížnosti učebnic přírodopisu*. Olomouc, 2005. 121. Habilitační práce na UP Olomouc.
- HRABÍ, L. Biology textbooks of Fraus publishing company and their text difficulty. *e-Pedagogium* (on-line), 2009, č. 1. Dostupné na www: http://epedagog.upol.cz/eped1.2009/clanek04.htm

- PLUSKAL, M. *Teorie tvorby učebnic a metody jejich hodnocení*. Olomouc, 1996. 152. Habilitační práce na UP Olomouc.
- PRŮCHA, J. *Hodnocení obtížnosti učebnic.* Praha: SNTL, 1984. 96.
- PRŮCHA, J. *Moderní pedagogika.* Praha: Portál, 1997. 279.
- SCHMIDT, H. J. *Hilfen für die Auswahl von Schulbüchers*. Grundschule, 23, 1991, n. 9. 50–52.
- OLECHOWSKI, R. Aspekte der Schulbuchforschung. *Erziehung und Unterricht*, 1995, vol. 145, n. 4. 266–270.
- OTTICH, K., KOWALCZYK, W. Das habe ich nicht verstanden! *Pedagogische Welt*, 1992, vol. 46, n. 8. 341–344.
- SHEPARDSON, D., PIZZINI, E. Questioning levels of junior high school science textbooks and their implication forlearning textual information. *Science Education*, 1991, vol. 23, n. 9. 50–52.

Evaluated textbooks

- BRADÁČ, P., KOLÁŘ, M. et al. *Přírodověda 5*, Člověk a technika. Praha: Alter, 1996, vol. 1. 47.
- HOLOVSKÁ, H., RÜKL, A. *Přírodověda 5*. Země ve vesmíru. Praha: Alter, 1996, vol. 2. 39.
- JURČÁK, J. et al. *Přírodověda pro 5. ročník*. Olomouc: Prodos, 1996. 87.
- KHOLOVÁ, H. et al. *Přírodověda 5*. Život na Zemi. Praha: Alter, 1997, vol. 3. 61.
- KOMANOVÁ, E., ZIEGLER, V. *Přírodověda 5.* Praha: Scientia, 1997. 125.
- KVASNIČKOVÁ, D., FRONĚK, J. ŠOLC, M. *Přírodověda pro 5. ročník*. Praha: Fortuna, 2001. 95.
- MATYÁŠEK, ŠTIKOVÁ, V., TRNKA, J. *Přírodověda 5*. Brno: Nová škola, 2004. 87.
- MLADÁ, J., PODROUŽEK, L. et al. *Přírodověda pro 5. ročník*. Praha: SPN, 2004. 95.

Address:
Doc. RNDr. Libuše Hrabí, Ph.D.,
Department of biology PdF UP,
Purkrabská 2,
771 40 Olomouc