

# Analysis of a selected professional text in a professional secondary school textbook

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## Abstract

This paper analyses a professional text of a textbook used at secondary school level. The aim of this analysis is to determine the average complex text difficulty rate of a selected professional text. At the same time, the analysis focuses on the density of technical expertise information in the number of terms.

### Keywords:

Textbook  
Measurement of didactic equipment of the textbooks  
Difficulty of the text

## 1 Introduction

Textbooks, whatever their form, are still a part of education at all levels and types of schools. After the liberalization of textbook market in the 90s of the 20th century, the textbooks have become attractive merchandise for the constantly expanding network of textbook publishers. The number of textbook publishers is currently approaching already seventy and the number of books they offer over a thousand various titles. This is one of the reasons why it is necessary to pay the textbooks an increased research attention. The findings, which textbooks research already has, are often built solely on intuition or long-term pedagogical experience. Conclusions thus formulated are often correct, nevertheless, they lack a broader empirical research anchoring. Schools use e-learning materials as educational resources, employ a range of media and teach and test a wide scale of information and communication technologies. Recent surveys show that textbooks fought successfully off the attack of these competitors and, as for school practice in primary and secondary education, their position remains among the dominant didactic media. Nonetheless, for the authors the procedures of textbook creation are crucial while for the teacher it is the choice of textbooks. According to the latest research, the textbooks should better reflect the requirements and recommendations of educational research. According to Knecht many shortcomings of the textbooks stem from a failure to respect cognitive dispositions of students. (Knecht, 2008, p.6)

As a school focusing, as for the pedagogical issues, on the didactics of technical programmes, we wanted to prepare a sample analysis of selected professional textbooks used in secondary schools. In the future, we want to employ the knowledge and skills related to analysis and evaluation of the quality of textbooks in foreign language vocational training using the Content and Language Integrated Learning (CLIL) method. Therefore, we are interested in the following data - comprehensive measurement of text difficulty, density of professional information as for the number of terms and concepts of term reasonableness relating to age. In 2011-2013, the expert group *Languages in education and training* was focused on possible ways to improve the results of the study of foreign languages. They carried out a comparative analysis on the basis of a report on innovative and scientifically proven methods of accelerating the languages learning. *Improving the effectiveness of language learning: One of the two main themes is the Content and Language Integrated Learning (CLIL)*.

Průcha J. (2008) has been involved in textbook research and evaluation. According to Průcha, current textbook research neglects important aspects such as learning situations, learning activities of pupils,

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processing of didactic information by pupils, the state of language skills of pupils and level of their reading literacy. It is obvious that a good Textbooks fall into curriculum research, within which they represent a specific area. (Janík, Knecht, 2008, p.10) They can be viewed from many perspectives - in a narrower context they can be understood as a product, a curriculum project or as a means of teaching; in a broader context, we can focus on the processes of their formation, approval, use, evaluation and so on. (cf. Fig. 1). We consider it necessary to deal with the issue of research methodology of textbooks, because there is a lot of unanswered questions, particularly relating to the objectivity and reliability of data produced by textbook research.

### Methods for evaluating the quality of textbooks

Every textbook - like any educational medium - has certain characteristics. The aim of the research was

- to define and identify these qualities accurately
- to somehow measure and evaluate, if possible, these qualities
- to predict what effects certain characteristics of a specific textbook can have in real school education.

For this purpose many techniques and evaluation tools have been developed characterized mainly by Průcha. (Průcha, 1998, Průcha, 2002)

As regards the identification of the textbooks characteristics: various taxonomies for various structural textbooks components have been developed. The general structure of a textbook model can be expressed by the following equation: Textbooks - verbal components - nonverbal components (structured into specific components) (structured into specific components). The following essential questions may be inferred just from that simple scheme: What should be the optimal proportions of verbal and visual textbook components? How should these proportions be adapted to the differing ages and abilities of students? What is the didactic effectiveness of verbal and nonverbal textbook components? These issues are addressed from a position of psychodidactics, particularly in relation to how students perceive, process and utilize the information carried by both the constituents of the textbook (Průcha 1998). If we look at the current school textbooks, published by different publishers, we find that they are, as these issues are considered, very varied.

### Measurement of didactic equipment of the textbooks

As for the structure of textbooks, we distinguish the 36 components (27 verbal and 9 pictorial components). Components are classified into three categories, depending on what function the textbook they fulfil (see Průcha 1998 for details): (1) The structure of the presentation topics - eg. expository text, curriculum summary, diagrams, models, statistical tables and etc. (2) The structure of learning control - eg. the questions and tasks on the topics, exercises, use of special fonts and colours for specific parts of the curriculum etc. (3) The structure of the textbook orientation - eg. division into lessons, live headers, index, etc. 13 On the basis of what components of the categories are represented in the textbook, the following coefficients are calculated: (a) partial coefficients of didactic equipment of a textbook: - the coefficient of apparatus use of presenting the curriculum (E I) - the coefficient of utilization of learning control (E II) - the coefficient of directing apparatus usage (E III) - the coefficient of verbal component apparatus usage (E v) - the coefficient of image components apparatus usage (E o) (b) The total coefficient of textbook's didactic equipment (E) All coefficients acquire theoretical values within the 0 -100%.

### *A comprehensive measure of text difficulty and density of technical information as for number of terms*

The text difficulty measuring is a specific category of textbook analysis. All analyses of this kind also stem from the work of J. Průcha (1998).

The text with which the pupil is encountered has certain characteristics (it may contain technical terms, or may be written so that though the student knows all the words in a sentence, he doesn't grasp the meaning of the sentence. According to Průcha (2002, p. 282), from a functional point of view, the didactic text is a text of any communication (verbal, visual or combined) which has specific properties allowing it to operate in learning communication. The use of text (and therefore learning) is clarified as an interaction between a subject and a text in which different characteristics of these 'partners' interact (Průcha, 2002). While learning, linguistic competence of the student and linguistic structure of the text stand against each other. If the subject (student) does not have a previous degree and didn't obtain adequate competences and is not motivated to reach them, the textbook is not a didactic tool of great importance for him. From the opposite side, we can say that if the authors of textbooks do not adapt text and image attachments to comply with the competencies of their students, the pains they took with the creation of textbooks are being wasted. The main purpose of the text of any textbook should be a delivery of carefully selected knowledge and skills aimed at pupils of a certain age and education. It should always be readable text so that information can be passed on. Another quality, that is for the text of the books always only relative, is its difficulty. Author of a textbook should always keep in mind

that any matter discussed should be preceded and followed by something. About this text speak as a thematically coherent and continuous text. A special quality of the educational texts should be their regulativity. This feature guides the pupil through the text. It comprises verbal notes, notes, summaries, control questions, graphical schema and tests. Furthermore, we consider the relationship of the textbooks to the curriculum, the communicateness of the text and the scope and difficulty of the text.

Our research sample was taken from two chapters from a secondary school textbook Farm machines, volume II, Machines for the protection and fertilization of plants (Forejt, 2013). We assumed that the two chapters in the book are of comparable comprehensive measure of text difficulty and the share of density of technical information in both chapters is not greater than  $i = 20\%$ ,  $h = 40\%$ .

A comprehensive measure of the difficulty of the text (T) is designed to detect text difficulty, especially for the presentation of the curriculum in the interpretative text (but may be used for any other texts). The degree of difficulty is calculated from a sample text, selected according to standard instructions. A comprehensive measure of the difficulty of the text should be comprehensive enough to cover not only the quantitative characteristics but also the qualitative (semantic) characteristics of the text of the textbooks. It should also be sufficiently valid, given the real acting of the difficulty of the text in learning. For practical reasons, it should also be sufficiently operative.

$$T = T(s) + T(p)$$

$$T(s) = 0,1 * U * V$$

$$U = \Sigma N / \Sigma U$$

$$V = \Sigma N / \Sigma V$$

$$T(p) = 100 * \Sigma P / \Sigma N * ((\Sigma P1 + 3\Sigma P2 + 2\Sigma P3 + 2\Sigma P4 + \Sigma P5) / \Sigma N)$$

Individual indicators to determine the degree of difficulty:

T (s) syntactic difficulty

T (p) semantic difficulty

U the average length of sentence segments

V the average length of sentences

$\Sigma P$  sum of all terms  $\Sigma N$  sum of all the words

P1 common expressions

P2 technical terms

P3 factual concepts

P4 numeric data

P5 repeated terms

We analyzed the selected text by dividing it into 5 blocks of 200 words (so that each section ended with a period). We rewrote it step by step into Excel, one word into a cell. Thus a column of words was created, that it was possible to calculate alphabetize and sift through expressions that are repeated in the text. Subsequently, it was possible to identify the terms P1 to P5, again, by selecting the columns and resorting. Subsequently, we have extracted the values required for the calculation in the required samples. Moreover, coefficients of density of technical information were still determined for the files. When working with each sample text of the textbook, we have calculated the number of sentences, words in each sentence and the number of verbs. Then I calculated the average values. The values obtained, if possible, were compared with those published in scientific literature.

First, syntactic difficulty was detected in selected passages. The average sentence length, the average length of sentence segments (U) and syntactic difficulty of the text (Ts) were calculated. Comparable values of syntactic difficulty (Ts) are indicated by eg. Beneš et. al. (2009), who studied the difficulty of text of secondary school textbooks for chemistry. In his work, they found the extent of Ts in selected textbooks ranging from 11.3 to 18.5 points, while the average length of sentences ranged from 12.8 to 17.6. Průcha (1998) indicates the difficulty of the text in on atmosphere in textbooks for primary schools and 11 secondary schools as reaching 16 points. Hrabí (2002) compared the natural history textbook for the 7th grade of primary schools and finds that the rate of syntactic difficulty ranges from 5.19 to 8.98 points.

Further, the average length of sentences was assessed. As the next step, semantic difficulty Tp was studied. Semantic structure of the text highlights a number of technical and factual terms, as well as numerical values that are used together with conventional (and familiar for the pupils) concepts and repeated expressions. Their quantity and especially their mutual relationship, they can demotivate pupils and overburden them. When comparing the syntactic and semantic difficulty both chapters, it was found that in the chapter Machines for

plant protection was found slightly higher syntactic difficulty text semantic difficulty but lower than found in the chapter Machines for fertilization of plants.

Subsequently, we determined the degree of difficulty of complex text T. The values listed below show that the difference between the chapters is 7.1 points.

Table 1 Comparison of indicators between chapters

	T	Ts	Tp
Plant fertilization	43,9	12,6	31,3
Plant protection	51	10,5	40,5

To determine the quality of textbooks, the value of density of technical information on the number of words and number of terms can be used. The calculated values of the textbook monitored are listed in table 3.

Table 2 The density technical information

	Machines for plant protection	Machines for fertilizing plants
Density of professional information in words "i"	4,7	11,3
Density of technical information in terms of "h"	9,0	21,8

In the analyzed text of the both textbooks wither on agricultural machinery, vo. II. and on machines on protection and fertilization of plants, an average comprehensive measure of text difficulty was found, ie. T = 47.5% in both chapters. The density of scientific information in words found reached significantly less than 20% and the density of instructive information in the number of concepts have been significantly lower than 40%.

Průcha (1998) indicates that by numerous empirical researches of textbooks it was found that T values ranged between 26.7 to 69.7 points. The values observed by us in the referenced textbook are above the point of simplicity and below the point of extraordinary difficulty. The analyzed textbook would be appropriate to enrich by certain components of the learning control apparatus, especially in verbal components such as preface, instructions how to work with the textbook, index and a modulation of curriculum levels.

P. Knecht's (2008) research has pointed to the possible existence of problematic concepts in textbooks as for their age-adequacy quality. According to Knecht, the pupil is often neglected in connection with the textbook research who might yet serve as an important source of information because it reflects, among other issues, adequate processing of educational content in textbooks. His research confirmed the fact that for the teachers, as well as for the authors and publishers of textbooks, it is important to take into account the cognitive dispositions the pupils of a certain age possess (Knecht, 2008, p. 155).

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