Structure, function and readability of new textbooks in relation to comprehension

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Abstract

Difficulties in understanding, the associated communication problems and gaps in knowledge transfer are present in all situations of our life. The causes of problems of comprehension during the teaching of subjects can be explained with the growing heterogeneity in the classes but also with gaps in the educational materials and in the methodical presentation of the content. Therefore it is necessary to revise/rewire teaching materials to guarantee all pupils the same starting conditions. The article concentrates on structure, function and readability of a selection of textbooks in the subject of history for the 9th grade.

Keywords: Readability of textbooks; difficulties in comprehension; function of the several structural elements of textbooks.

1. State of research

The analysis of textbooks as interdisciplinary research has a long tradition. The purpose of the several studies were and are textbooks as so called Politicum, Informatorium and as Paedagogicum, another field of science form the issues of the theory of textbooks, studies of the design of textbooks or the development of strategies for sale. Works on reception and effect of textbooks are an exception in the long list of publications, although as the main aims of educational media are considered education and the establishment of identity. One of the few interviews concerning the use of history textbooks was carried out by BODO VON BORRIES in 2002 and published in 2005. The summary results of this sample show the borders of skills of reception of the students. In lots of cases the students were not able to understand the structure of the information. So the real intentions of a textbook will go missing by many recipients in this case students. This situation demands for examinations of the causes of communication difficulties. After the results of the PISA study on reading literacy in the year 2000 a boom in this direction has recently grown up. However, the results of the studies concern mainly the criteria of textuality of textbooks, the narrative structure, the context and sense making characteristics such as the reference to the present or the involvement in a multimedia learning environment. Questions of grammatical, lexical or semantic elements seem to be not relevant. Only one aspect of linguistic analysis, the textual coherence, gets a greater attention. Initially there has to be searched for definitions of the term textbook in the relevant scientific literature. Also the requirements to a textbook have to be analyzed. These results are then the basis for the comparison with the actual
design of textbooks in use. Especially since the beginning of the 1980s textbooks change continuously appearance and conception.

2. Construction of the term textbook

Normally a textbook is considered as a collection of contents of a particular issue in an appropriate linguistical and didactical form. Although textbooks for school use offer only a small part of the scientific findings the educational materials must be correct in contents. In this sense the textbook stands between factual literature and scientific works. It serves for planning, initiation, support and evaluation processes of information and communication. Textbooks structure in many cases the single units and are often responsible for the quality of the lessons. But textbooks have to be aware also of educational and political aspects and have within the society an education and identity creating function. Therefore the textbook is one of the most important genres of literature.

Due to the diversity of the various textbooks a definition is possible only within a very broad framework. Requirements on the other hand can be outlined much clearer. In the current skill orientated practice have to be mentioned primarily specific skills and abilities concerning the single subjects and related knowledge about methods and factual information. BODO VON BORRIES demands in particular the ability of knowledge transfer. For this purpose modern textbooks offer increasingly varied possibilities of access e.g. on so called workshop-pages. Editors try additionally to upgrade the important but disliked teaching tools by aesthetical extras.

3. Main functions of a textbook

The chapter above talks among others about an education and identity creating function of the media. In this context BAMBERGER/BOYER/SRETENOVIC/STRIETZEL speak about a cultural function. Especially the features regarding the identification are strongly connected with cultural, social and political arguments and can deliberately or accidentally be used or abused for influence.

In addition to these functions, which cannot directly be controlled by school members, textbooks should fulfill a list of other assignments relating to the school in general and to the teaching in particular. First of all the textbook certainly must be described as one of the main sources of information within the educational context. Although the content of textbooks has to agree with the official curricula the selection within these frames depends on the arbitrary and subjective criteria of the authors. In this sense they add a certain direction of information. The weight of certain contents is guided by tasks or controlled impulses. Therefore the demand for multi-perspective view can only be implemented up to a certain point.

The content in the analyzed schoolbooks itself is set in a strictly structure. Modern textbooks present units on double pages or in a similar volume, which often already correspond to didactically structured lessons. The juxtaposition of these units follows again the prescribed curriculum of the appropriate grades. In this way the structure of the books supports the teacher in the preparation of the whole program as well as in the presentation of single lessons. BAMBERGER/BOYER/SRETENOVIC/STRIETZEL call this phenomenon of textbooks the function of structuring. In addition some textbooks offer also a differentiation between basic and additional information, distinguish levels of tasks or present different methods to elaborate the contents. The above mentioned team of authors outlines two other functions, which obviously support the didactic and methodical approach of teachers. On the one hand the attractive design of new textbooks increases the motivation, on the other hand the textbooks offer already a sufficient number of instructions and tasks to deepen the content, which can substitute oral or written examinations. Added all functions of textbooks it is not surprising that BAMBERGER/BOYER/SRETENOVIC/STRIETZEL speak of media for self-instruction.

4. Aspects of design

The most important challenge for the design of textbooks is the readability. Readability means in this context primarily the realization of several criteria of clarity. The comprehension of texts is based on both characteristics such as vocabulary, complexity of words and sentences, but also on contextual factors which concern the reader itself. These include capabilities in the use of the language, professional skills, the interest of the reader and - not to
underestimate - the motivation. A more motivated reader will obtain easier and faster the comprehension as a reader with little interest.

Regarding the readability and the clarity of texts, since the first third of the 20th century many studies was carried out, so that today is accessible a series of data. Concepts of comprehensibility get special attention, which operate preferentially with mathematic formulas. But the various formulas consider only an insufficient number of aspects, so they will not be worked out in detail. Much more important appear studies, which work on the level of the texts, the sentences and the words. For this purpose there was developed a detailed screen for text analysis with the aim to locate as precise as possible the causes of difficulties in understanding. The screen includes not only linguistical aspects but also the optical structure of textbooks, the single elements and relations between them.

BAMBERGER/BOYER/SRETOGENIC/STRIETZEL name in their book a number of other criteria which contribute to more clarity. There are included e.g. the font size, which should be over 10-point, the text style, the letters or the spaces between the single words.

5. Requirements to a textbook

To define the requirements to a text into a schoolbook first it is necessary to outline closer the term text. Although there cannot be found a standardized definition of what a text is, most of the explanations agree in one relevant point. A text is a tissue of a certain structure within which can be made coherent written or at least writeable statements. A lot of linguistic studies cite preferentially the 1981 edited Introduction of text linguistics written by ROBERT ALAIN DE BEAUGRANDE and WOLFGANG ULRICH DRESSLER. They list 7 significant criteria such as cohesion, coherence, intentionality, acceptability or intertextuality, which distinguish texts and non-texts. According to DE BEAUGRANDE and DRESSLER texts in schoolbooks fulfill a highly communication orientated purpose, so that none of the 7 criteria should be neglected. They are absolutely necessary if an informative text wants to fulfill regulatory principles such as efficiency, effectiveness or adequacy. It remains to examine in what extension the single requirements are present in the analyzed textbooks.

6. Structural elements of textbooks

While in the 19th century the text represented the main part of a textbook, in the modern textbooks are added various structural elements. The distribution of the various elements in the single books is very different, all together is only the strong weight of the main element text. SUJEW identifies three categories: basic texts, additional and explanatory texts. In relation to the analyzed textbooks the basic texts correspond to texts written by the authors, additional texts would be historical sources like citations and the explanatory texts mean declarations or notes, in total the glossary. In addition to the textual elements the non textual components in new school textbooks play also a significant role. Into this category fall texts with the intention to appeal such as tasks or suggestions, in SUJEW called apparatus for the appropriation of contents, materials for illustration or visual materials and all paratextual supplements called apparatus for the orientation. In CHOPPIN are listed under this point all forms of titles, the pagination and all notes. Taking into account the above-mentioned three models there can be given the following distribution:

<table>
<thead>
<tr>
<th>TEXTBOOKS OF HISTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text components</strong></td>
</tr>
<tr>
<td>Basic texts</td>
</tr>
<tr>
<td>Texts written by the author's</td>
</tr>
<tr>
<td>Addition texts</td>
</tr>
<tr>
<td>Sources as: citations, summaries, etc.</td>
</tr>
<tr>
<td>Explanatory texts</td>
</tr>
<tr>
<td>Explanations, introductions, interpretations, clarifications, etc.</td>
</tr>
<tr>
<td>Visual elements</td>
</tr>
<tr>
<td>Photographs, images, figures, etc.</td>
</tr>
<tr>
<td>Appeal</td>
</tr>
<tr>
<td>Tasks, ideas, suggestions, etc.</td>
</tr>
<tr>
<td>Orientation</td>
</tr>
<tr>
<td>Index, symbols, glossary, etc.</td>
</tr>
</tbody>
</table>

Table 1: Elements in the analyzed textbooks
7. Construction of textbooks

For a whole century textbooks were exposed a continuous change, but the most striking changes emerged in the last two decades as a result of educational requirements as well as new opportunities due to the technological progress. Print media became cheaper so that more money could be invested in the design of the books. Compact text blocks were separated into paragraphs and were increasingly enriched by visual materials. There were made changes in typology and the possibilities of different text styles were exploited. These amendments have the purpose to increase the ability to concentrate and to prevent all signs of exhausting. In principle textbooks should become more attractive. „The picture conquered step by step the textbook“, with the result that text phrases are getting shorter. Studies by ALAIN CHOPPIN show a share of visual elements with an average of 50% in current textbooks of all subjects. Tendentially the optical requirements are rated higher than educational guidelines. This fore it is necessary to give the competence to distinguish relevant from not relevant elements as well as the ability to realize relations between text and illustrations.

A large part of the analyzed textbooks begins chapters with introductional pages consisting of a short text and expressive images. Some books introduce the following chapter with a kind of brainstorming. Subsequent to these opening pages starts the main part of the books: on a maximum of 4 pages are offered the single units consisting of texts written by the authors and different text sources. The units usually are completed with deepening questions or tasks. More recent textbooks operate preferentially with graphical elements, these include visual sources, paintings, maps, tables, etc. At the end of each main unit are mostly inserted summaries of the most important dates and events of the respective era. Some of the books offer in addition to the chronological contents so-called cross and longitudinal studies treating an important development or process. Important personalities or definitions are listed at the end of the book under Lexicon. In this column of paratextual supplements have to be mentioned also pages with certain methods of learning usually called Workshop-pages. Another common aspect of the analyzed textbooks is the direct appeal to the recipients with explanations regarding the handling of the book or additional advices.

This seemingly superficial examination of the single textbooks shows especially a deviating from the conception of reading and learning books and a closer approach to workbooks in a multimedia reality.

8. Relations between text and visual elements

In a time of rising multimedia communications also in the history textbooks an extensive usage of visual elements has become the standard. The development essentially can be reconstructed also on the analyzed textbooks. Older books mostly have only a small number of visual extras in relation to newer media.

![Figure 1. Distribution of text and visual elements](image)

Images can transmit within a short time more information than texts in the same period. Moreover pictures can be remembered over a long time while the informations in a text will be forgotten. Further pictures and photographs increase the credibility and transmit informations also to recipients who are not able to read or to understand a
certain language. EKKEHARD FELDER writes that images are able to cancel the shortcomings of the media language such as arbitrariness, conventionality, representativeness and to make more transparent the construction of reality and its processing.

Usually the pictures facilitate understanding of the text and leave more authentic and credible written statements, texts themselves guide the reflection and give a rational allocation of the contents. In this respect they support each other, making contents interpretable, clear and understandable. In this case we talk about a complementary relationship between text and image. If the visual element repeats only the information, the relationship has to be described as superfluous. Such duplications are used to support the remembrance. If one of the two elements is more informative than the other we speak about a dominant connection between text and image. According to ROLAND BARTHES the pictures are always dominant, HARTMUT STÖCKL speaks in this context of superiority. Especially in textbooks for school use the message of images should be clear, because they are never isolated elements but always in conjunction with a text.

During the work with textbooks it is usual, that images are watched before reading the text. According to this at the selection of pictures have to be considered two fundamental functions. These are first the correct transmission of primary informations, which should correspond to the text, and second the requirement to motivate the recipients to read the text.

All textbooks operate with different kinds of images. Illustrations, so-called descriptive pictures or according to STÖCKL material images of a mentioned object or some named person, apparently outweigh. Structural images such as tables or maps represent only a small part just as reflexive images such as paintings. There has to be noted, that not all images can be assigned clearly to one type of image. Most of the pictures have features of several categories. To compare the images they were assigned to that type whose criteria they mostly meet.

9. Readability of the analyzed textbooks

The readability of text depends on various characteristics; according to RICHARD BAMBERGER the most important are: the difficulty or complexity of content, the difficulty of the language itself, the quality of style, the readability of the print as well as the reference to the reader.

To measure the readability of a text also in the academic community are applied mathematical methods calibrated for different languages. Starting from RUDOLF FLESCH a number of formulas for measuring readability were established. The basis is the Flesch Reading Ease (FRE), also called Flesch-degree. A numerical value is there an indication for the clarity of texts. Since the average German words are longer than English words, there was calculated a new formula for German in 1978 by TONI AMSTAD. Criticism on the several formulas can be found everywhere in literature, because of this there were compared the results of two measuring methods with the objective of a higher reliability. On the one hand the formula by AMSTAD, on the other the Wiener Sachtextformel (WSTF) by RICHARD BAMBERGER and ERICH VANECEK.
AMSTAD-formula: $F_{\text{FREgerman}} = 180 - \ ASL \times ASW \times 58.5$

$\text{ASL} = \text{Average Sentence Length}$

$\text{ASW} = \text{Average Number of Syllables per Word}$

The higher the Flesch-degree, the easier can be read the text. Good understandable texts have on an index of 60-70 and should be suitable for the 8th and 9th grade.

Vienna-formula: $W_{\text{STF1}} = 0.1935 \times MS + 0.1672 \times SL + 0.1297 \times IW - 0.0327 \times ES - 0.875$

$W_{\text{STF4}} = 0.2656 \times SL + 0.2744 \times MS - 1.693$

$\text{MS} = \text{percentage of words with 3 and more syllables}$

$\text{SL} = \text{average sentence length}$

$\text{IW} = \text{percentage of words with more than 6 characters}$

$\text{ES} = \text{percentage of words with 1 syllable}$

The scale begins with 4 for a very easy text and ends with a value of 15 for extremely difficult texts.

Applied to the entire text of the chapter on the Roman Empire, the table shows the values of the analyzed textbooks:

<table>
<thead>
<tr>
<th>Anno Durch die Vergangene Zeitbilder</th>
<th>AMSTAD</th>
<th>WSTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geschichtsbuch</td>
<td>61.4</td>
<td>7.74</td>
</tr>
<tr>
<td>Forum Geschichte</td>
<td>54</td>
<td>54.2</td>
</tr>
<tr>
<td>Gegenwart</td>
<td>60.2</td>
<td>8.2</td>
</tr>
</tbody>
</table>

The table shows that the texts according to the formula of FLESCH/AMSTAD in three cases are under the recommended level for the 9th grade, therefore too difficult.

Because of additional criteria such as the percentage of words with more than 6 characters or the percentage of monosyllabic words the Wiener Sachtextformel reveals different results in relation to the Flesch-degree. The results of these calculations seem strange and paradox in particular on the example Geschichtsbuch. Although it has the most complex sentences according to the WSTF, it is one of the most easiest among the analyzed books. To criticize is also the fact that the formulas do not take into account typographical criteria such as a clear and logical presentation or the organization of the various elements. Also stylistic characteristics of the texts flow into the formulas only conditionally. Basically, as well as RICHARD BAMBERGER confirms, the formulas measure only the linguistic difficulty of documents like a statistical survey. A lot of important criteria in the context of the linguistic structure, which influence the readability are not considered. The results of the calculations give too little information about the nature of the texts. Much more extensive appears in this context the Hamburger Verständlichkeitskonzept by the psychologists INGHARD LANGER, FRIEDEMANN SCHULZ VON THUN und REINHARD TAUSCH. Their studies have primarily the purpose to analyze the transfer of knowledge and the ability to maintain informations. Although the concept has no theoretical basis, as critics like to say, it may refer to representative empirical results. The researchers calculate the clarity of texts on four main characteristics: simplicity, which requires among other things familiar words (after BEST familiar words are mostly short words) or simple sentences, text-organization, shortness and conciseness and as fourth dimension additional stimulants. In particular the fourth dimension in mathematical surveys remains without consideration. Just in school textbooks this criterion should not be missed. Motivation is one of the driving feathers in the process of understanding.

In addition to the Hamburger Verständlichkeitskonzept should also be considered the Lesbarkeitsprofil by BAMBERGER and VANECEK. There was a procedure developed, which connects quantitative calculations with subjective judgments.

10. Recommendations

Works on reception and effect of textbooks are still missing in the long list of studies. Also the relations between the various elements in textbooks and their influence on comprehension are not observed enough in the current
scientific works. Therefore it is necessary to connect studies on readability and narrative aspects of texts with the analysis of structure and to outwork significant relations. Efficiency, effectiveness and adequacy could be settled only if the textbook as a whole becomes the focus of research. Actually there is a thesis in progress, which concentrates on the above mentioned emphasis. The first part includes a linguistic study according to the parameters of linguistic structuralism and communication orientated text analysis. In the second part these results are the basis for the empirical research. There will be worked out questionnaires for teachers and pupils to assess the textbooks and there will be made observations in the classroom. Texts will be tested on pupils to evaluate the understanding according to specific criteria.

References


