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Textbooks and Educational Media in a Digital Age

Guest Editors
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Editorial

Research on textbooks has long and strong traditions in the Czech Republic (see overview study written by J. Průcha for this issue). In recent years, several books have addressed this topic. Jan Průcha's (1998) monograph can be considered a fundamental work on the topic, several volumes were initiated by The Institute for Research in School Education at Masaryk University in Brno (see Janík, Najvar, & Doskočilová, 2013). Despite that, we missed a more recent special journal volume presenting various research investigations in the area. A well themed issue can focus attention on a hot issue, and present a more diverse array of voices. The world conference on textbooks and educational media held in Ostrava and organized by IARTEM and the University of Ostrava's Faculty of Education in September 2013 was a good opportunity to fill this gap, and inspired the idea of this issue.

Orbis scholae is happy that it could provide authors from very diverse places – Australia, Brazil, the Czech Republic, and Spain – with the opportunity to exchange ideas and empirical findings about the textbooks or, more properly, teaching and learning resources.

According to many experts, the transition to digital media problematizes the traditional definitions of textbooks. There are variations of digital media, ranging from traditional textbooks in digital form, to supplementary learning objects engaging the learner in different ways in knowledge construction. Current textbook research provides reasons to use the notion of the 'textbook' with considerable care and caution. Wikman and Horsley (2012) argue that varying educational traditions, contexts, and settings load the concept with different meanings, and offer sometimes different and competing discourses. Echoing Augustine's thoughts about time, most of us know what a textbook is until we have to define it precisely. Many definitions encompass a primary conceptualisation that textbooks are texts produced for educational use within educational institutions like schools. They are also considered to be 'adapted' texts that convey a special form of approach to knowledge (Wikman, 2004). This discourse provides some frames for the concept of the 'textbook', but the meaning of 'textbook' can be regarded as elusive, and can only be considered in relation to very highly articulated contexts.

Furthermore, the research area of the textbook can still be described as under-theorized. Finding a theoretical approach which makes reference to the presence of textbooks in classrooms is a challenge for educational research (Braga Garcia, this

issue). Nevertheless, two interconnected shifts in textbook research and theory can be traced. The first is the noticeable move from analysing textbooks as products, to investigating their use in teaching and learning processes. Both printed and digital textbooks, and other curriculum materials, are modified, adapted, and customized by teachers, yet only a little is known about these processes, and even less about the textbook-based actions of the students, both in the classes and at home.

The second shift is related to the paradigmatic basis for textbook research. Although a multi-paradigm standpoint is still characteristic, sociocultural approach seems to be fertile and beneficial, and is accepted by many current researchers. A sociocultural approach to teaching and learning resources emphasizes the role of 'learning environment', where students can utilize learning tools to learn and develop. The 'ecological' conception of instruction has been successfully employed, for example, by many researchers investigating the role and impact of ICT in school settings. Textbook researchers Horsley and Lambert contributed to the conception with the theory of ecotones, which can help us comprehend the transitional character of current instruction, not only in relation to textbooks.

Horsley and Lambert (2001) have proposed that classrooms can best be understood as learning environments. The essence of the ecosystem concept is that any environment can be analysed and understood in terms of how its energy runs through it in a highly organised and structured way. The position and role of the textbook as an element in such dynamic learning environments is poorly understood – or at least confused. If we can begin to analyse classrooms in such terms, it may enable us to 'place' textbooks (and other learning resources) in different classroom settings. This ecological analysis can be developed a little further in looking at the way that textbooks continue to evolve, particularly in the context of the wider resource environment, including the digital information explosion. Horsley and Lambert (2001) proposed the biological concept of ecotones to help analyse these changes in a way that avoids the erroneous assumption that new computerised technologies will simply replace the old print-based ones. In their own words:

> Biologists use the term 'ecotone' to describe an area where two adjacent ecosystems overlap – for example, where a forest gradually turns into grassland. The ecotone has an ecology of its own. It can support forms of life not found in either of the adjacent systems. Today, there exists the educational equivalent of an ecotone between traditional learning environments and the emergence of new learning environments designed around student centred interaction and internet & technology based learning tools (Horsley & Lambert, 2001, p. 38).

The underlying point here is that although there have always been different classroom ecologies, as discussed above, they have in fact mostly operated under the same set of educational assumptions. Over the years, these have pretty well governed fundamental classroom relationships within superficially diverse teacher-student-resources learning ecologies. Put another way, differences in traditional classroom appearances may be so superficial that they may be no more than one

might expect from within a single ecosystem. But this ecosystem approach leads us to imagine that all classroom practices and all teachers are transitional in nature, and the natural inclination in teachers is not to operate at extremes, but in transition between learning environments; fostering both learner centred and teacher directed learning in the same classroom; promoting transmission approaches and active learner agency and constructivist approaches within the same classroom and the same school; promoting individual orientations and group and collaborative classroom activities and tasks within the same classroom.

The sociocultural approach allows us not only to approach the classrooms as learning environments, it also to enables to conceptualize the textbook as an object of the school culture, and as an artefact of school life. Three papers in the issue sought to employ a sociocultural approach as a starting point for their investigations, and a background for reflection.

Tânia Maria F. Braga Garcia's paper reports on the research project analysing the constitutive elements of the assessment process performed by Brazilian teachers in selecting textbooks available through the centralized national program. The enormous diversity of Brazilian society proves to be a great challenge when analysing textbook policies. The authoress explains that it is not possible to understand the Brazilian educational programs and life in the schools without investigating the roots of economic and social differences. The researchers sought to find out, for example, what criteria teachers use in the course of textbook selection, how teachers consider diversity and local culture when selecting the texts, and whether there are any specific strategies developed by schools to help in the selection process. The framing of the study, i.e. references to the concepts of the textbook as an object of the school culture, the textbook as a market product, and the textbook as an artefact of school life make Braga Garcia's paper even more valuable.

The other two articles address textbooks from mutually opposite perspectives: in local and global contexts, although both of them are based on sociocultural theory. Alvarez Seoane and Rodríguez Rodríguez analysed educational materials produced and funded by local municipal institutions in Galicia, Spain. Despite the fact that many studies highlight the globalizing and centralizing character of textbooks, there is also a need for the resources embedded in local contexts. The authors explain that the importance of such materials lies in contextualization of the learning, and in adjusting to the particularities of each region or community. The authors report on their study of educational recourses, published by local authorities, focused on the features like content area, topic, format, authorship, and language.

Mike Horsley and Zuzana Sikorová conducted a secondary analysis of data collected on classroom teaching and learning resources from TIMSS Studies 2003, 2007 and 2011. The paper explores what resources were used in mathematics and science lessons in 2011, according to the teachers' reports, comparing the use of textbooks, workbooks or worksheets, and computer software. Surprisingly, the results show that textbooks remain the very basis of instruction internationally, and even that the use of textbooks as a basis resource has increased in many of the countries participating

in the study since 2003. Nevertheless, it is also apparent that different teaching and learning resources are emphasised in different countries. The paper also proposes a theoretical framework for a sociocultural approach to textbooks and other classroom teaching and learning resources.

The last research paper in this issue is framed within the broad discourses of quality of instruction and educational reform. It is not focused on educational media, despite the fact that it complements the previous papers nicely. Vojtěch Žák presents a mixed methods follow up study of the instruction of three Czech upper secondary physics teachers after eight years. So this "molecular" study covers a roughly similar time span and similar subject as the "molar" study by Horsley and Sikorová. The patterns of instruction changed very little in the cases Žák followed. The results of micro- and macroanalyses converge and confirm the stability of instructional practices.

The discussion paper by Mike Horsley included in this issue shall be an important step towards *The Standards for the Use and Development of Classroom Teaching and Learning Materials*. The document grew out of concerns about the limited attention given to this topic in other standards for the teaching profession. The development of such standards shall reflect the fact that the way teachers use classroom teaching and learning materials "is critical in affording or constraining student learning".

Last two articles of this special issue are interconnected, in a sense. The first report, by Jan Průcha, outlines the long tradition of textbook research in the Czech Republic, a tradition in which the author of the report played a key role. And – last but not least – this special issue on textbooks and new media is an outstanding opportunity for celebrating the 80th anniversary of Professor Jan Průcha himself, and his life dedicated to education, Czech educational sciences, and educational research. The article by Josef Maňák and Tomáš Janík summarises his renowned research career and outstanding contribution to educational sciences in the Central Europe.

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Criteria Used by Teachers in Brazilian Public Elementary Schools in the Process of Textbook Selection

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Abstract: This paper reports the results of research which analyzed the constitutive elements of the assessment process performed by teachers in selecting textbooks available through the Brazilian National Programme of Textbooks (PNLD). The starting point of the research was the empirical confirmation of a significant number of teachers pointing out difficulties in analyzing the books available for selection by their schools. On the other hand, the teachers also criticized the books being used, highlighting their inadequacy for their work and the students' needs. The teachers collaborated with the investigations performed throughout the last few years, providing their views on their options of use and *non-use* of the materials chosen and received from the PNLD. The participant teachers are from public elementary schools, located in both urban and rural areas.

Keywords: textbook assessment, textbook selection, Brazilian National Programme of Textbooks (PNLD), teacher education

The organization of the educational system in Brazil is based on the articulation of three levels: federal, state, and municipal. Public and curricular policies emanate from these three levels, as well as the creation and maintenance of public schools – the first years of elementary school are predominantly supported by the municipal level (1st to 5th grades); the final grades of elementary school (6th to 9th) and high school (10th to 12th grades) are predominantly supported by the states; with professional educational and university courses predominantly supported by the Federal government.

The restructuring of the Brazilian educational system, initiated three decades ago, still defines goals and actions today. The Ministry of Education co-ordinated the elaboration of the Decennial Plan of Education (1993–2003), in which the government adopted the perspectives of equity, quality and systematic evaluation for the system. In 1996, Federal Act 9.394 restructured the educational system. As of that moment, the Brazilian government formulated a set of guidelines to define the curricular orientation and the basic (minimum) contents for the educational system in the country. However, it also allowed for the flexibility of the curricular components through the guidelines formulated by the state and municipal systems.

This structure must be taken into consideration even in the case of public policies related to textbooks, as it implies centralized and local actions. The existence of a National Programme of Textbooks (PNLD), for which the Ministry of Education is responsible, is marked by the relationships between unity and diversity, as well as national and local, which are expressed in the different facets of the Programme.

10 This programme has existed since 1985 and its main purpose is to provide textbooks to children and adolescents who study in Brazilian public schools. The programme includes the following features: a centralized procedure for the assessment of textbooks, which should be submitted by the commercial publishers, based on previously defined criteria; a Textbook Guideline, to inform the results of the assessment procedure to schools and teachers; a local process in the schools to select textbooks; and a centralized purchase process to acquire textbooks and ship the materials to the schools.

In order to start the analysis, it is first necessary to understand the local context, throwing some light on some aspects of Brazilian society. Brazil is a very large country, geographically, with an estimated population of 200 million inhabitants, distributed across the country in large cities – such as São Paulo – as well as in smaller towns with less than one thousand inhabitants. It is a country which has highly industrialized areas (manufacturing electronic devices, cars, agro-industrial products, fishing industry, etc.) and areas with rural farmers, local fishermen, and populations living off of hunting and gathering activities, and other subsistence activities.

Thus, it is common to say that Brazil is *one and many countries*. Further information will help illustrate the meaning of this expression, so that the implications for the production of textbooks may be analyzed. The Brazilian population, in the different areas, presents diverse origins and different local cultures. This is the result of the presence of native populations and populations who moved to the country as slaves or immigrants (African, European and Asian) in the different stages of the country's history.

The official encouragement of European immigration to Brazil in the 19th century (Act of Lands of 1850) – with the prospect of acquiring lands or working on the farms through partnerships – brought groups of Germans, Italians, Polish, and Ukrainians, among others. During the 20th century, other groups, such as the Japanese, Arabs, Israelis, Turkish, Mozambicans, Angolans, Koreans, and many others continued to come to the country, configuring the absolutely culturally diverse set that compounds the Brazilian population today. Therefore, any question related to identity, in the Brazilian case, must be discussed based on the understanding that we "are diverse".

In fact, this diversity is a great challenge when deliberating and analyzing textbooks policies. It is not possible, however, to understand the Brazilian educational programs and daily life at schools without investigating the roots of economic and social differences and inequalities. From this perspective, it is necessary to take culture as a resource for teaching contents, as a way to approach diversity, while it is simultaneously equally necessary to be aware of what Paulo Freire (1987) calls the need for the formation of critical consciousness, which allows the subject to situate and comprehend themselves in the world. These two aspects are challenges that should, and must, be embraced by school education in Brazil.

When transposing these diversity issues onto the educational sphere, we are faced with the fact that the Federal government is responsible for defining the educational objectives for the entire population, and expressing them in contents

and methodological proposals which should incorporate diversity in the formulation of public policies. Furthermore, the authors and publishers of textbooks, as well as textbooks evaluators and educators, should take these aspects into consideration on a daily basis. In this context, the National Programme of Textbooks (PNLD) – which provides free distribution of textbooks for all the students in public schools for the twelve years of study – can be not only understood as a question of financial resources, but also one of an ethical and didactical nature.

In the PNLD context, there are some questions to be investigated: How do teachers make their choices? What criteria are used in the selection of a textbook for their students? Do teachers consider diversity and the local culture when making their selection? Are there specific procedures or strategies developed by schools to assist in the selection process?

In order to understand and analyze these questions, some specific studies are being developed, aiming at: a) understanding the criteria used by elementary schools' teachers to select textbooks; and b) analyzing the relationship between teachers' selection criteria and the criteria used by experts of the Brazilian National Programme of Textbooks. The issues surrounding the evaluation and selection of textbooks were defined, based on the results of investigations carried out in recent years in urban and rural public schools, in which teachers pointed out difficulties in the analysis of the textbooks available for selection. This text will present the theoretical references, methodologies, and some of the results obtained by these studies.

1 Theoretical approaches

Finding a theoretical approach which makes reference to the presence of textbooks in the classrooms is a challenge for educational research. However, some studies developed by Núcleo de Pesquisa em Publicações Didáticas (NPPD/UFPR) aim to analyze the relationship between teachers, students, and textbooks. The project's research has been particularly focused on understanding the following aspects: Textbooks and other didactic materials; Criteria used by teachers in selecting textbooks; Textbooks in the classrooms; Textbook production.

All the studies developed within the NPPD/UFPR work within the areas of both general and specific didactics (social sciences, natural sciences, languages). The adoption of this methodological perspective adds an extra challenge, as the dialogue between these areas is not common in developing research on textbooks in Brazil. Some concepts have been used as references for the studies, as presented next: the textbook as an object of school culture; the textbook as a market product; and the textbook as an artifact of school life.

The textbook is *an object of school culture* (Forquin, 1993, p. 167), a "set of cognitive and symbolic contents which are selected, organized, 'normalized', 'routinized', under the effect of the imperatives of didactics, and thereby constitutes the object of a deliberate transmission within the school context." Its content expresses

the results of a process of natural selection in which the meanings of scholarization, and the contents considered relevant to be taught, are both defined. Therefore, the textbooks express what we consider valuable enough to transmit to the new generations, especially in regard to scientific knowledge, underlining the understanding of science as a historical and social construction.

However, as was highlighted by Juliá (2001), school culture also includes a set of practices that allow for the *transmission* of this knowledge, and the incorporation of these behaviours. Within this perspective, the concept of *school culture* enables researchers to consider the textbook as an artifact of this culture, emphasizing the comprehension of not only the scientific knowledge transmitted, but also of the forms of teaching and learning favoured at a certain time. Furthermore, it is also important to be aware of the values – and therefore the social and cultural choices – that drive the educational proposals, which aim to transmit part of the culture considered relevant to the new generation.

An estimated 50 million students in Brazil use the textbooks received through the National Programme, thereby building their social values on this foundation. Therefore, studies based on the concept of school culture could contribute to the understanding of themes such as the contents presented, the relationships with the curriculum, and the contribution of the textbooks in the construction of identities, among other things. The purpose of these studies is to analyze the relationships that comprise the space of cultural and social production into which textbooks are inserted, so as to highlight their role as an expression or materialization of the culture that the school should be transmitting and preserving.

The second reference is supported by the analysis through a political-economic perspective, allowing for the understanding of textbook production through the perspective of macro-structural relationships. Thus, the textbooks may be understood as results of actions that involve not only the authors, but also the publishers who produce and commercialize the books, as well as the consumers. In the case of Brazil, there is currently a predominance of large international capital groups, with few Brazilian publishers remaining. Small publishers – important for proposing books with an alternative didactic point of view – have almost entirely been closed down or bought up by other larger publishers, which included the Spanish groups during the 1990s.

In a country like Brazil, where the number of readers is admittedly low, the Federal Government's presence as a larger consumer of textbooks guarantees the circulation of financial resources that, undoubtedly, support the existence and revenue of many publishers. Every year, the National Programme spends about one billion dollars purchasing textbooks for elementary education that will then be distributed in public schools throughout the country.

The third theoretical perspective is related to perhaps the most complex facet of textbooks: their existence *in school life*. It is imperative, for this perspective, to highlight the concept of the *culture of school* (Forquin 1993, 167) as "a social world"

with its own characteristics, its own pace and rituals, languages and imagination, its own modes of regulation, and forms of production. The textbook, as an artifact of school culture, is borrowed by the culture of school, and begins to comprise the set of elements which then constitute school life.

According to this point of view, the content of school experience is neither the same in all societies, nor is it the same in all schools. This content is transmitted in a real and complex process that must be understood in greater depth by educational research. As a consequence, qualitative research and especially ethnographic studies are favoured, using interviews and participant observations, as well as other instruments that make it possible "to know the forms of material existence of the school, and to emphasize the space in which the individuals experience, reproduce, know, and transform school reality" (Ezpeleta & Rockwell, 1989, s. 23).

The definitions based on the school subjects' actions are established within this social space – in everyday life – especially by the teachers and students. The studies with this approach are still in their infancy, according to the literature (Choppin, 2004; Fernández, 2005; Garcia, 2007; Valls, 2009). For the aforementioned authors, it is necessary to develop in depth the studies focused on the presence of textbooks in the classroom.

In this perspective, the Brazilian scenario presents some specific questions which should be investigated. How do schools and teachers choose the textbooks? How do the teachers and students use the textbooks in the classes? What is the meaning of their content for the populations of the different Brazilian regions? It is necessary to analyze how the Brazilian programme affects the production of textbooks available for teachers' selection (annually since 1990) in order to understand the relationships between textbooks, schools, teachers, and students, and to answer questions about the selection process.

2 The Brazilian Programme of Textbooks (PNLD): historical elements, rules and criteria

Brazilian textbooks have earned attention from national governments for a long time. In the last century, more actions and policies related to the distribution of textbooks were co-ordinated by the Federal Government. However, it was only in 1985 that the National Programme of Textbooks (PNLD) was initiated – this designation has been maintained until today –, with the goal of universalizing the distribution of textbooks to all public school students in all school subjects.

In 1993, the textbook evaluation began to be understood as an essential element of the Programme. The Brazilian government established a committee of experts in charge of evaluating the quality of the textbooks most requested by teachers, as well as establishing general evaluation criteria. This decision has had a great influence on Brazilian textbooks, and the evaluation process developed in the last two

decades has produced expressive changes in textbook contents and design. In 1996, an educational reform changed the national curriculum and opened up room for new discussions on the use of textbooks, and the cognitive and ideological contents transmitted by them.

The evaluation group of the Programme is comprised of education experts who were invited by the Ministry of Education, and the results of the assessment process are released in a Guideline published by the Federal Government. Teachers and public schools can select textbooks which were previously approved by the experts and included in the national Guidelines. Every year, the assessment groups are responsible for analyzing books produced by commercial editors. This is done in accordance with the guidelines given through Federal Edicts; the evaluators assess the books based on specific criteria defined in these official documents.

Thus, it is possible to say that the current production of textbooks used by public schools in Brazil is a strongly controlled process, with parameters defined by the State. In the last two decades, the National Programme has slowly produced changes in Brazilian textbooks, creating an interesting model: enforcing general guidelines to be followed, while at the same time avoiding the problem of "one textbook for all", which is unacceptable in Brazilian school culture nowadays. In this perspective, a gradual process of criteria production by the National Programme of Textbooks has taken place with the support of the universities. More recently, professionals with experience in elementary and high schools classrooms have been invited to comprise such teams.

After every new evaluation process, the criteria are published in the Edicts of the Ministry of Education, aiming to advise the publishers on how to elaborate and present textbooks. These indicators are translated into items by the official evaluation experts, composing tables relating to the following aspects: contents, teaching methodology, graphic design and quality, and citizenship construction. There are eliminatory and classificatory criteria. These criteria are disclosed to public school teachers in the Textbooks Programme Guidelines, aiming to help navigate the choice of titles (available at http://www.fnde.gov.br/index.php/pnld-guia-do-livro-didatico).

Some criteria are used to include or exclude textbooks in the Guidelines: prejudice manifestations, conceptual mistakes or discrepancies in the theoretical proposal announced by the author, and its actual development in the student's book. The Textbooks Programme Guidelines highlight the evaluators' concerns with the specific criteria about human rights, the construction of citizenship and respect to diversity, amongst others, and transport these analyses to the teachers and into the schools.

Regarding contents and methodologies, the evaluators present considerations on specific concepts of science used by the authors in each subject. The methodological choices are usually analyzed, showing points of agreement and points of disagreement with the National Curricular Parameters. The experts try to present evidence to point out the best quality and also to point to the problems that the team encountered in each textbook.

3 Methodological choices

As previously mentioned in the theoretical references section, some research developed within the NPPD/UFPR face a challenge: to understand how textbooks are included in classroom life, and how they affect the organization of teaching and learning. This general purpose can be divided into specific objectives, which have been pointing the way for qualitative approaches in "field research" and "ethnographic studies".

According to Wolcott (1991, p. 21), many researchers believe that "field study" and "ethnography" are "labels for the same thing". However, we agree with Wolcott's position in that "they are related but are not the same". It is possible to point out, using Wolcott's words, some common elements and one essential difference of the two methodologies:

> Field study and ethnography draw upon the three techniques basic to all field-oriented research: experiencing, enquiring, and examining. What distinguishes between them is that anyone doing ethnography makes a claim not only about procedures, but also that the result will be ethnography. Ethnography is the end product for the culturally focused description and interpretation that characterize anthropological fieldwork. (Wolcott, 1991, p. 21)

According to this perspective, ethnographic studies should be understood as field studies "plus something special" in the nature of their development and outcomes. Participant observation is the privileged procedure and the concept of culture is essential to the inquiry of the initial research questions, as well as to the analysis of the data produced by the researcher through their empirical work.

In an attempt to understand what happens in schools' daily life and the innumerous experiences regarding schooling, both methodologies – field studies and ethnographic studies – are used in the research developed by the NPPD/UFPR. The strongest influence comes from Mexico, especially form the academic production developed at the Departamento de Investigaciones Educativas – DIE (Educational Research Department), some of which under the co-ordination of Dr. Elsie Rockwell.

The concept of everyday life produced by Agnes Heller has developed elaborate theoretical and methodological principles to support ethnographic studies in the Mexican educational context, associating sociology and history with an anthropological point of view. Thus, studies developed *in* schools are encouraged, especially because "schools are certainly not the same throughout the capitalist world, nor are they among the Latin American countries" (Ezpeleta & Rockwell, 1989, p. 11). Although we recognize the existence of laws and structures in capitalist society, schools exist in the diversity and differentiation of material historic reality; and we must understand this reality to make new practices possible.

It is relevant to remember the centrality of the concept of culture, an essential tool in understanding how the school processes are constructed, as well as understanding their meanings to the subjects who make up the social world that we call

school. However, it is not sufficient to explain just the internal processes and meanings which are produced by the school.

This type of research – supported historical materialism – also implies the reconstruction of other processes linked to power, ideological domination and knowledge production, in a society marked by social inequality (Ezpeleta & Rockwell, 1989, p. 44). In countries like Mexico or Brazil, many educational researchers want more than to just study cultural processes as symbolic systems and interpret their meanings. They expect to clarify the relationships between the school, society, and the State; in order to do that, they must use some specific concepts of culture.

This is the direction of the research developed under the co-ordination of the NPPD/UFPR, the results of which will be partially analyzed in the next section. The concept of culture elaborated by Raymond Williams (2003) was chosen in order to support the studies performed *in schools*. This concept allows for the examination of relationships as derived from human actions, while at the same time acknowledging the existence of pressures and limitations on them. This perspective allows for the analysis of social relationships – and, therefore, of relationships produced by and in the school – as historically derived from the dialectics between the structure and action of the subjects (Schmidt & Garcia, 2008, p. 39).

The methodological resources applied featured questionnaires and interviews developed with teachers working in different grades of elementary and high school (Garcia, Garcia, & Pivovar, 2007; Silva & Garcia, 2010); participant observation was sometimes used as the main fieldwork strategy and sometimes as a complementary one (Chaves & Garcia, 2011); activities developed in courses for teachers' education were used to discuss the theme and to collect information about the textbook selection (Garcia, 2007); finally, some studies featured interviews made with the textbooks "in hands" as an additional resource (Talamini & Garcia, 2008; Garcia & Maciel, 2011).

This methodological option has offered a rich and challenging possibility for studying the presence of textbooks in classrooms in Brazil, as well as helping understand and explain the relationships established by schools, teachers, and students using this *complex object* as an artifact of the school culture. In this article, the results of the studies that focused on the textbooks' evaluation and their selection by teachers were particularly favoured. The different studies analyzed saw the participation of 140 teachers who work in elementary schools, and 60 teachers who work in high schools. Empirical data were produced using interviews and questionnaires as main procedures in the fieldwork.

4 Teachers and their criteria in assessing textbooks: a synthesis based on some studies

This section presents some of the results obtained by the set of researches developed by the NPPD/UFPR in the last years. The elements presented next characterize

how teachers analyze and select textbooks, highlighting what they consider to be important for their work.

4.1 How do teachers make their choices?

As previously mentioned, teachers in Brazilian public schools are able to choose textbooks to use in their classrooms, based on a selection of books that are previously approved by experts who were invited by the Ministry of Education to comprise an evaluation group. The Federal Government purchases the textbooks chosen by the teachers with public financial resources, and distributes the materials for all the students of public schools.

The PNLD proposes that teachers get involved in the textbooks selection process, which as a matter of fact happens in some schools. However, the schools do not have homogenous organization standards when analyzing and defining the books which will be purchased, as shown by some interviews:

> The book was chosen by the school teachers. We had a meeting and reached a consensus (A, Elementary School teacher, 2008).

> The school pedagogue called me to see if I agreed with the book that the colleagues had chosen. She showed it to me, I had a look at it, and agreed with the choice, as I am new in the school (M, Elementary School teacher).

> I did not participate in the choice of the textbook, because my school is too far away (Elementary School teacher at a countryside school, 2012).

Answers like these were frequent, indicating the existence of similar practices in different schools and educational systems. The participating observation contributed to highlight the different ways through which the selection process is performed, which does not always include the participation of teachers. The research verified that there are no specific meetings in most of the cases; the teachers meet up during the day – during the break, for example – and exchange ideas about the books they know or that are available for assessment. In some rural schools, teachers reported they have not been a part of the selection process, which was performed by technical personnel from the education administrative sectors.

The research only observed a more detailed assessment of books sent by the publishing companies in a few situations. The analysis guided by specific technical criteria was rarely verified. In one of the locations where the research was performed, the teachers organized themselves into groups according to the disciplines, in order to develop formative activities. In this case, it was possible to observe that the discussion was carried out in a wider way, using more precise technical criteria:

> The choice was made by the teachers after a course about textbooks, which was followed by an analysis conducted at the school with the pedagogues, who sent the forms to the Ministry of Education (R, High School teacher, 2008).

> The book was chosen through heated debates with the local group of teachers. Afterwards, the school filled in the form and sent it to the Ministry of Education (L, Elementary School teacher, 2008).

> There were debates among the teachers, but I lost the argument, as I did not want the book which was chosen (L., Elementary School teacher, 2008).

In situations like these, the time destined to debate the theme is bigger. Because the meetings gather a group of teachers of one specific discipline, the discussions are centred on didactical and methodological issues – such as the objectives of the discipline in the local curriculum, the teaching contents, and the quality of the texts, and of the activities proposed by the textbook. The available books are examined by the teachers, who look for the material which is closest to the local curricular proposal. Even when there is no consensus about the choice, a situation like this provides the teachers with the presentation of the selection criteria, which means the analysis becomes a formative process.

Therefore, the results regarding the selection process of textbooks can be presented according to three situations: a) a situation in which the teachers were actually involved, discussing and proposing alternatives; b) a situation with a low degree of participation, due to strict deadlines or low interaction among teachers; c) a situation in which teachers do not participate at all, leaving the textbook choice to other professionals.

4.2 Elements favoured by teachers in their analysis

Teachers of the first grades of elementary school showed that their choices are more oriented towards general criteria, such as the size of the texts or their vocabulary, even when selecting history or geography textbooks. This situation is expressed by some of the collaborators, in reference to the history textbook for initial grades:

> I choose a book to use not just for the history class, but also for the Portuguese lessons, as we can then read and orally interpret what the book is presenting (AL, Elementary School teacher, 2010).

> I try to choose a book which helps me illustrate the contents. I analyze the texts and illustrations, and avoid the ones that have texts which are too long, and difficult language, which needs then to be "translated" by the teacher (A, Elementary School teacher, 2010)

Issues linked to specific concepts, themes or methodologies in general were not raised by the analyzed group. It is relevant to note that many initial grades' teachers in Brazil have a general formation in pedagogy, and they reported having difficulties in assessing books about specific contents, as they are not specialists in these subjects.

Teachers who work with the final grades of elementary and high schools – who are specialists in one subject (such as history or physics) –, however, look more carefully at the concepts and the approach used by each author, as well as considering the general criteria. Specific methodological strategies – such as the use of documents to teach history, or the use of experiments to teach sciences – were highlighted by the teachers, coinciding with the criteria used by the official evaluators.

Both generalist and specialist teachers reported that it is important to compare the textbook proposal with the local curriculum. Although looking for a similar proposal, the teachers affirm that it is always complicated to connect their class programs with the textbook organization. This is shown in the interviews:

> The contents approached in the books do not "fit" the curriculum (AB, Elementary School teacher, 2010).

> Even when we choose the books, there are still difficulties when relating the proposal to the school programme and the municipal guidelines (N, Elementary School teacher, 2008).

The criteria relating to the presence of prejudice or stereotypes, known as the criteria for citizenship construction, were rarely remembered by the teachers of both groups. Although it is considered an exclusion criterion in the National Programme, it is not possible to assume that the textbooks approved in the Guidelines no longer present this type of problem. Research conducted by the NPPD/UFPR (Garcia & Maciel, 2011) point out that images and texts which potentially lead to linguistic and ethnical prejudice can still be found in textbooks approved by the Programme, despite the evaluation process.

Image quality, text level, and activity types were frequently pointed out by teachers of the two groups. Most of them considered the texts – in all textbooks – inappropriate when taking into consideration the level of the students. Thus, despite the evaluation processes, there are not many choices for the teachers: most authors use very similar models in presenting the different contents in a "didactic form".

4.3 What is the reference used by teachers in selecting a textbook?

The set of researches developed showed relevant issues on the processes which constitute the Brazilian National Programme. Although the books' official evaluation is public, and is available for consultation by the teachers, the research verified that the choice in the schools is still guided by other referential criteria.

The first criterion to be highlighted is the experience. Most of the teachers in both groups stated that sometimes their choice is guided by the experience they have had with a certain textbook in previous years – a tendency towards reproduction in their choices. Many teachers prefer a known textbook that has already been used in another situation. In a group of 13 specialist teachers, seven pointed out that they

face difficulties when using the textbook for the first time and, therefore, prefer sticking to their previous choices.

Beginning teachers frequently reported that they follow the choices made by older or more experienced colleagues from the same school. In some schools, discussions about the textbooks were observed, including the analysis of the books provided by the publishers. But for the most part, teachers reported that choices are made very quickly in order to meet deadlines established by the Ministry of Education, which limits the possibilities to discuss the subject with colleagues or conduct a deeper analysis of the books offered. Considering the limitations imposed by the deadlines or the difficulty of access to the books, the teachers understand that the experience is a criterion which may contribute to making a better choice.

Perhaps this aspect can help explain another result shown in the research: only a few teachers reported that their choices are supported by the official evaluation. Printed copies of the Guidelines with the criteria and evaluation results have been sent to all public schools, and nowadays the Guidelines are also available at the PNLD webpage. However, most of the teachers say they do not use the Guidelines to make their choices, reinforcing the fact that the opinion of the evaluation experts is not considered a reference when analyzing the books. As a consequence, the best textbook according to the National Programme is sometimes the worst one from the teachers' perspective. This phenomenon has already been verified, but it needs to be better understood by educational research.

A second criterion used by teachers is the priority of one curricular component over the others. Some teachers of the initial grades of elementary school (1st–5th grades) who participated in the research said that they first select the reading and writing textbooks, and then look for textbooks for other disciplines in the same collection. This group of teachers considers history, geography, and sciences to be somewhat less important for the students at this school level. This pattern presented by some teachers can partially be justified by the municipal, national, and international examinations – such as the Pisa –, which have been focusing on the assessment of native language and mathematics skills. This reinforces a model which already existed in the Brazilian school culture – as well as in other countries – one which favours these two fields of knowledge over others.

The researches verified the existence of such practices, even though the contents of other disciplines are also present in the Brazilian curricular proposals. This selection model sees the choice of textbooks based on their belonging to a certain book collection, rather than being based on the specific proposal for a particular school subject. Despite the efforts of researchers from the fields of history, geography, physics, in discussing proposals and ideas to improve the quality of the textbooks of these disciplines, teachers still choose them based on their collections, and not on content.

This preference for collections can also be explained by the fact that teachers of the initial grades teach all school subjects (Portuguese, mathematics, sciences, history, and geography). Therefore, the teachers choose the textbooks they consid-

er adequate to teach reading and writing – which is understood by them as a more complex task, demanding stronger support material – and, hence, choose the other titles from the same collection.

However, the researchers were also able to verify that some of the teachers choose the textbooks independently of the collection they belong to. This form of choice was observed in teachers who had had the opportunity to develop continuing education activities on specific contents, which enabled them to feel more prepared to identify the characteristics of a good textbook for each of the specific school disciplines.

5 Final considerations

Based on the research results, it is possible to emphasize some issues to be discussed in future investigations, and in teachers' education activities in Brazil. First, it is necessary to develop new studies on the criteria used by teachers in different situations, explaining the processes in regard to their formation, experiences, the level of the school where they teach, and the school location, amongst others.

Second, it is necessary to propose some specific activities on textbooks for teachers' education programs. Besides these specific courses, we suggest the production of materials in collaboration with the universities and schools. The aim behind this idea is to construct didactical and epistemological knowledge that could guide teachers' actions, helping to select textbooks in a more grounded way.

Finally, if we want elementary school teachers to use more specific and appropriate criteria to select textbooks, the universities must find new ways of providing and conducting teachers' education courses, based on research. Teachers need to understand the aspects that support the analysis and selection criteria used by the experts of the National Programme in order to use them wisely in their choices.

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Characteristics and Properties of the Didactic Materials Developed by Local Governments

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Abstract: This paper presents the most relevant results from research conducted in the department of Teaching and Educational Organization at the University of Santiago de Compostela to identify educational media and didactic materials supported by municipal entities. Firstly, we will make some general comments on the topic and discuss a review of previous studies and the theoretical reasoning behind our interest in this field of research. Afterwards, we will go on to present the first part of a study focusing on the analysis of materials produced with support from municipal institutions. The steps followed during this phase of the research will be described, and then we will present the results and a general assessment of the characteristics of didactic materials found.

Keywords: textbook, didactic materials, teaching resources, local education

Many recent studies on materials in the Spanish context and internationally highlight the globalizing and centralizing character of textbooks (Rodríguez Rodríguez, Horsley, & Knudsen, 2011), which often leads students to lose touch with their immediate reality, and impedes a connection with their prior knowledge. Undoubtedly, there is a need for textbooks that include work proposals adapted to student diversity (Rodríguez Rodríguez, 2006), but we also need supplementary resources to help contextualize and adapt materials to the particularities of each region or community, as in the case of Spain.

In many cases, the development of didactic materials in local contexts has provided a chance to break the unifying character of textbooks and foster a work culture nearer to the reality of students and teachers. Likewise, the publication or elaboration of didactic materials as alternatives to textbooks in local contexts has sometimes been the result of alternative social movements seeking to include proposals different from those usually covered in books.

However, in our opinion, the study of didactic materials produced in local contexts should be undertaken with a consideration for the particularities of each context and reality, as it is not hard to find scenarios where locally contextualized materials have been promoted to destabilize centralizing education policies.

To provide quality education, schools must currently give proper attention to the particular needs of their students. Depending on the contents and activities included, materials can help to establish links between what happens in the school, and what happens in the social environment.

In general terms, and considering the sociocultural setting of our study, we could say that the contextualization of materials in local educational contexts can contribute in the following ways: by complementing textbooks which often do not cater to the cultural peculiarities of our students; by encouraging the development of significant learning through activities contextualized in the environment that motivate both students and teachers; and by attending to students with special educational needs, whose particularities are often not addressed. Moreover, these materials can contribute markedly to the preservation of local heritage and appreciation for the surroundings. Numerous studies have shown that materials often reflect little concern for the immaterial and architectural heritage proximate to students[1].

In the Spanish educational system, local governments are subordinate to the regional administrations and the State, which are responsible for public education services, and have legal authority in this area. However, local governments exercise their educational functions in the regulated education (still holding educational buildings; participating in the management of complementary and extracurricular activities, programs of adult education, childhood education, art and music education, professional training, and so on; taking part in school boards and State School Council and City School Council), as well as non-regulated education (undertaking training processes throughout life in response to neighbourhood needs; conceiving education as part of other municipal policies and programs).

A first look at the activities, projects, and initiatives undertaken in recent years by municipalities in Galicia and other parts of Spain reveals that some city councils have paid special attention to activities involving the production of didactic materials and resources for a variety of objectives and goals (Álvarez Seoane, 2010).

It is not strange to see a mayor, council member, or historian presenting a new book, guidebook, educational project, or other didactic materials produced or funded by a city council. Likewise, there are many projects funded by local authorities for the purpose of developing didactic materials adapted to their local reality (Rodríguez Rodríguez & García García, 2007). If we notice what happens at schools, we can see that teachers and students use some of these materials in the classroom or as aids to certain activities. See for example, the *LEPI Project*, a support resource for school libraries in the municipality of Ames (Ames, 2005), the project on water published by the city of Ourense (Iglesias Novoa & Estévez Estévez, 1994), the comic book about the municipality of Carballo (Rajal, 1999) and the proposal for contextualized materials in the municipality of Pontes, focusing on different aspects of associations and community life in schools and other less formal contexts (Rodríguez Rodríguez & Castro Rodríguez, 2007).

These materials were conceived, in many cases, for educational purposes from a variety of perspectives. The existence of these materials and their dissemination

[1] For a deeper understanding of these issues see: Rodríguez Rodríguez, J., Horsley, M., & Knudsen, S. V. (2011). Local, National and Transnational identities in Textbooks and Educational Media. Tenth International Conference on Research on Textbooks and Educational Media. Santiago de Compostela: IARTEM.

among the population and in schools sparked our initial interest in their study and analysis. From a didactic point of view, we began to look into the features and functions of materials that were produced by municipalities. In this regard, several questions came up which did not have an answer in the scientific literature, such as the following: What are the reasons that lead many municipalities to produce their own materials? Why do other municipalities produce no didactic materials at all? What features do these materials present? What aims are they elaborated for? Why are these materials funded by local authorities? What training do the authors of these resources have? What use is made of the materials developed for local contexts?

1 State-of-the-art

With these issues in mind, we initiated a line of research at the University of Santiago de Compostela that would allow us to understand the features and functions of materials created with the support of local administrations. We will now look at some of the principal reasons that help us justify the concern and study of these didactic materials, as well as their contribution to our field of research.

1.1 Materials concept

One of the main aspects requiring clarification from the outset was the meaning of educational materials produced and funded for local educational contexts. The truth is that we are living at a time of undefined terminology in the field of educational technology, and in the specific field of materials analysis in non-school educational contexts. We need to specify what we are referring to by the concept of didactic materials in the setting of our study. In our case, we were faced with the task of defining what is meant by didactic materials produced or funded in municipal educational contexts, for more information on the meaning and implications of undefined terminology in the field of educational technology, we recommend (Rodríguez Rodríguez & Montero Mesa, 2004). Throughout the course of this paper, and in order to guide our study, we use the following definition: a resource intentionally elaborated for school, work, or social settings with the support of one or more local governments insofar as planning, design, publication, and/or dissemination for the primary purpose of mediating learning processes, either by providing proposals for educators, facilitating knowledge-building processes, or as a primary source of information. We will specify the didactic materials considered in our study in section 2.3, *Specification of learning materials studied*.

1.2 The Galician reality

We could say that in recent years in the Galician context a significant number of materials have been produced and funded by local educational institutions. As an

example, we can mention the didactic materials developed in the museum setting by the Education Department of the Pontevedra Provincial Museum (Castaño García, 2007), and by the Department of Communication and Cultural Management of the Lugo Museum (Reigosa, 2010). In the school setting, we can mention the resource elaborated by the Magdalena Municipal Nursery School in the city of Ames, based on the project carried out with their students during the 2007/2008 academic year (Dios Suárez & Otero Cores, 2009), and the didactic material on traditional games developed by A Capela Primary School (López García, 2006). In the business context, we can mention the didactic materials prepared by Sotavento Experimental Wind Farm (Candela Barreiro, Feijoó Varela, Rodríguez Rodríguez, & Teijeiro Bóo, 2005). Similarly, as indicated in recent research (Mareque León, 2011), municipal education departments devote part of their efforts and budgets to the design and evaluation of didactic materials. Most of the cases mentioned refer to educational resources developed for the purpose of addressing content or topics not raised in local school textbooks. Usually, materials developed for schools include work proposals serving the objectives and suggestions from curricular designs that should be taken as reference, but that may not be covered in textbooks.

1.3 Responsibilities of municipalities

A detailed review of the core responsibilities that must be met by municipalities (Caballo Villar, 1997, 1999) reveals that the Basic Law on the Status of Local Government (España, 3 de abril de 1985) stipulates mandatory and optional educational responsibilities, as expressed in Article 28, "Municipalities may carry out activities complementary to those of other public administrations, in particular activities relating to education, culture, women's rights, housing, health, and environmental protection", which may include the development of didactic materials. Regarding this issue, it would be interesting to know to what extent policies for the development of didactic materials are influenced by these responsibilities and the lack of specific funding.

1.4 Analysis of didactic materials approach

Based on previous research (Area Moreira, Parcerisa Arán, & Rodríguez Rodríguez, 2010), we can see that the interest in studying materials funded by municipal entities runs parallel to the need to study the materials produced in socio-community contexts. In a relatively recent study, Rodriguez (2010, pp. 31–32) points out that, "the participation of other institutions in the educational process, the important educational space generated by social education, the role assigned to didactics in the shaping of teaching-learning scenarios in the different contexts and the existence of new community settings where educational activities take place all entail the need to analyze and reflect on the meaning of materials in different professionals scenarios".

1.5 Diverse format and recipient

A look at the typology and characteristics of the materials published in the Galician reality reveals significant diversity in terms of format and target audience. We find materials funded by local authorities that could be intended for schools (Taboada Pérez, 2011), or materials mainly destined for groups such as adults, museums, cultural centres, social and cultural entertainment centres, and tourism centres (Fernández Bello & López Ferro, 2009).

1.6 Diverse authors

The materials created in municipal educational contexts are designed by professionals from different knowledge area backgrounds. In addition to teachers, social educators, and pedagogues who have didactic training, it is not uncommon to find didactic materials and educational resources created by local governments, authored by historians, biologists, linguists, and other professional backgrounds without specific didactic training. At first, it would seem that this confluence of professionals in the process of elaborating materials could have a beneficial impact in terms of improving elaboration processes, and representing an opportunity for professional development. Nevertheless, as stands out in some of the materials produced by municipalities that were analyzed, lack of pedagogical training was evident in some materials, manifested either in how they were organized, how the activity proposals were written or the underlying educational conceptualization.

1.7 Territorialized materials

The development of our study started out with a belief in the potential of local considerations and the idea that materials can contribute, in Carbonell's words (1995, p. 214), to "reinventing the territory" in the sense that they can promote the discovery of new educational spaces existing within municipalities, promote respect for cultural diversity and encourage the development of decentralized educational processes. Likewise, we believed that the formulation of locally contextualized proposals with contributions from the territory could help prevent cognitive non-contextualization produced by exclusively formal learning, which often tends to produce a high degree of social non-contextualization and uproots the child from their socio-cultural environment (Álvarez, 1990). It is also necessary to keep learning community principals in mind (Flecha García & Puigvert, n. d.; Freire, 1997), and emphasize the establishment of dialogic learning, the consideration of the family and relations in the development of materials, schools as learning centres for the whole community and the joint action of the teaching staff, and the consideration of other community entities in the development of proposals. We also agree with Alfieri (1990) in the needs for local protagonists (made up of families, local institutions, associations, and production structures) to be committed to providing children with

an experimental foundation that is rich, integral, authentic, distinct and healthfully conflictive.

1.8 Preparation of materials in local educational contexts

In our view, the development of didactic materials in local educational contexts constitutes a great opportunity to formulate alternative proposals to textbooks, so that we can compensate for many of their deficiencies. To provide quality education a school must pay proper attention to the particular needs of its students, especially in those education systems that insist on the need for addressing student's territorial and socio-linguistic diversity. Depending on contents and activity proposals, materials can contribute to weaving ties between what happens in school, and what happens in the social setting. Another aspect that has been highlighted in numerous accounts is the feasibility of elaborating materials contextualized in the municipal educational reality in order to help preserve heritage and appreciation for the local environment (Braga García & Schmidt, 2011; Rodríguez Rodríguez & García García, 2007).

In order to properly understand the object of our study and the research background leading up to the development of our research, we carried out a bibliographical review to determine the current situation. Insofar as recent literature reviews or national and international conferences, hardly any research was available focusing on the analysis of the issue of materials produced or funded in local contexts.

For an example of this we can look at the reviews and papers published in recent international conferences on Textbooks and Didactic Materials organized by the International Association for Research on Textbooks and Educational Media (IARTEM) (Bruillard, Aamotsbakken, Knudsen, & Horsley, 2008; Horsley, Knudsen, & Selander, 2005; Horsley & McCall, 2009; IARTEM & Education-Madagascar, 2008; Rodríguez Rodríguez, Horsley, & Knudsen, 2011), The International Conference on Scholastic Manuals (Quebec, 2006) and The International Seminar on Scholastic Texts (Educación, 2006). Similarly, we paid close attention to literature reviews analyzing the situation in recent years (Martínez Bonafé & Rodríguez Rodríguez, 2010). To summarize the research reviewed, we can say the following: *There is little tradition of research on the subject, basically experiences* (in general, the studies in this area focus on experiences presenting examples of different materials and papers published in local contexts revealing a proliferation of materials approaches and styles), *lack of awareness in schools regarding didactic materials produced in municipalities* (Rodríguez Rodríguez, 2006), *participation by a variety of professionals in the design and elaboration of materials, diverse types of didactic materials, and local presence in didactic materials*. According to a number of recent studies published regarding the content of textbooks, we observed that local considerations were virtually non-existent. There were hardly any references to content or tasks that encourage students and teachers to develop initiatives involving the local reality. However, we

should point out the existence of new research reflecting on the need to produce materials addressing the local reality.

2 Method

This section discusses the methodological process and results of a descriptive empirical study regarding the analysis of characteristics and features of materials developed by local governments. The descriptive study is part of a wider research project whose overall objective is to identify and understand the decisions, functions, processes and characteristics of didactic materials in print and digital format created with the support of local governments in the province of A Coruña. To do so, we developed a data collection form including several analysis categories, which will be mentioned later. After completing the data collection form, we needed headed off to city councils in order to collect and describe learning materials.

2.1 Study sample

To select the study sample, we considered the entire population of the province of A Coruña (Galicia, Spain), consisting of 93 municipalities. A deliberate non-probability sampling was used to select informants in these municipalities. First of all, we contacted the town hall by telephone, explaining the purpose of our research and the information sought. We were then referred to the person, agency, or department that best knew the information.

In most city councils (29%), municipal culture workers provided information regarding existing materials and their location. In other cases (16%), the person in charge of municipal libraries was considered to have best knowledge of these resources, because much of the materials published by municipalities can be found in these libraries. Less commonly (10%), information was provided by the Department of Education at the city council.

In addition to this direct contact with the 93 city councils, other local institutions were contacted for information: nursery schools, municipal museums, and city public libraries. Moreover, we paid close attention to the information in municipal websites and information provided by key informants.

2.2 Data collection

A descriptive research method was used, framed within a mixed research design (qualitative and quantitative variables). This study aimed to describe the elaboration of didactic materials in the municipality without influencing its development, and as background for other research designs. By means of this overview, we can establish the variables, unique cases, and representative cases of good practices worth studying in more depth in the future.

The methods used for data collection were interviews (Ketele & Roegiers, 1994) and document analysis (Creswell, 2005; Prior, 2003). A telephone survey was used to analyze if the municipality produced or had produced didactic materials. If the answer was yes, access to those published materials was requested. The didactic materials provided by town halls, libraries, schools, and key informants were then analysed in order to extract information to describe the overall picture and characteristics of these materials in the province of A Coruña. To identify relevant information in these documents, a categorized instrument was prepared. The categories studied include the following: geographical location; year of publication; authors' training, position and gender; format; language; target context; themes of the didactic material; and its use in schools. These aspects are discussed in detail in section 4 of this article. These categories favoured a data analysis method based on codification and allowed us to establish patterns and category analysis that were analyzed using SPSS statistical software.

2.3 Specification of didactic materials studied

Due to the need to specify the type of teaching and learning materials in the study and the very vagueness of the concept of didactic materials (Rodríguez Rodríguez, 2001), before starting document collection, we defined the concept of didactic materials developed with support from the local administration.

It was understood to mean the following: a technological resource intentionally elaborated for school, work, or social settings with the support of one or more local governments insofar as planning, design, publication, and/or dissemination for the primary purpose of mediating learning processes, either by providing proposals for educators, facilitating knowledge-building processes, or as a primary source of information.

These learning materials may appear in several experiential modalities and symbolic systems (audiovisual motion picture; audiovisual fixed image; audio media; digital media; print media; actual-means manipulative resources, and symbolic-means manipulative resources), but must serve an educational program or project.

Ten non-exclusionary criteria were established for selecting publications. Thus, meeting at least one of the following criteria was required:

- The didactic material is structured as a teaching unit.
- The didactic material makes reference to its didactic purpose.
- Some of its authors are teachers or educators.
- Publisher describes it as a didactic material.
- The didactic material deals with curricular topics.
- The didactic material is designed for use by an educational institution (school, museum, training centre) or its members.
- The didactic material is part of an educational or training project.
- The didactic material is part of a municipal plan.
- The didactic material is designed to respond to an educational process.

- Publications without an initial educational purpose but likely to be used educationally due to their thoroughness or interest for the topic.

In addition, an eleventh exclusionary criteria was established, stipulating that the following would not be taken into account in the study: publications lacking an education or training purpose, those without a didactic treatment of contents or iconographic design, and those providing very basic information.

The above criteria provide guidelines for identifying didactic materials, but to complete the concept of didactic materials developed with support from the local administration we needed criteria to identify what constitutes local government support. Firstly, we understood that the local government supported the development of didactic materials or educational resources whenever they participated in any of the four stages of development (planning, design, publication, or dissemination). Secondly, we identified such participation whenever at least one of the following four criteria were met:

- Institutional logo of the city council appears on the material.
- The didactic material contains a foreword or similar signed by a member of the government and mentioning the relevance of the didactic material.
- Explicit expression of gratitude to the council for its participation in any of the development stages (planning, design, publication, or dissemination).
- The official municipal website makes the educational material available for dissemination.

2.4 Categories considered

After identifying the selection criteria for the didactic materials in the study, categories to encode the information in these documents were established. This was done bearing in mind the overall research objectives, as well as other research on evaluating teaching resources and related archival and documentation processes (Abadal Falgueras & Codina Bonilla, 2005; Álvarez Cienfuegos, Gayoso Calatayud, & Novoa López, 1993; Marín Fernández, 1998; Moya Anegón, López Gijón, & García Caro, 1999; Parcerisa Arán, 1996). The categories selected were the following: geographical location, year of publication, authorship (training profile, employment status, and gender of the authors), form of the materials, language of publication, target context, and topic.

3 Results analysis and discussion

Data obtained from the analysis of documentation is here presented in light of the categories listed above. We would like to begin by noting the difficulty of getting information from city councils. The lack of knowledge and time, segmentation of goverment structures, and changes of government were factors hindering our search

for didactic materials produced with the support of local government. Although our parallel search in libraries, museums, schools, and municipal websites located at least one resource in all councils, we must indicate that the participant sample (those municipalities which actually responded) was approximately 82%.

3.1 Geographical location

The 761 resources located were unevenly distributed among 93 councils. Most resources (67.7%) were located in a minority of municipalities (10.75%). In 6 municipalities in the province of A Coruña, more than 30 publications were located that met the research criteria, while in 4 other municipalities, between 16 and 30 publications were located. Between 3 and 15 educational resources were found in 33 municipalities. In other words, 21.8% of didactic materials were located 21.5% of city councils. On the other hand, the remaining municipalities, comprising the majority of those in the province of A Coruña (67.75%), registered the smallest percentage of resources (10.5%). This is because in 50 municipalities, only one or two publications were found. From the data obtained, assertions can't be made regarding the reasons for these differences, but the following may have an influence on the distribution of didactic materials: budgetary differences (municipalities with the highest population have more financial resources) (Mareque León, 2011); the presence of technical workers or politicians sensitive to the role of local governments in the contextualization of teaching (Candedo Gunturiz, 2002); lifelong learning programs in the municipality; the presence of education professionals who design their own didactic materials (Braga García, Lima Picanço, Santiago Bufrem, Rodríguez Rodríguez, & Knudsen, 2013) or, from another perspective, the work done by municipal libraries (training materials created in some councils are no longer preserved, thus, conservation efforts by libraries may have an influence).

3.2 Year of publication

The data indicates that no didactic materials previous to 1984 were located. From that date, the presence of didactic materials was increasingly observed, as can be seen in Figure 1, because municipal administration in Spain as it known today started with the Spanish Constitution in 1978 (España, 29 de diciembre de 1978), and the first municipal elections in 1979. We can imagine that in the early years city councils focused their resources on other programs, and not on making didactic resources. There may have been an influence by the regulation of participation in education by the educational community introduced in the Organic Law regulating the Right to Education in 1985 (España, 4 de julio de 1985).

There was also a slight increase detected in 1990, probably due to the creation of the International Association of Educating Cities that year, which meant that some councils joined this international project and started designing didactic materials contextualized to their own reality, see, for example, the collection *Papeis de Ed-*

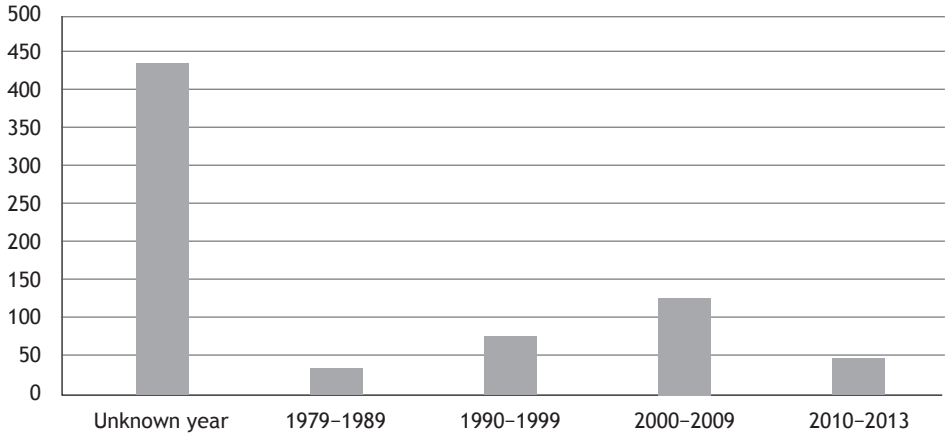

Figure 1 Educational resources by year of publication

ucación (Education Papers) developed by the Department of Education in Santiago de Compostela (Rodríguez-Abella Gómez, Varela Morales, Iglesias Martínez, & Papín Fernández, 2008).

3.3 Authorship (training profile, employment status, and gender of the authors)

Regarding the *training profile*, authors of 22% of materials had a bachelor's degree related to the design and evaluation of didactic materials, while 12% of materials had a mixed group of authors (consisting of people with a background in design and evaluation of didactic materials, and other people with specialized scientific careers, such as biology or history). The fact that there are authors with a didactic profile helps to explain the adequate structure and organization of didactic materials and their contextualization (Ramos Fernández, Castro Rodríguez, & Rodríguez Rodríguez, 1999). The percentage of materials whose authors had no-didactic training was residual (0.88%). Finally, the majority (65%) of materials located did not indicate the training profile of their authors.

Regarding author *employment status*, 62.8% of cases did not indicate the author's job profile. Of the remaining cases (37.2%), the majority were city council workers (12.5%), followed by museum training department workers (11.62%), primary and secondary school teachers (4.9%), members of associations (4.9%), and university professors (2.9%). In general, we can say that none of the authors were professionals dedicated exclusively to elaborating didactic materials, but did so as a supplementary task.

In the category of *gender* of authors, there is a clear predominance of mixed work groups consisting of both men and women (30.7%). In cases involving individual or co-authors, more educational resources were elaborated by men (10.2%) than by women (only 2.4%).

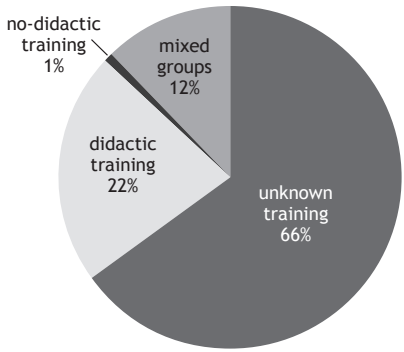

Figure 2 Training profile of the authors

KIND OF RESOURCE	EXAMPLE: TITLE, BRIEF DESCRIPTION AND LINK
Web	"Educabana": Access to local deposit of publications.
	http://concello-cabana.es/portal/educabana
Video	"Ao pé do Lar: As cociñas da xente": Video about the grandparents kitchens missing of great historical speeches.
	http://vimeo.com/9162923
Book	"Concello de Oroso. Guía histórica en imaxes": Resource elaborated by a cultural asociation in partnership with the council for awareness of local culture.
	http://www.manuelpazos.info/Marzoa.pdf
Pamphlet	"Mareas negras": Monograph of scientific communication elaborated by a museum to answer questions about the ecological disaster caused by the Prestige (oil tanker) in November 2002.
	http://mc2coruna.org/emuseo/?woo_extras=mareas-negras
Notebook	"COEducando construimos igualdade": Teaching guide of good practice in equal education.
	http://www.igualdade.naron.es/sites/arquivos/guia_coeducacion.pdf

Figure 3 Examples of Educational Resources

3.4 Format of the materials

The didactic materials found can be classified into two groups (Figure 3): digital format (32%) and printed or manipulable format (68%). Among those in digital format, web resources were predominant (65.2%), followed at a distance by video (20%) and CD (11.8%). Among the materials in printed or manipulable format, books (56.3%) and pamphlets (25.16%) stood out. They were followed by notebooks (10.9%), binders (1.3%), and community newspapers or magazines (1.3%). These results are in line with other studies in Galicia (Romero Rodríguez, Gradaílle Pernas, & Montero Souto, 2008).

3.5 Language of publication

One aspect of great importance in the context of our research refers to the language in which didactic materials are written. Galicia has its own language, and both Galician and Spanish are official languages. Galician is recognized in the school curriculum as a subject matter, and as the mandatory vehicular language in certain subjects.

The Galician language was predominantly used in didactic materials created with the support of local governments (69.8%), but Spanish was also used (22.9%). Residually, there were bilingual publications (in Spanish and in Galician) (2.9%) as well as trilingual publications combining text in Spanish, Galician and English (or sometimes Spanish and English) (4.3%).

It should be noted that in recent years, the Department of Culture, Education, and University Planning of the Autonomous Region of Galicia has offered financial assistance to encourage the use of Galician in didactic materials (see e.g. the 2013 edition: http://www.edu.xunta.es/web/node/8557) and city councils have responded to these calls. Likewise, the enactment of the Galician Language General Standardization Plan (Galicia, 2006) and municipalities' own commitment has had a positive influence on the elaboration of didactic materials in the Galician language.

3.6 Target context

With respect to the target context category, it should be noted that a large majority (60.1%) of the publications considered to be didactic materials or resources elaborated with the support of city councils in the province of A Coruña target the social context. The social sphere promotes sociability, as well as cultural and social development in the target population, thus promoting incorporation into social networks in terms of education, employment, leisure, and social participation. We found a wide variety of contents among the materials for the social sphere: recovery of historical memory with older people, didactic materials related to programs for equality and against gender violence, as well as those promoting local identity or popular science. Defining target contexts turned out to be complex. In this case, we

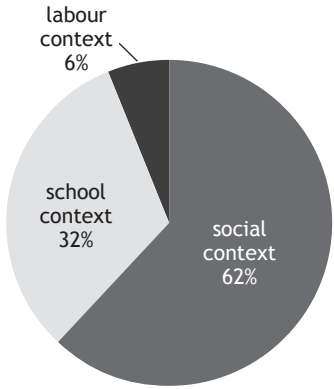

Figure 4 Educational Resources by target context category

situated ourselves midway between other terms used in the literature: non-formal education (educational activity outside the official education system to facilitate learning by adults and child population subgroups) (Trilla, 2003) and social education (development of sociability, social movement as well as student cultural and social promotion) (Petrus, 1997).

Secondly, 31.4% of the materials were destined for the school context with a clear predominance of curricular topics (biology, history, literature, and so on) addressed from the standpoint of local reality, as well as the tangible and intangible heritage of the municipality. We are referring to formal education ranging from primary education to secondary and higher education. And finally, 5.7% of the educational resources found were for the labour context. They tended to focus on job-hunting, continuing training, and models for administration workers. We would like to point out that this area was quite underdeveloped, and most resources were found in only three city councils. In Figure 4 we can see a pie chart with information regarding this category.

3.7 Topic

A variety of contents were found among the publications elaborated by city councils. What stood out from the rest (37.1%) were didactic materials where heritage was the main theme (natural, historical, linguistic, cultural, architectural, and so on); followed by city tours or hiking trails (21.8%); those relating to social policy, such as materials about equality or the use of new technologies (16.7%); 12% were resources on curricular content, especially those focussing on the environmental; and there was a similar frequency of materials for the popularization of science (10%). Many of these teaching materials contextualized in the Galician reality claimed to offer themes that were not present in textbooks with a “centralist” view of the curriculum (Martínez Bonafé, 2003, 2008).

A particularly important fact is that the vast majority of materials tested do not appear to be part of a community action project (Parcerisa, 2010, p. 23). Instead, they seem to respond to specific themes, isolated interests for political campaigns, or unique municipal needs. Our findings are in line with other studies seeking to determine the type of materials developed in local contexts, which highlight the presence of materials regarding cultural heritage and city tours or hiking trails (Castro Rodríguez, Rodríguez Rodríguez, & Zapico Barbeito, 2013).

3.8 Use in schools

Although not the primary objective of the study, during materials collection we had the opportunity to hear opinions from librarians, those in charge of municipal cultural programs, and teachers regarding the use made of these materials in schools. In general terms, and bearing in mind research on the use of materials in schools, we can highlight the following: teachers often lack knowledge of the materials existing in socio-educational institutions near schools containing locally contextualised educational proposals. Adherence to textbooks and the lack of an adequate materials dissemination policy may partly explain the ignorance of these materials (Rodríguez Rodríguez, 2001). A sporadic use of didactic materials to supplement textbooks in the development of certain activities has occasionally been detected. A large part of the material produced by municipalities is used as reference materials. It should be noted that a lesser degree of knowledge of local materials is detected in those schools where teachers are not permanent. The fact that their job is only guaranteed for one course leads teachers to focus on using didactic materials available at the school, i.e. mainly textbooks.

4 As a synthesis

To summarize, we could say that no common pattern of didactic materials design and publication was found in the city councils in the province of A Coruña. This may be because municipalities design didactic materials and educational resources to answer specific needs of their own territory, and since needs differ among municipalities, it is reasonable for the characteristics of educational resources to also differ.

The diversity among city councils manifested itself in an uneven territorial distribution of resources, seeing as the majority of didactic materials located were concentrated in 10 municipalities, there was also a wide range of contents and topics interacting with the diversity of target contexts and groups, various presentation formats (although print was still dominant), and a diverse use of language including Galician, Spanish, and English, with a clear predominance of the first.

There are two other categories in our study where significant similarities were observed. One is the year of publication, which presented some differences among municipalities, but showed a common trend in that publication of didactic materials

with support from city councils has continued to increase gradually since 1984. In the category of authorship we also identified a predominance of professionals trained in the evaluation and design of didactic materials (or mixed groups including authors with this educational profile); employed in education-related fields but in a variety of contexts (schools, museums, councils, etc.); and there was no significant gender gap, with a predominance of groups with a mix of male and female authors.

As a final comment, we believe that the literature review and the empirical data demonstrate that this is a field of required research which presents new possibilities for the study of textbooks and didactic materials. Although the lack of previous research makes it more difficult to understand some of the characteristics of materials sponsored by local governments, we can say that these administrations are interested in developing didactic resources that can complement school textbooks and help the community to understand its environment. The study results suggest the need for deeper analysis on issues such as government decisions affecting the elaboration of didactic materials at the municipal level; the professionals who design these materials; the didactic evaluation of existing materials and the effective use of didactic materials. We hope to provide new results on some of these issues in the near future. The results also highlight the need for more municipalities to promote the elaboration of materials contextualized in their sphere.

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Classroom Teaching and Learning Resources: International Comparisons from TIMSS – A Preliminary Review

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Abstract: This paper explores international comparisons of data collected on classroom teaching and learning resources from TIMSS (Trends in International Mathematics and Science Study) in Mathematics and Science. Since its commencement in 1995, TIMSS has collected data from students, teachers, and principals using questionnaires on the perceptions of classroom teaching and learning resources. The paper examines what classroom teaching and learning resources teachers use in different countries, and explores the extent to which the textbook is still being used as the 'basis' of instruction, or as a 'supplementary' resource in the classrooms. It also explores continuity and change in the way teachers report they provided resources from 2003 to 2007, and 2011. The paper briefly reports on the range of studies using TIMSS data to explore the links between school and classroom factors and student achievement. This current research endeavour and its conceptual frameworks have largely ignored the role of classroom teaching and learning materials. The paper proposes a theoretical framework for considering how classroom teaching and learning materials may afford student achievement and learning. It shows that textbooks are the basis of instruction in an international context. However, it also shows that across countries, teachers value different classroom teaching and learning resources differently. The paper concludes with suggestions for further research to examine the relationship between use of different types of classroom teaching and learning materials, and student achievement based on multi-level analysis, but reminds of the need to reconsider the traditional input – output framework.

Keywords: teaching and learning resources, textbooks, sociocultural approach, TIMSS

This paper undertakes an international comparison of data collected on classroom teaching and learning resources from TIMSS (Trends in International Mathematics and Science Study), which is conducted every four years by the International Association for the Evaluation of Education Achievement (IEA).

Overall, international measures of student achievement, such as TIMSS and PISA (Program for International Student Assessment – conducted by the OECD), have become more and more critical in the development of national and international educational policies. They represent an external benchmarking system that is used to explore the impact of national and international educational reform and policy developments. Increasingly, international measures of student achievement have been used to identify and promote educational policy reform settings from nations that lead these international measures of student achievement.

1 The TIMSS student evaluation

The purpose of TIMSS is to assess performance in mathematics and science of students in grade 4 of schooling, (usually students have a mean age of 9.5 years); and in grade 8 (usually students have a mean age of 13.5 years). TIMSS achievement data was collected in 1995, 1999, 2003, 2007 and 2011, with another round proposed in 2015. In 2011, more than 60 nations participated in the TIMSS study, with a sample of more than 500.000 students worldwide.

The focus in most TIMSS analyses and discussions is around the averages for each country in terms of student achievement, and national comparisons between these averages. TIMSS and PISA develop league tables of student performance on tests that allow comparison between different countries. The focus on making national averages for league table comparison masks great differences, not only between countries, but within them as well.

The development of the TIMSS student evaluation programs has also provided some of the most extensive data sets on students, classrooms, schools, and families in the history of education research. This data allows the explaining and interpreting of students' scores in tests in the contexts of educational and sociocultural settings.

Among other things, TIMSS incorporates specific analysis of classroom teaching and learning resources, and presents some data on how these learning resources correlate with student learning (as measured by TIMSS). The data on classroom teaching and learning resources is but a very small component of the wider data sets. From its commencement in 1995, TIMSS has collected data from students, teachers, and principals, using questionnaires on the perceptions of classroom teaching and learning resources. The TIMSS questionnaires, 1999–2011, typically ask participating principals to identify if there's a shortage of teaching and learning resources, and then teacher's questionnaires ask teachers about classroom resources and materials used in their classrooms.

1.1 Use of TIMSS data to explore links between school and classroom factors, and student achievement

The extensive data sets have provided the impetus for a huge range of studies that explore the impact of different student characteristics, school structures and operations, teaching and pedagogical differences, and socioeconomic and educational systems variations in student achievement within and between countries.

A range of studies have explored these links to analyse educational factors that may contribute to studying learning and achievement. Drent et al. (2013) reported that in particular, secondary analyses studies were increasingly trying to differentiate factors which might have these impacts. Examples of these studies include factors such as class size (Breton, 2014), classroom composition (Chudgar et al., 2013), quality of curriculum (Hook et al., 2006), learning strategies (Kaya & Kablan,

2013), instructional strategies (House, 2009), self-concept and valuing of mathematics (Eklöf, 2007), student self-perception (Shen & Tam, 2008), students' perception of the learning environment (Vandecandelaere et al., 2012), social capital of students (Pugh & Telhaj, 2008).

But very few studies have analysed textbooks, and the studies focused on computers, tablets, and other ICT resources studied them in isolation from other teaching and learning resources used in the classes under study, e.g. study on ICT-use in primary mathematics instruction (Eikelman et al., 2012), or student computer use in science (House, 2012). The only two studies aimed at the school resources and their relationship with student achievement. Afana et al. (2013) compared Israeli Arab, Israeli Hebrew, and Palestinian Authority schools, and focused on shortages of resources as a factor of different achievements. Wilkens (2011) sought to determine whether there was a relationship between the types of textbook approval systems, and students learning outcomes.

Drent et al. (2013) use the generic framework for the review of the TIMSS studies based on classic input – output process. The framework conceptualizes input factors as related to the outputs, but operating to process factors at the class or school level. Scheerens et al. (2007) identified a number of process factors that enhance effectiveness, or 'black box' factors, related to high achievement. According to Drent et al., the process factors include: achievement orientation and expectations; curriculum quality/opportunity to learn; structured instruction; differentiation, adaptive instruction; feedback and reinforcement; evaluative potential; school/class climate; educational leadership; effective learning time; consensus and cohesion among staff, and parental involvement.

2 Theoretical model and research questions

In this paper, we introduce the learning model which allows us to frame the research questions and explore the complexities of use of classroom teaching and learning resources. This model and its applications will be briefly described below.

2.1 Sociocultural approach to classroom teaching and learning resources

Sociocultural approaches to learning have their origins in the approach of Vygotsky. Lantolf (2004) explained sociocultural theory as "a theory of mind … that recognizes the central role that social relationships and culturally constructed artifacts play in organizing uniquely human forms of thinking" (pp. 30–31). So the role of mediational tools – either physical (e.g., calculators, maps, or computers) or psychological (e.g., literacies, pedagogical frameworks, conceptions of learning, and language itself) is an important aspect of learning (Thorne, 2004). Hall (2001) explained the significance of such tools, stating that "the means themselves and the ways in which we

use them in the pursuit of action with others do not simply enhance our individual development, but rather, they fundamentally shape and transform it" (p. 29).

A sociocultural approach to classroom teaching and learning resources emphasises that such resources will be critical tools in the learning process, heavily mediated by the teachers use in making meaning from them, and crucial in creating zones of proximal development for students – learning environments where students can utilise learning tools, and the expertise of others to learn and develop. Following these ideas, "… the most pertinent question may not be *what* is included (or not) in a particular textbook package, but *how* instructors are using it (or not) in their teaching practices, and *why*" (Allen, 2008, p. 7).

Mediational tools are dynamic. That is to say, the use of tools and the role they play in learning depend on the cultures in which they are found, as well as human agency (Lantolf & Thorne, 2006). Given the role of the sociocultural practices that develop in different educational and cultural contexts, it would be expected that different classroom teaching and learning resources will be valued differently in different cultures and communities. Furthermore, classroom teaching and learning resources, and the sociocultural practices of their use, will evolve. An expression of this is that significant differences will be observed between cultures and communities about teaching and learning resources, and the sociocultural practise of their use. Such differences in the primacy of cultural resource practices will include: nature of teaching and learning resources, how they are used, attitudes towards them, their funding and provision; and their heritage history and trajectories. Furthermore, since learning environments are contextually and culturally bound, sociocultural practices will differ in some measure even from school to school, from community to community, from teacher to teacher, from class to class, from student to student.

At the same time, sociocultural approaches to thinking about classroom teaching and learning resources will emphasise their importance and role as powerful cultural learning tools: that are critical for promoting thinking operations, and inducting student learners into disciplinary practices and domains of knowledge. In playing these roles, classroom teaching and learning resources are mediated by teacher and student use, and shape thinking and internalisation. Sociocultural approaches emphasise that the primary role of classroom teaching and learning resources is to scaffold student learning – through providing sources of knowledge and inquiry they should promote self-regulated learning skills. They also assist teachers plan the development of learning environments. It is to be noted that since each discipline has its own practices, e.g.: community of practice, discourse, language, community of learners, different teaching and learning resources also have their aligned sociocultural practices. Different teaching and learning resources provide different forms of scaffolding; they support students learning in different degrees and ways.

Sociocultural approaches emphasize the fact that teachers mediate the use of classroom teaching and learning resources. Teachers use and interpret the resources to develop intersubjectivity, establish common student goals, and to create a zone of proximal development for students. Resources should support drill and practice

in the zone of actual development, but also provide challenging inquiry in the zone of proximal development, and promote conceptual growth. While thinking of the nature and purpose of classroom teaching and learning resources, it is important to consider the resources from learner's perspective, and to consider the role of resources in the learning environment.

2.2 Use of textbooks and digital resources in the classroom: the research questions

TIMSS data is useful in providing evidence to answer many questions relating to the international use of classroom teaching and learning materials. These research questions include:

RQ1: What classroom teaching and learning resources were teachers using in mathematics and science in 2011?

Are teachers using textbooks as the basis for instruction in maths and science in 2011? Do they employ workbooks and worksheets? Is computer software used more as a basis, or as a supplement? Do higher performing countries use more textbooks or computers as the basis for instruction than lower performing countries?

RQ2: Is the use of textbooks falling?

Comparing the data from 2003, 2007, and 2011, what changes can be tracked regarding the extent and way of using textbooks?

Two hypotheses were formulated based on the research question 2:

H1: There is a significant difference between the average percentage of students, whose teachers use textbooks as a basis for instruction in 2003 and 2007; 2003 and 2011; 2007 and 2011 in:

(a) grade-4-science,
(b) grade-4-mathematics,
(c) grade-8-science,
(d) grade-8-mathematics.

H2: There is a significant difference between the average percentage of students, whose teachers use textbooks as a supplement for instruction in 2003 and 2007; 2003 and 2011; 2007 and 2011 in:

(a) grade-4-science,
(b) grade-4-mathematics,
(c) grade-8-science,
(d) grade-8-mathematics.

Regarding classroom teaching and learning resources (CTLR), the data on printed media, i.e. textbooks and workbooks/worksheets, and digital media, i.e. computer software, has been processed. The TIMSS teachers' questionnaires did not define 'textbooks' as printed media explicitly. However, it is obvious from the context that e-materials including digital textbooks were covered by the term 'computer

software'. The extent of CTLR use is expressed in percentages of students in the countries whose teachers use various CTLR in specific ways. The ways of CTLR use involve 'as a basis for instruction', 'as a supplement', and 'not used'. The students' achievement is represented by mean scores the students achieved in TIMSS tests.

3 Methods

The research methodology employed the following steps:

In step 1, the TIMSS data for grade-4 and grade-8 science and mathematics resources that teachers use for teaching was identified from TIMSS 2011, 2007, and 2003 reports. This data was sourced by a large scale teacher survey conducted by TIMSS, where teachers reported the classroom teaching and learning resources that they use to teach the subjects nominated. TIMSS questionnaires incorporated two types of items regarding teaching and learning resources. First, the principals were asked to identify if there is a shortage of CTLR in their schools. We did not analyse this data, because it does not provide direct information on usage in the classrooms. The analysis presented in this article focused on the second data source, the teachers' questionnaires.

TIMSS teachers' questionnaires were targeted on textbooks, workbooks/worksheets, and computer software having been used in science and mathematics, in grade 4 and grade 8. In addition, the science teachers were asked about the reference books. In fact, the questions included one more resource: concrete objects in mathematics and science equipment or materials. The analysis in this article omitted these materials on purpose – it only focused on the text and/or pictorial resources in printed or digital form. In 2003 and 2007 questionnaires, teachers responded to two types of questions: *Do you use a textbook(s) in teaching mathematics/science in the TIMSS class? (Yes/No)* and then *How do you use a textbook(s) in teaching science/mathematics to the TIMSS class? (As a primary basis for my lessons, As a supplementary resource)*. In the 2011 version, the questions had been merged into one item: *When you teach mathematics/science to this class, how you use textbooks?* with the following multiple choice responses offered: *Basis for the instruction, Supplement, Not used*. In addition, the same questions were targeted on workbooks/worksheets, and computer software on both subjects in the TIMSS 2011 study.

The International TIMSS Databases provided data on percentages of students whose teachers use particular CTLR in specific ways (as a basis for instruction, as a supplement, not used), matched to the average scores of students taught by the teachers. The sample based on TIMSS 2011 comprised the data from 50 countries participating in grade-4 study, and 42 countries participating in grade-8 study. For comparisons of 2003, 2007, and 2011 data, only those countries were included that participated in all three studies, i.e. 20 countries for grade-4 analysis, and 29 countries for grade-8 analysis. The changes in time could be followed regarding only textbooks, because TIMSS 2003 and 2007 targeted only this teaching and learning resource.

In step 2, we involved statistical analyses to test the hypotheses H1 and H2 formulated in relation to research question 2. The non-parametric Mann-Whitney U test was applied to examine the differences between the percentage values of students whose teachers use classroom teaching and learning resources in 2003, 2007 and 2011. The non-parametric test was chosen because the data available had not been normally distributed, as shown by the Shapiro-Wilk test, and the skewness and kurtosis examination.

4 Results

4.1 What classroom teaching and learning resources were teachers using in mathematics and science in 2011?

As shown in Table 1, textbooks were used as the very basis for instruction. The mean percentage of students whose teachers use textbooks accordingly, was lowest in the case of science in grade 4 (about 70 percent), and the highest with mathematics in grade 8 (77 percent). Workbooks were used as a basis of instruction comparatively less (34–46 percent of students), and computer software at the lower end (7.3–15.9 percent). The highest ranking of textbooks is cross-referenced by other data. An average 45 percent of students whose science teachers in grades 4 and 8 reported using textbooks in 'every or almost every lesson', and another 25 percent of students whose teachers reported using them in 'about a half of the lessons' (see Table 2).

Table 1 Percentage of students, whose teachers use classroom teaching and learning resources as a basis for instruction: An international average

		Textbooks (%)		Workbooks (%)		Software (%)	
	N	Mean	S.D.	Mean	S.D.	Mean	S.D.
Science: grade 4	50	69.7	28.2	41.0	20.8	11.2	11.3
Maths: grade 4	50	75.5	24.4	45.6	22.4	9.0	8.9
Science: grade 8	42	74.1	21.6	35.4	15.4	15.9	1.3
Maths: grade 8	42	77.2	19.1	33.7	17.9	7.3	6.8

Source: TIMSS 2011 International Database (2013)

Notes: N = number of countries participating in the study; S.D. = standard deviation

Table 2 Percentage of students whose teachers use textbooks or other resource materials in science lessons according to the reported frequency of using (an international average)

Frequency in science	Every, or almost every lesson (%)	About half of the lessons (%)	Some lessons (%)	Never (%)
Grade 4	44.7	25.2	27.0	3.0
Grade 8	45.6	24.3	28.4	1.7

Source: TIMSS 2011 International Database (2013)

The mean values, of course, can be misleading, as we can here infer from relatively high standard deviations values. Among various countries reporting, huge variances existed in the percentages of students whose teachers use *textbooks as a basis for instruction*: from 3.6 percent of grade-4-science in England, up to 99.3 percent of grade-4-mathematics in Chinese Taipei, and science in Georgia. Nevertheless, the questionnaire investigation brought to light following findings:

- Related to grade-4 study, in 26 countries (out of 50 participating), more than 80 percent of students were taught by teachers who reported they used textbooks as a basis for science instruction. The same holds for 29 countries for mathematics instruction.
- Related to grade-8 study, in 22 countries (out of 42 participating), more than 80 percent of students were taught by teachers who reported they used textbooks as a basis for science instruction. The same holds for 26 countries for mathematics instruction.

There were countries in which the percentage of students whose teachers use textbooks as a basis for instruction, was high regardless of the grade or subject, for example Georgia, Armenia, Chinese Taipei, Korea, Saudi Arabia. On the other hand, there were several countries in which the percentage of students, whose teachers use textbooks as a basis, was comparatively very low in both subjects and grades: e.g. England, New Zealand, Australia, and Chile.

The critical terms are, nevertheless, 'as a basis' and 'as a supplement'. The above findings are relevant to the use of textbooks as a basis for instruction. On analysing the data relevant to the textbooks used *as a supplement*, the international average of students whose teachers used textbooks accordingly in 2011 is a little more than 20 percent (22.3 in grade-4-science, 21.1 in grade-4-mathematics, 24.3 in grade-8-science and 21.2 percent in grade-8-mathematics.) It is necessary, however, to take into account that it might be difficult to distinguish between 'as the basis of instruction' and 'as a supplement'. If we consider using the textbooks in the instruction *totally,* i.e. regardless to the way of use, then it is evident that the percentage of students is still lowest in the countries as England, New Zealand, and Australia. But here great discrepancies among subjects and grades have appeared: in grade-4-science the percentage was less than 50 percent, while in grade-4-mathematics it was already about 75 percent, and in grade 8 it rose to more than 85 percent in England, and to more that 90 percent in other countries. To express it in another way, in spite of several countries in which the percentage of students whose teachers do not use textbooks in grade-4-science, is comparatively high (Australia, England, New Zealand, and Malta), the international average of students whose teachers *do not use textbooks* at all, dips to very low figures: 8 percent in grade-4-science, 3.4 percent in grade-4-mathematics, and approaches only 1.6 percent in grade-8-science and mathematics. The distinct difference between grade 4 and grade 8 in the countries at the lower end of textbook usage can be illustrated by the example of Australia: science teachers of 54 percent of students and mathematics teachers of 29 percent

of students reported not using textbooks in grade 4, but science teachers of only 3.7 percent of students and mathematics teachers of only 3.4 percent of students in grade 8.

Using computer *software as a basis* for instruction varied noticeably, from no grade-4-mathematics teacher reporting usage in Poland, up to the exceptional value of 49.9 percent of grade-8-science students from Korea whose teachers reported using software in this way. The situation can be described as really manifold. The highest use of software was reported by countries such as Korea, Hong Kong, Qatar, and Saudi Arabia in both grades and subjects. However, it is important to point out that not all technologically developed and/or comparatively rich countries used software extensively. For example Japan, Finland, and Germany belong among the countries with less than 3 percent of students whose teachers reported the use of software as a basis. The relationship between using *textbooks and software as a basis for instruction* varied noticeably, too. There are countries in which both resources were widely used, e.g. Saudi Arabia (textbooks 91%; software 42% in grade-8-science) and Korea (88%; 49.9%). Then, there are countries, in which teachers distinctly preferred textbooks over software, e.g. Finland (textbooks 94%; software 1.1% in grade-4-science) and Japan (82%; 2%). The only countries reporting predominance of software were New Zealand and England (for grade-4 science and mathematics, and grade-8-science), and Northern Ireland (for grade-4-science), being the countries with the least dependency on whichever text resource used as a basis for instruction, including textbooks and workbooks.

We can conclude that in 2011 all over the world, textbooks still highly prevailed as classroom teaching and learning resources in most countries, regarding science and mathematics, both in primary and lower secondary schools. At the same time, the usage of different resources varied distinctly relating both to the extent and the way in which the resources were introduced into instruction.

4.2 Is the use of textbooks falling?

As we could see above in the text, according to the TIMSS 2011 findings, textbooks stay firmly in place for classroom teaching and learning resources in science and mathematics. But what are the emerging trends, if any? With the widespread use of digital resources, we pose the question of whether teachers across the countries would use textbooks less than in previous years. Two basic hypotheses were formulated:

> H1: There is a significant difference between the average percentage of students whose teachers use textbooks as a basis for instruction in 2003 and 2007; 2003 and 2011; 2007 and 2011; in grade-4-science / grade-4-mathematics / grade-8-science / grade-8-mathematics.
> H2: There is a significant difference between the average percentage of students whose teachers use textbooks as a supplement for instruction in 2003 and 2007; 2003 and 2011; 2007 and 2011; in grade-4-science / grade-4-mathematics / grade-8-science / grade-8-mathematics.

For testing the hypotheses, only the data available from the countries participating in all three TIMSS international studies 2003, 2007, and 2011 were applied to comparison of development in the particular countries. Thus the data sample of 20 countries was selected for grade 4 analysis, and the data sample of 29 countries for grade 8[1]. The mean percentages of students whose teachers used textbooks in 2003, 2007, and 2011, according to the teachers self-reports, are listed in Table 3.

Table 3 Percentages of students whose teachers used textbooks as a basis for instruction and as a supplement for instruction in 2003, 2007 and 2011: An international average

Textbooks use	N	As a basis (%)			As a supplement (%)		
		2003	2007	2011	2003	2007	2011
Science 4	20	57.8	57.2	70.7	27.0	30.8	19.4
Maths 4	20	63.5	63.8	70.8	32.2	32.9	23.7
Science 8	29	57.9	56.5	75.1	38.2	37.0	23.1
Maths 8	29	66.6	62.8	78.7	31.3	32.2	19.5

Sources: TIMSS 2011 International Database (2013); Foy & Olson (2009); Martin (2005)
Note: N = numbers of selected countries

For the statistical analyses of differences among the findings from three separate years, the non-parametric Mann-Whitney test was applied, due to the data not being normally distributed. The main results were as follows:

- In all cases the differences between findings from years 2003 and 2007 are not statistically significant. The percentages of students whose teachers used the textbooks do not differ for either as a basis, or as a supplement. It holds true for grade-4-science, grade-4-mathematics, grade-8-science, and grade-8-mathematics without exception. The hypotheses H1 and H2 have not been proven for the years 2003 and 2007.
- On the contrary, there are statistically significant differences between the percentages of students whose teachers used textbooks as a basis for instruction in 2003 and 2011, as well as in 2007 and 2011. The findings apply to the grade-4-science, grade-8-science, and grade-8 mathematics. Hence hypothesis H1 has been proven for these three cases. From 2003/2007 to 2011, the percentage of students whose teachers use textbooks as a basis for instruction *increased* significantly (see Figures 1 and 2). In the case of the grade-4-mathematics teachers, the differences have not been statistically significant. The detailed results of Mann-Whitney U tests are presented in the Attachment, Table 6, reporting mean ranks, U statistics, and *p*-values.
- The findings with regards to the textbook use as a supplement are similar. There are statistically significant differences between the percentages of students

[1] The total numbers of all the participant countries in grade-4 studies were: 26 in 2003, 36 in 2007, and 50 in 2011.The total numbers of all the participant countries in grade-8 studies were: 47 in 2003, 49 in 2007, and 42 in 2011.

whose teachers used textbooks as a supplement for instruction in 2003 and 2011, as well as in 2007 and 2011. The findings apply to grade-4-science, grade-8-science, and grade-8 mathematics. Hence hypothesis H2 has been proven for these three cases. From 2003/2007 to 2011, the percentage of students whose teachers use textbooks as a supplement for instruction *decreased* significantly (see Figures 1 and 2). In the case of the grade-4-mathematics teachers, the differences have not been significant. For detailed results see Attachment, Table 6.

In order to get better grasp of the changes that have taken place, the examples are reported below, regarding individual countries which took part in the 2007 and 2011 TIMSS studies. Total number of 29 countries participated in the grade-4 study. For instance, if comparing the data on students whose teachers used the textbooks as a basis in grade-4-science, the percentage increased in 25 countries (regardless of the statistical significance). In 10 countries, the reported difference from 2007 to 2011 amounted to 25 percent: e.g. in Austria, Czech Republic, Norway, Kuwait. Only in 4 countries the percentage decreased – most markedly in Singapore (by 7.6 percent). As for grade eight, 35 countries participated both in TIMSS 2007 and 2011. The percentage of students whose teachers used textbooks as a basis increased in 31 countries totally, of which in 14 cases more than by 25 percent, including such countries as Italy, Israel, Turkey, and Slovenia. The percentage fell only in 4 countries, including England (almost by 14 percent) and USA (about 9 percent).

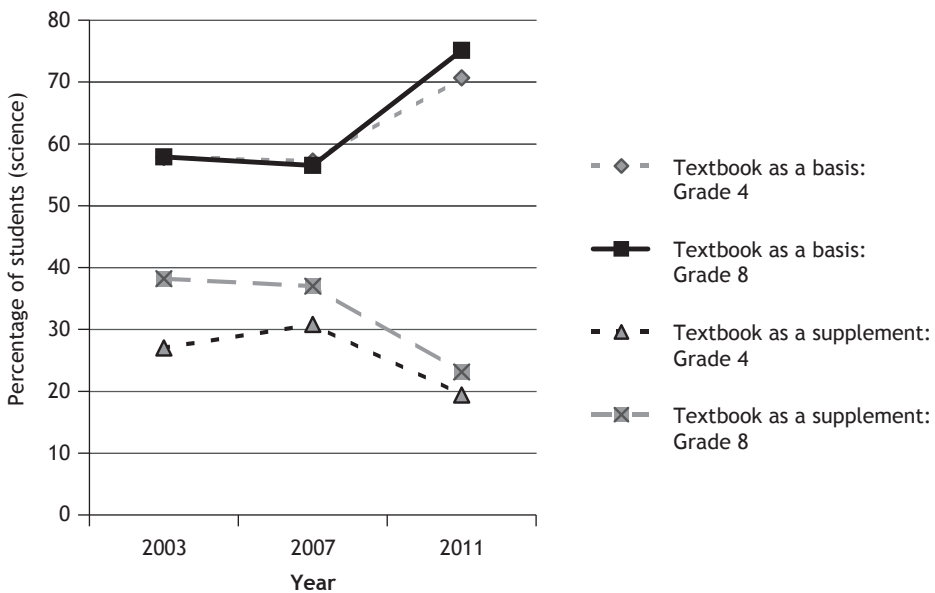

Figure 1 Percentages of students whose teachers used textbooks as a basis for instruction and as a supplement for science instruction in 2003, 2007, and 2011: An international average
Sources: TIMSS 2011 International Database (2013); Foy & Olson (2009); Martin (2005)

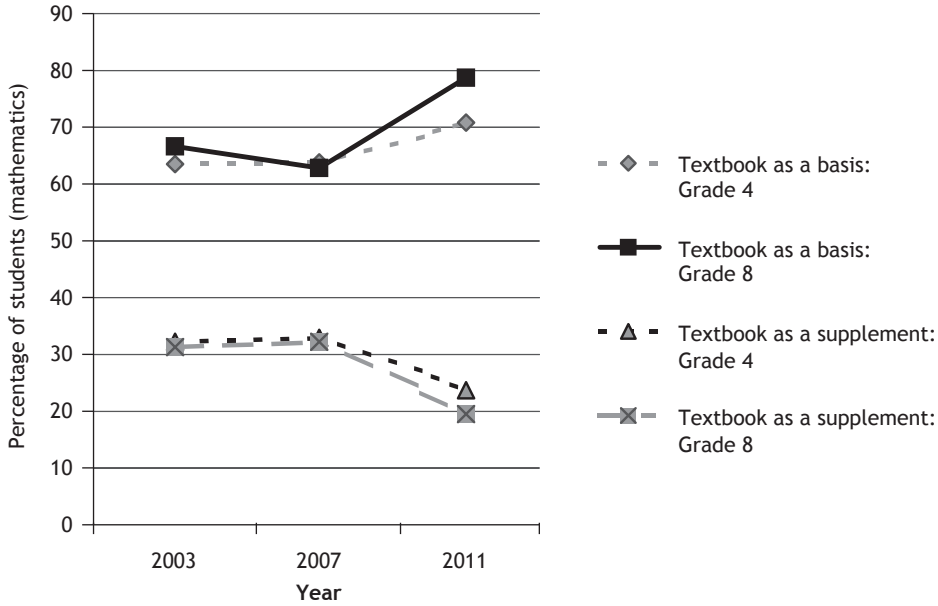

Figure 2 Percentages of students whose teachers used textbooks as a basis for instruction and as a supplement for mathematics instruction in 2003, 2007, and 2011: An international average
Sources: TIMSS 2011 International Database (2013); Foy & Olson (2009); Martin (2005)

On the basis of TIMSS questionnaires data analysis certain conclusions can be derived. Between the years 2003 and 2007, as teachers self-reported, the extent and basic ways of using textbooks did not change. In the next period – in the 2011 study – a considerable change occurred: the percentage of students whose teachers used textbooks as a basis for instruction markedly rose, and at the same time the percentage of students whose teachers used textbooks as a supplement distinctly declined. These changes appeared in both subjects and in both grades, statistical significance has been confirmed for grade-4-science, grade-8-science, and grade-8-mathematics. Hence the decrease of textbook use has not become reality beyond doubt. On the contrary: on an international scale, more teachers used textbooks as a basis for their teaching in 2011 than four or eight years ago. It is of course necessary to factor in the methodology of data gathering based on the teachers' responses in questionnaires. Nevertheless, the findings seem to be consistent.

5 Conclusions and discussion

From several viewpoints, we searched for the answer to two basic questions: what classroom teaching and learning resources teachers use for instruction, and whether any changes can be tracked regarding the extent and way of using textbooks.

As far as the resources use is concerned, textbooks still highly prevail as classroom teaching and learning resources used as a basis for instruction. According to the TIMSS 2011 Study, more than 70 percent of students were taught by teachers using textbooks as a basis of instruction. The other key classroom teaching and learning resources – workbooks/worksheets and computer software – were used as a basis comparatively less (workbooks – about 40 percent, software – about 11 percent in average). For more detailed description see Tables 1 and 2.

Teachers across various countries in the world became even more textbook dependent than before. TIMSS 2011 findings show that the average proportion of students whose teachers use *textbooks as a supplement has decreased*, while the average proportion of students whose teachers use *textbooks as a basis has significantly risen* since 2003 and 2007 (see Table 3). On the other hand, it does not mean that workbooks/worksheets and computer software were not used – teachers used them rather extensively as a supplement. The average values range from 52.7 to 62.2 percent of students whose teachers used workbooks or software as a supplementary aid (see Table 4).

Table 4 Percentage of students whose teachers use classroom teaching and learning resources as a supplement for instruction: An international average

	N	Textbooks (%)	Workbooks (%)	Software (%)
Science: grade 4	50	22.3	55.6	52.7
Maths: grade 4	50	21.1	52.9	55.9
Science: grade 8	42	24.3	60.0	60.5
Maths: grade 8	42	21.2	62.2	54.6

Resource: based on TIMSS 2011 International Database, 2013

Note: N = number of countries participating in the study

At the same time, the situation can be described as diversified with *different resources emphasised in different countries*.The data in Table 5 may well exemplify the great diversity in using classroom teaching and learning resources across countries. As an example, the outcomes of grade-4mathematics have been employed. The percentages of students whose teachers used textbooks and computer software as a basis are presented, reported by teachers from the ten highest ranking countries, and from ten countries ranking at the low end of scale, according to the students' scores. Both among the high achieving countries and among low achieving countries there are huge differences in percentages of students whose teachers self-reported particular CTLR use. The state of affairs in grade-8-mathematics and grade-4 and 8-science is very much alike.

The situation described above is in accord with sociocultural approaches to classroom teaching and learning researches. Given the role of the sociocultural practices that develop in different educational and cultural contexts, it would be expected

that different classroom teaching and learning resources will be valued differently in different cultures and communities.

Table 5 Percentage of students whose teachers used textbooks or software as a basis for instruction in high-achieving and low-achieving countries in grade-4-mathematics

Rank	M4_top 10	CTLR used as a basis		Rank	M4_low 10	CTLR used as a basis	
		Textbooks	Software			Textbooks	Software
1	Singapore	69.6	16.2	41	Bahrain	76.0	17.1
2	Korea, Rep. of	98.6	25.1	42	UAE	80.4	17.8
3	Hong Kong SAR	87.7	34.4	43	Iran	90.5	2.4
4	Chinese Taipei	99.3	17.3	44	Qatar	69.8	29.0
5	Japan	92.0	1.3	45	Saudi Arabia	93.4	29.7
6	Northern Ireland	43.1	12.9	46	Oman	48.5	4.6
7	Belgium (Flemish)	39.3	1.9	47	Tunisia	44.2	5.4
8	Finland	94.6	5.5	48	Kuwait	96.5	9.4
9	England	10.3	23.5	49	Morocco	76.6	6.4
10	Russian Federation	94.6	1.1	50	Yemen	88.9	1.8

Source: TIMSS 2011 International Database (2013)

The TIMSS data analysis raises significant questions about how to conceptualise the way that teachers select and use classroom teaching and learning materials. The role of textbooks seems to be changing. In the traditional concept of teaching based on transmission, textbooks serve mainly as a source of information, the basis for transmission. In the constructivist concept, the function of the control of learning, learning management, is the most important – in the first place, the textbook is an activity and inquiry source (Horsley & Walker, 2005; Sikorová, 2011; Červenková, 2010). At present, two more textbook functions seem to strengthen, which keep themselves in the background with traditional textbooks: co-ordination and integrative functions. Co-ordination function means that textbooks should "co-ordinate using other educational aids", like videos, animations, worksheets, computer programs (Mikk, 2000, p. 18). According to our view, integrative function is even more important nowadays. It means that textbooks underpin the comprehension and integration of knowledge the students receive from other resources. The textbook serves as a background and basis for understanding information. In

the context where multiple resources are provided for student learning, it may be opportune to reconsider traditional understandings of the environment in which textbooks are used. In a context that incorporates multiple learning resources, consideration needs to be given to how such resources interact; and the capacity of resources to be linked and integrated to other resources (Horsley, Knight, & Huntly, 2010).

In relation to both print and digital student educational resources, it is not the quantity or even quality of classroom teaching and learning resources that is critical, but the use to which they are put by teachers and students. More current research (Grubb, 2008) has argued that many resources in schools are complex and compound, in that their use is mediated by other resources. For example, laptops and digital educational resources, and an increasing number of interactive whiteboards, may be provided, but the impact on student performance and educational outcomes of these resources will be dependent on the way that teachers use them. Print and digital textbooks, as well as other teaching and learning resources, are modified, adapted, and customised by teachers to produce classroom teaching and learning materials. According to Grub (2008), this process of resource construction depends on both the level of classroom teaching and learning resource inputs, and the ways that teachers turn these inputs into classroom resources, that support learning.

As we implied above (see Table 5), the relationship between CTLR use and student achievement seems to be unambiguous and inconsistent. So far, this paper has undertaken the descriptive analysis and some related theoretical consideration. But two further research questions have been posed, both focused on analysing the relationships between the types of CTLR, and student achievement. These research questions include:

- Do the students' achievements differ if their teachers use different kinds of classroom teaching and learning resources as a basis for instruction? In other words: if your national education system uses more textbooks or workbooks/worksheets or computer software, do your children achieve more in TIMSS?
- And do the students' achievements differ if their teachers use classroom teaching and learning resources in different ways, i.e. as a basis for instruction or as a supplement?

However, the input–output conceptual framework behind current multilevel frames of analyses are not aligned with theories of learning that show how use of materials by teachers can afford or constrain the development of learning environments to promote learning and development. Modifications to the usual multilevel analyses are being developed by the authors to address these questions.

One finding that any examination of TIMSS data on teacher use of classroom teaching and learning materials proves true is that – digital education is yet to arrive in classrooms; is unlikely to arrive anytime soon; may not be associated with increased achievement; and that politicians' claims that the laptop or tablet is the textbook of the future, is patently untrue.

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Table 6 Results of Mann-Whitney U test: significance of differences between the percentages of students whose teachers used textbooks in 2003, 2007 and 2011

Textbooks used	As a basis				As a supplement		
	Year	Mean Rank	U	Sig.	Mean Rank	U	Sig.
Science: grade 4	2003	21.1	187.5	.735	17.8	148.5	.350
	2007	19.9			21.2		
	2003	17.1	131.0	.042*	23.9	116.0	.038*
	2011	24.0			16.3		
	2007	17.8	129.0	.045*	24.1	111.5	.027*
	2011	21.2			16.1		
Maths: grade 4	2003	20.1	192.5	.839	19.6	179.0	.965
	2007	20.9			19.4		
	2003	18.4	157.5	.250	22.9	134.5	.119
	2011	22.6			17.2		
	2007	18.8	166.0	.358	22.9	135.5	.126
	2011	22.2			17.3		
Science: grade 8	2003	30.8	383.5	.565	29.1	402.5	.955
	2007	28.2			28.9		
	2003	22.4	215.5	.001*	36.0	211.0	.002*
	2011	36.6			22.3		
	2007	21.3	182.5	.0002*	36.3	224.0	.002*
	2011	37.7			22.7		
Maths: grade 8	2003	31.7	358.0	.331	27.9	375.5	.626
	2007	27.3			30.1		
	2003	23.4	244.0	.006*	35.1	236.5	.007*
	2011	35.6			23.2		
	2007	22.3	210.5	.001*	36.3	223.5	.002*
	2011	36.7			22.7		

Resources: based on TIMSS 2011 International Database, 2013; Foy & Olson, 2009; Martin, 2005
U = Mann-Whitney U test statistics; Sig. = p-value at $\alpha = 0.05$ level; *the value is statistically significant at $\alpha = 0.05$ level.

The Quality of Physics Teaching – Cases of Teaching over Time and in Space by Three Teachers

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Abstract: The strategic goal of the research, including this empirical study, is to contribute to the search for connections between the teaching quality and other factors, and to deepen the understanding of the context of the teaching quality. The research questions are posed as follows: Have the parameters of the quality of physics teaching changed after eight years? In what way do the teachers perceive these parameters, their (un)successful implementation in their teaching, and their possible changes over time? To answer these questions, a mixed method research design was used. A case study was chosen as the basic research plan. An ex-post facto research was chosen as the design of the quantitative part of the research, and the data was collected using the method of pedagogical observation. Regarding the qualitative part, the data were collected using semi-structured interviews. The research sample consisted of three physics teachers, teaching in Czech grammar schools, who are considered experts with an extended level of reflective competence. The research focused on a longitudinal comparison of the parameters of the quality of physics teaching (in the school years 2004/2005 and 2012/2013), and so this contribution describes cases of teaching, more precisely cases of the teaching quality of the particular teachers. The research revealed that the parameters of the quality of physics teaching of these selected teachers changed very little over the period of eight years. Also, the curricular reform taking place in the Czech Republic in this period has probably not influenced teaching quality changes. It seems that teachers are aware of the influence of various stakeholders of the teaching process, including those who are not directly present in lessons (e.g. school management, parents). This research shows that it is reasonable to look at the teaching quality from a wider perspective.

Keywords: quality of teaching, quality of physics teaching, pedagogical observation, case study, longitudinal study, context of education, curricular reform

The quality of teaching, teachers, and schools (generally quality in education) have for some time been one of the main topics of pedagogical discussions. The evidence for this are, especially, conceptual works from abroad (e.g. Reynolds, 1995; Terhart, 2000), as well as works from the Czech environment, to which context this study is connected (e.g. Janík & Chvál, 2012; Janík et al., 2013). *The strategic goal* of the research, including this presented study, is to contribute to the search for connections between the teaching quality and other factors, and to deepen the understanding of the teaching quality context. As the title of this study indicates, we limit our concerns only to the teaching quality of a concrete subject – physics. In the sense of the strategic goal, we will deal with the teaching quality in a broader context. To a certain extent, it is a connection of a subject methodology (here physics) with a broader context (general methodological, pedagogical, social etc.).[1]

[1] This corresponds with the word "space" in the title, which is understood as an abbreviation taken from the field of physics and mathematics.

Regarding the context, we consider also the time dimension as important. This means that the text presented below has a longitudinal character. We think that the time aspect is, to the detriment of many research studies, rather overlooked; a considerable number of research studies in the field of pedagogy (and not only in this field) are orientated to a description of a certain state which is connected to a relatively narrow time interval.[2] The motivation for the consideration of the time was the fact that there was a possibility comparing the present quality of teaching of physics, and the state from the school year 2004/05, i.e. before the implementation of the curricular reform in the Czech Republic.

The curricular reform can be an important factor influencing the quality of teaching, so we discuss this matter shortly.[3] Reforms implemented in different countries have, of course, different characteristics. They may be based on different starting points, aims, and impacts on the process of education and its results, etc. Research findings and considerations of different aspects of curricular reforms may be found, for example, in works by Künzli (1998), Fullan (2001), Flores (2005), Rollf (2009), and many others. It would not be possible, in this paper, to deal with all particular findings if we focused only on, for instance, the aims of the particular reforms. This area is very wide, and as claimed by Altrichter (2009, p. 247), the resulting shape of the reform is influenced more by its implementation than its original plans and the intentions connected to it. This brings us to the idea that the key role is played by the particular actors participating in the reform, then also on the teachers, and in which way they approach it. It is, therefore, difficult to generalise particular findings about the influence of reforms on the teaching process. On the other hand, we consider the finding by Künzli (1998, p. 8) as potentially beneficial, that any curriculum change may be an opportunity for considerations about the concept and sense of school and its structure, etc. An indication, how teachers participating in the research approached the curricular reform is also presented in this study.

Research findings connected closely to the context of this research (Czech curricular reform at upper secondary /academically oriented/ school level) are presented by Janík et al. (2011). However, we do not know about any research focusing on the teaching processes in the class before and after the reform, and their comparison. This may be a partial benefit of this research. If we talk about the academic achievement of pupils and its comparison before and after the reform, we may use, to a certain extent, the international comparative research studies, such as PISA and TIMSS (in the context of the Czech Republic, see Potužníková, Lokajíčková, & Janík, 2014). However, also here it is true that the teaching process and its changes take place in a wider context than only in the context of the curricular reform, so the

[2] On the other hand, it is possible to observe the time development of some phenomena in international comparative research studies of school education, such as PISA, TIMSS, etc. The newest overview of those taking place in the Czech Republic is provided by Potužníková, Lokajíčková and Janík (2014).

[3] We are also fully aware of other factors and actors participating in the teaching process and its changes (see primarily Section 3).

impact of the reform cannot be determined exactly. The aim of this study is to focus on this wider context.

To uncover, to a broader extent, the context of the teaching quality, we decided to interview physics teachers whose teaching was analysed in this study. We consider the selected teachers to be reflective practitioners who observe and evaluate their own teaching practice in order to understand it well and improve it. This comes out from the previous research conducted among teachers (Žák, 2014, p. 77). The reflective practice model (or its elements) has been considered relevant for a long time in works by many authors (e.g. Goodman, 1984; Korthagen et al., 2001; Pollard, 1998; Schön, 1983). The findings that the selected teachers have a relatively developed level of the reflective competence were identified in previous research (Žák, 2014, p. 77).

We could look at the selected teachers and their role in obtaining relevant pieces of information about the teaching quality, in the sense of Korthagen et al. (2001), in a simplified way as follows: During their practice, teachers become more and more aware that the original implicit professional intuition (gestalt) becomes a structured scheme which can culminate to a development to a certain theory shared by other teachers. We can assume that the selected teachers managed to transform the original gestalt (the unconscious professional intuition) into a scheme (a certain better organised overview), and to proceed to a theory which can be shared with other professionals. Taking into account this fact, we can consider the obtained information from the teachers as relevant data for solving the below stated research problems.

In connection with the strategic goal, the concrete aim of this text is to present research findings describing parameters of the teaching quality of physics, and their changes in time (regarding selected teachers), and evaluation of these parameters and their changes by the teachers themselves. As *research problems* connected with the stated goals, we formulated the following research questions:

- Did the parameters of the teaching quality of physics of the selected teachers change over the period of eight years?
- In what way do the teachers perceive these parameters, their (un)successful implementation in their teaching, and their possible changes over time?[4]

Considering the fact that this study has a methodological overlap, relatively significant space is devoted to research methodology (Section 1). Results (section 2) are organised around the research problems – a longitudinal comparison is presented in Sections 2.1 and 2.2, and readers are introduced to teachers' reflections, which is integrated into the previous research findings (Section 2.3). In the conclusion (Section 3), we summarise our findings, and compare them with findings of other research pieces.

[4] Considering the overall approach, which was mixed method design of a qualitative type (see the next section of the paper), we do not formulate hypotheses in connection with the research problems.

1 Methodology

From the methodological point of view, the mixed method design, combining both the qualitative and quantitative approach, was used to solve the research problems. The basic research plan was a case study. This is typical of qualitative research, and so we can say that this qualitative approach was dominantly used (see Creswell & Plano Clark, 2006). In accordance with the requirements placed on a case study (see Yin, 2003, p. 13–14), there was a quest:

- to see the case (the teaching led by a particular teacher, more precisely the teaching quality) as an integrated system[5];
- to investigate the quality of teaching of a given teacher in as natural an environment as possible;
- to use more sources and methods for the collection of relevant data.

The rate of respecting the stated principles will be obvious from the following. The quest to investigate in as natural an environment as possible went to the fact that for the design of the quantitative part (solving primarily the first research problem), basically, ex-post-facto research where data are collected using the method of pedagogical observation, was chosen. Regarding the qualitative part (solving primarily the second research problem), data were collected using a semi-structured interview.

From the time sequence view, the process was managed in the sense of Creswell and Plano Clark (2006) rather sequentially; quantitative data collection (observation) was followed by interviews (qualitative data collection). While in the case of the first research question the process was basically only quantitative, the approach to the second question depended on the first one (the questions posed in the interview were formulated according to the quantitative findings of the first question). The linkage of the data was done when making a description of particular cases (Section 2.3). In accordance with Tashakkori and Teddlie (1998), it resulted in a combination of quantitative and qualitative approaches at various levels.

Considering the research plan, we would like to explain (or at least to contribute to the explanation) the basics of the case, or cases, which are the quality of teaching (conducted by given teachers). The case study design was chosen in order to focus on several cases of many – more precisely, three grammar school teachers of physics whose teaching (its quality) we decided to investigate more closely. It is obvious that conclusions of the research can only be generalised to a certain extent. However, they can bring important impulses for further research and for further education of (future) teachers (of physics) and their teaching practice.

[5] It is a question of what to consider, in this research, as particular *cases*. To make it simple, we can relate particular cases in this study mainly to teachers, and so we talk briefly about *cases of teachers*. However, as a particular *case* we should denote, rather than a teacher, directly what we investigate, so *the teaching led by a particular teacher*, or more precisely *the quality of teaching led by a particular teacher*. Particular cases are created not only by teachers, pupils, and other actors, but also by their interactions, mainly during the teaching process.

The research sample were available physics teachers (and their teaching), who can be considered, according to the previous research, to be experts with a relatively developed level of reflective competence (Žák, 2014, p. 77). The selected teachers can be considered experienced, with relatively long teaching practice.[6] These teachers teach physics in several grammar schools in Prague (upper secondary level). The basic information about them is as follows:

- Teacher 1 – teacher of Mathematics and Physics (Faculty of Education), teaches Mathematics, Physics, and relevant seminars, 15 years of practice.
- Teacher 2 – teacher of Mathematics and Physics (Faculty of Mathematics and Physics), teaches Mathematics and Physics, 25 years of practice.
- Teacher 3 – teacher of Mathematics and Physics (Faculty of Mathematics and Physics), teaches Mathematics and Physics, 17 years of practice.

The essential parts of the research were conducted as follows:

- Trained observers (hereinafter: researchers) observed, in the school year 2004/05, seven to eight lessons by each of the teachers.
- In the school year 2012/13, each researcher again observed seven to eight lessons by the same teachers (in the same schools, in comparable classes, regarding the study year).[7]
- Comparison of the teaching process (from the quality parameters set beforehand point of view) in the school years 2004/05 and 2012/13 – see Sections 1.2, 2.1 and 2.2.
- Semi-structured interviews with teachers – see Section 1.3.
- Linkage of the quantitative and qualitative findings – see Section 2.3.

1.2 Observation of the quality of physics teaching (quantitative part)

The research instrument, used to observe the physics teaching (and its quality), was the tool developed by Žák (2008, 2014) using a rating system which has become an inspiration for proposals of other observation tools, e.g. the tool by Zlatníček (2011,

[6] This study does not deal with other teachers, for instance, with shorter teaching experience, with less developed reflective competence, or teachers from other types of schools than grammar schools. This is the limitation of the research.

[7] The researcher and the teachers agreed on the day when the teaching lesson would be observed. The dates were suggested by the researcher, and the teachers, in the majority of cases, agreed with the proposals. The teachers were not informed what exactly would be observed in order to observe a normal class and not a specifically prepared lesson. The number of seven to eight lessons of each of the teachers proved to be, in the previous research investigation of ten teachers (Žák, 2008), as sufficient; this number of lessons enables us to observe characteristic teaching features.

p. 124–129), falling into the area of the quality of foreign language teaching. The basic information about the tool can be found in Žák (2014, p. 69–71).[8]

Notes to the evaluation methodology of a longitudinal comparison of frequency of quality parameters occurrence (see more in Section 2.1). In this research part, we investigated the relative frequency of occurrence (realization) of teaching quality parameters[9] in the school year 2012/13, which was compared with the results from the year 2004/05. The relative frequencies were divided into three intervals:

- low occurrence – in 0% to 33% (included) of lessons – marked with 1 (Table 1);
- medium occurrence – 34% to 66% (included) – marked with 2;
- high occurrence – 67% to 100% – marked with 3.

In case that the relative frequencies fall into the same interval in both research phases (in the school year 2004/05 and 2012/13), there is one appropriate number only in the column for the school year 2004/05 in Table 1. If the relative frequencies in each of the research phases fall into different intervals, there are two different numbers (for each of the years separately). However, it is not possible to consider, automatically, a transfer from one interval to the other to be a significant change of the frequency of occurrence, as, for example, the change from the upper limit of the low occurrence interval to the lower limit of the medium occurrence interval (e.g. change from 32% to 35%) does not represent a real change. Significant changes marked with (*) are changes where the frequencies differ by at least 33%, which corresponds with the length of one interval. As there were, for each teacher, seven to eight observed lessons, 33% means about two to three lessons. The presented parameters (see the first column in Table 1) are only those parameters where it is sensible to investigate changes in the frequencies (we omitted, above all, the parameters with a low reliability, more detailed in Žák (2014, p. 71) and parameters whose scale does not contain the possibility N – "parameter was not observed").

Notes to the evaluation methodology of a longitudinal comparison of arithmetic means in parameters scales (see Section 2.2). The comparison was conducted in the way that the scale grades – –, –, +, ++ were denoted with the values –3, –1, +1 and +3, which express, besides other things, that the scale is equidistant. For each of the parameters, the arithmetic mean was calculated and rounded to the nearest stated values. Table 2 presents symbols – –, –, +, ++ for parameters whose frequencies of occurrence in both observed years are higher than 33% (other are

[8] Teaching quality is defined in different ways. In our case, the set up of particular parameters was based on the opinions of 15 different experts – methodologists of physics, grammar school teachers of physics, university experts in the field of pedagogy, and physicists-scientists. These parameters concern the teaching processes.

[9] The current Czech version of the record sheet of the research instrument with detailed characteristics is available from http://kdf.mff.cuni.cz/~zak/vyuka.php in section "výzkum a vývoj v didaktice a pedagogice" – "nástroj k posouzení kvality výuky fyziky". This version contains detailed delimitations of particular parameters of the teaching quality in Czech language (in which the tool was standardised).

marked with "not defined"). These are parameters which are marked, in Table 1, with values 2 or 3, or parameters where the frequency is automatically 100% (their scales do not contain the possibility N). If it is not possible to round an arithmetic mean unambiguously to one of the values −3, −1, +1 a +3, e.g. 2, Table 2 presents the corresponding pair of symbols, e.g. +, ++. The significant changes, marked with (*), are those changes where the arithmetic mean changed by 1.0 or bigger (it represents half of the distance of the neighbouring scale grades) and at the same time, the scale grade changed.

1.3 Interview with teachers (qualitative part)

Regarding the qualitative part of the research, we interviewed the selected teachers, and the interviews were semi-structured. The basic content scheme was given by the goal, which was to identify how the teachers see the teaching quality parameters of their teaching and their changes (the second research problem). Beforehand, we prepared a set of fundamental questions for each of the teachers, which should identify why the particular parameter is typical of their teaching, or how they explain a particular change. For example, *It was revealed that you often conduct physical experiments in your teaching. Why do you do that?… Why do you consider it important?* Or: *It seems that you care the most of all teachers about the active learning of your students – you try to make the students involved into the teaching process, you try to raise discussions … Do you consider it important? Why? … Does this approach have any negative aspects?* We asked the teachers different questions reflecting the given teaching quality parameters. At the same time, during the interviews, new questions were posed, and so the interviews got closer to non-structured interviews.

Written notes made by inquirers (researchers) were transcribed in the way that the content and structure of the transcriptions revealed connections between the teachers' answers and observed activities. In these transcriptions, the quantitative and qualitative findings are matched together if there is a connection – see section 2.3.

2 Results

2.1 Longitudinal comparison of parameters occurrence frequency[10]

The relative frequency of parameters occurrence for all three teachers are summarised in Table 1. The parameters are formulated in the way that higher frequency of occurrence can be understood as a more positive aspect than their lower occurrence. We can say that the teaching conducted by Teacher 1, regarding the frequencies of

[10] This part comes from the published text by Žák (2013).

the parameters, did not change after eight years. The teaching conducted by Teacher 2 changed only in one parameter out of 17 (in a negative way), and the teaching conducted by Teacher 3 changed positively in three out of 17 observed parameters. In total, the teaching changed only minutely, regarding the parameters occurrence (in 4 cases out of 51, i.e. in less than 10% of the cases).

Table 1 Relative frequencies of parameters occurrence divided into intervals[11]

Teachers	Teacher 1		Teacher 2		Teacher 3	
School year	04/05	12/13	04/05	12/13	04/05	12/13
1.1 physics expertise	3		3		3	
1.4 teaching aids	2		3		2	1
2.1 lecturing	3		3		2	3*
2.2 heuristic method	1		1		1	
2.3 experiments	2	1	3		2	1
2.5 mathematics	3		2	3	3	2
2.6 abstraction	2	3	3	2	2	3
2.9 knowledge structure	3		3		2	3*
2.10 work with text	1		2	1*	1	
3.1 students' interest	3		3		3	
3.3 linkage with practice	3		3		3	
3.4 inter-subject links	1		1	2	1	
3.5 art, culture	1		1		1	3*
3.6 students' activity	3		3		3	
3.7 demands placed on students	3		3		3	
3.8 use of assessment	3		3		3	
4.1 students' expressing	3		3		3	

2.2 Longitudinal comparison of arithmetic means for parameter scales

The arithmetic means for parameter scales (more precisely: grades − −, −, +, ++, which are the closest to the arithmetic mean) are summarised, for all three teachers, in Table 2. The parameters are formulated in the way that higher arithmetic mean (higher scale grade) can be understood in the way as more positive. For this reason, three changes are evaluated as positive, while five changes as negative. We can say that the teaching conducted by Teacher 1 changed, regarding the arithmetic mean, after eight years, rather negatively. The teaching conducted by Teacher 2 almost did not change, and in the case of Teacher 3, changed positively. Moreover,

[11] The numbering of the parameters in the left column is the same as in the original research instrument. For this reason, some of the numbers are missing.

the teaching changed, in total, only slightly regarding the arithmetic mean. Only the minority of the parameters changed, considering each of the teachers. If we compare the arithmetic means, there were changes only in 8 out of all 48 possible cases (when the arithmetic mean is defined), i.e. in less than 20% of cases.

Table 2 Arithmetic means at parameters scales

Teachers	Teacher 1		Teacher 2		Teacher 3	
School year	04/05	12/13	04/05	12/13	04/05	12/13
1.1 physics expertise	++		+		+	
1.2 teacher character	++	+*	++	+	++	
1.4 teaching aids	+	–, +*	+		not defined	
2.1 lecturing	++		+		+, ++	+
2.2 heuristic method	not defined		not defined		not defined	
2.3 experiments	not defined		+		not defined	
2.5 mathematics	++		++	+	++	
2.6 abstraction	+		+		+	
2.9 knowledge structure	+		+		+	
2.10 work with text	not defined		not defined		not defined	
3.1 students' interest	+	–*	+		+	
3.3 linkage with practice	+		+	++	+	
3.4 inter-subject links	not defined		not defined		not defined	
3.5 art, culture	not defined		not defined		not defined	
3.6 students' activity	+	–, +*	+		+	
3.7 demands placed on students	–, +	+	+		+	
3.8 use of assessment	+		+		+	
4.1 students' expressing	+		+		+	++*
4.2 relation cultivation	++	+, ++	+	++	+, ++	++*
4.3 atmosphere	+		+	++	+	++
4.4 active learning	+	–*	+		+	++*

2.3 Cases of teaching quality of particular teachers – linkage of quantitative and qualitative findings

In the following text, we link together findings from Sections 2.1 and 2.2 (rather of a quantitative nature) with information obtained during the interviews with teachers (rather of a qualitative nature).[12] The interviews with the teachers were orientated on both the parameters which are typical of a given teacher (in contrast to the other two), and to significant changes of quality parameters of their teaching after eight years. The following text is structured, above all, in this sense.

[12] Authentic word expressions of the teachers are in inverted commas.

The case of Teacher 1 – an expert in physics, lecturing, using ICT[13]. This teacher showed almost unchanged *physics expertise*[14] over time (1.1, sole ++, Table 2). Besides the university studies, his expertise was influenced by two grammar school teachers who taught him mathematics and physics. These two teachers, thanks also to their precision and enthusiasm, inspired him to become a teacher of mathematics and physics.

His *lecturing* was evaluated similarly as comprehensible and factually correct (2.1, sole ++), which is closely connected to the physics expertise. This teacher understands lecturing almost as a necessity, because he thinks that students are not able of self-study in comparison with the past – they do not, for example, do their homework. It is not only the fact that they do not do assigned homework. Sometimes teachers from that school are asked by the school management not to assign homework too often to their students. This recommendation is taken after the principal, after a discussion with the students, was told that the students felt overloaded, and that in the afternoon they have other interests and duties. The principal even expressed her opinion that the students should take less tests, in order not to complain. The school management also make their teachers aware of the fact the school cannot afford to lose students, due to weak school results. The school would be given less financial resources, which could end with a fewer teachers in the school. These opinions have been asserted by the principle for the last two years. The teacher expressed his hope that the principal would understand soon this is not the right way, as she started to teach an ordinary class (and not a selected group of interested students). This experience could bring her to the conclusion that her suggestions are not a suitable solution.

Regarding the *character of the teacher* (1.2), there was a slight worsening (1.2, from ++ to +), but the evaluation is still positive. The character of the teacher (considering the given scale) shows, beside other aspects, a willingness to discuss with students. The teacher stated that he is not used to "presenting the subject matter and leaving the class", but at the same time, he mentioned so called pseudo-interested students. These are students who, in the teacher's words, would like to discuss the subject matter more deeply, but the deeper understanding is above their mental possibilities. The teacher, in this case, tries to answer their questions in a simple way, and adds that they will deal with the particular topic later on in detail. Regarding students who are really interested in physics, he recommends them to participate in physics competitions.

This is the only teacher who showed worse *utilisation of students' interest* (3.1, from + to −). The problem is seen by the teacher above all in the students. He per-

[13] This is only an abbreviation which describes, only in a schematic way, and therefore roughly, the below stated characteristics. It is similar with the other teachers.

[14] Physics expertise of teachers exhibits mainly in the physical correctness of their way of expressing themselves. Regarding this, for instance, Campanario (2006) and Sliško (2006) point out wrong or misleading formulations in current textbooks, which is evidence that this is one of the permanent topics in didactics of physics.

ceives limits mainly in weak students (it is given by less populated years), and in students' insufficient home continual preparation.

The *students' activity* (3.6, slight worsening from + to −, +) is influenced, according to the teacher, for example, by which lesson the teaching takes place in. In the afternoon lessons, which was the case of the observed class in the school year 2012/13, the desirable students' activity is lower, and the students misbehave more often. However, it is not true that in the first lessons the students are always more active. The teacher observes in classes focused on Computer Programming, for example, a certain slowdown caused, probably, by a night spent in front of a computer. The atmosphere in the classroom also depends on the class itself, as some of the classes are less disciplined.

The above mentioned factor of time, and the mentioned pressure from school management make the teachers serve the subject matter "in a ready way" to the students, rather than to require a more active approach from them. This could be the cause of the worsening of *active learning* (4.4, from + to −).

Students' lower activity can be reflected in a limited *utilisation of teaching aids* (1.4, slight worsening from + to −, +). The teacher tries to bring physical aids and conduct experiments with them whenever he deals with a given topic, it means that he does not use them only in certain lessons. There are exceptions when it would be, for example, difficult to bring aids from remote school areas. In these cases, the teacher carries on experiments only in classrooms closer to the teacher's office, where all the aids are kept.

To the question as to what could improve the quality of teaching, the teacher answered that mainly the decline of his full-time engagement to 17 to 18 lessons a week (he teaches 23 lessons per week, it is more than the standard full-time engagement, as he has two children, which is financially demanding). Another limit is, in his opinion, the limited finance for buying physical aids (the costs are partially covered by financial donations from the parents of students). As potentially positive, the teacher perceives the fact that PowerPoint presentations, videos, and various animations have become an ordinary part of his lessons. In laboratory work, they use the measurement system ISES[15] (about 20% of all work). The teacher is aware of the limits of the technical equipment, which itself cannot secure a better standard of teaching. The teacher thinks that there is dispersion between the knowledge and skills of the students in different classes. He also notices that it is a significant change, considering the past, and it is connected with less populated years, and fewer students are interested in studying at the grammar school. There are students with average elementary school achievements who would not study at grammar school some years ago. Many of the students are also weak at mathematics.

Students do not possess some skills that they used to have in the past, for example, they are not able to make a continuous written text. For this reason, the

[15] Available from http://www.ises.info/index.php/en/systemises.

teacher uses materials created in various projects, e.g. a worksheet for optics, in which students fill in the required pieces of information (e.g. measured values). The teacher admits that this also makes his work easier, as it is not so time consuming to evaluate such worksheets. This approach is adequate in humanist classes; in science classes, it is suitable to ask students to make more demanding and a longer form of notes from laboratory work. Over the years, the continual home preparation of the students has worsened, and the school management has more or less accepted this lower level (see below).

The case of Teacher 2 – an experimenter, making linkage with practice, perceiving problems with mathematics and literacy. Teacher 2 excels in using *teaching aids* (1.4, sole 3 in Table 1 and + in Table 2), which is connected with the fact that she quite often conducts high quality *experiments* (2.3, sole 3 and +). The frequency and quality (arithmetic mean at the scales) of both parameters are, basically, unchanged over time. The teacher is fully aware of this fact, and she would like to carry out experiments even more often. On the other side, she knows that it is necessary to take care of the mathematical side of physics, even though experiments are closer to her heart. She manages to find financial resources for buying the physical aids, mainly from the parents of her students. When talking about experiments and students' motivation, she sees a problem in the fact that grammar school physics starts with mechanics which, due to its difficult mathematical apparatus, rather discourages the students, and the possibility of conducting experiments is limited. The teacher likes demonstrative things, for example electricity. She expresses this in a concise way as follows: "I like showing students that something works in practice." This is evidence that she tries to make a *linkage with practice and life* (3.3, sole ++).

Even though the teacher focuses mainly on experiments and linkage with practice, she knows that it is also important to support the *abstract imagination* of students (2.6, sole 2, other teachers 3). So she, for example, makes calculations with her students in the lessons, so the students can imagine how many particles are in ordinary solids, etc.

Regarding the *mathematical model* (2.5, sole +, other teachers ++), we can put the lower quality into connection with the teacher's favour for experimental physics. This might also be influenced by the fact that the students possess lower mathematical skills. For example, they cannot express an unknown quantity from an equation, or divide by a two digit number without the use of a calculator, which students used to know in the past. The teacher sees the connection between the problems with mathematics and the insufficient level of literacy of the students. The students face problems when reading results on their calculators (e.g. they forget to consider the exponent). The teacher also notices that her students cannot formulate such erudite questions due to a lower level of literacy than in the past.

Regarding the *work with texts*, it was less common than eight years ago (2.10, decline from 2 to 1), so the teacher got to the same level as the other two teachers.

However, she tries, in her own words, to make the students work with textbooks (e.g. she assigns homework from textbooks).

When talking about changes in the recent years, the teacher appreciates the fact that the school uses an electronic register. She has, besides teaching, more duties, because she is a head of the subject committee, co-operates on preparations of graduation balls and entry examinations. In the past, the school management used to be responsible for these duties, but recently, it is the teachers' responsibility. Another significant change is the decline in the students' literacy (see above). The students struggle with finding relevant information in mathematical-physical tables and generally, they work in a worse way with the book. The teacher perceives intensively that today's generation, which she teaches, is different. She could not say that worse, but "short-cutting". Another change is that the teacher can only assign the students less demanding written work, in comparison with the situation ten years ago.

The teacher thinks that the quality of her teaching could improve if her full-time engagement were lowered. Now, she has to teach 23 lessons per week. She would like to teach 4 lessons every day, for example two consecutive lessons, then she would like to have a break and then continue with other two lessons; it means 20 lessons per week. The teacher would appreciate having a person in the school who would be responsible for technical aspects, for example repairing teaching aids. The teacher likes it, and she considers herself as a skilful person, but sometimes she is not able or does not have enough time to deal with more complicated repairs. She would also like to have fewer than 30 students in the classrooms (she used to have about 40 of them 25 years ago). The teacher complains about the fact that she sometimes teaches far away from her office, so she has to carry teaching aids a long distance.

The case of Teacher 3 – linking physics with culture, communicative, supporting active learning. This teacher excels in the *relation of physics to culture and art* (3.5, sole 3 and sole improvement). The teacher perceives making connections between cultural and historical contexts and physics as a necessity. He considers the history of physics as an internal part of physics. It is suitable mainly for students with humanistic interests. However, the teacher is self-critical, he is aware of certain gaps in this area, and he tries to learn more to fill in the gaps.

He is the only teacher who reached the highest grade in parameter *teacher character* (1.2, sole ++). He added that he loses rarely patience in situations where the students break the rules of politeness.

It is also typical of the teacher that he rarely uses *teaching aids* (1.4, sole 1). The teacher said spontaneously that he admits that he would like to use teaching aids more often (and conduct experiments more often). The problem is that the students want him to talk more with them during the teaching process, and so he doesn't have so much time for experiments. However, the students use physical aids when experimenting during laboratory work.

The teaching of the teacher reached the highest arithmetic mean for parameters in the area of communication and upbringing. Regarding *students' expressing* (4.1, sole improvement from + to ++), the teacher prefers the students to make formulations of their thought in their own words first, and then he makes the explanation himself. The teacher is aware of the big disadvantage of this approach, as it is time consuming. He thinks that it is important to use professional language (when introducing new terminology) and, at the same time, to use "colloquial language" which is closer to the students. This communication can take place in cycles, where the professional and colloquial languages alternate. *Lecturing* (2.1, significant change of frequency from 2 to 3) cannot be omitted in the teaching process, especially at the upper-secondary level.

Talking about *working atmosphere* (4.3, ++) and *active learning* (4.4, sole improvement from + to ++), the teacher estimates that about one third of the students in the observed class work; the others rather wait, and they do not participate themselves. Regarding these two parameters and the parameter of *cultivation of students relation* (4.2, ++), the teacher adds that he and they have a "correct open relation". The observed class (Year 7) had in Year 5 and 6 two different (young) physics teachers, whose teaching was not assessed as good, either by the students or their parents. He thinks that physics was out of the interest among the students, they perceived it as useless. The teacher set certain rules at the beginning of Year 7, he clearly stated what he expected, and it seems that the students understood it. The teacher regards this class as slightly above average, considering behaviour.

Talking about the *mathematical model* (2.5, sole 2, other teachers 3), the teacher understands the use of mathematical means as an internal part of physics, he also considers it important that the students are able to solve a physical problem generally, and are able to think critically about a given general mathematical relation. Considering his experience, he thinks that a quarter of the students reject solving problems generally, but the majority of them know how to do it. It is important for him to conduct the dimensional analysis in his lessons which can help the students to understand better quantity equations ("formulae"), to make estimations and to make general solutions of physical problems, including critical thinking about quantity equations.

When the teacher was asked if it is important to build *knowledge structure* with the students (2.9, significant increase of frequency from 2 to 3), he answered positively. For example, he makes parallels between gravity and electrostatic field.

Talking about changes in the recent eight years, and what could influence the teaching quality, the teacher answered that at first sight, nothing. Then he added that he acquired a better view over the field, he thinks more carefully about what to teach. He does not implement everything that is given from FEP[16] and is contained in textbooks. In his opinion, textbooks are good manuals, but students are not able to

[16] Abbreviation for Framework Education Programme for Secondary General Education (Grammar Schools), available from http://en.vuppraha.cz (in Czech: Rámcový vzdělávací program, abbreviation RVP).

learn everything they contain. Requirements given by FEP and by universities (placed on their students) are, in his opinion, unreal (inappropriately high).

In connection with this, he formulates the opinion that today's students are in a more difficult situation than their counterparts in the past, as they are overloaded with information. They have a lower possibility of concentrating. However, it is not possible to base the teaching process only on the search for information by students. The teacher stresses that students have to be addressed with language they understand. He also admits that he is limited by the fact that he does not know the world of his students well.

The teacher can see, generally, differences between students of four-year and eight-year study programme in his grammar school. The students of the eight-year study programme may have better prerequisites, but they do not deal with their possibilities in a very responsible way. Sometimes, they seem to act like children. They have a longer time to explore the school system, and so they can outwit it more easily. Students of the four-year study programme can better use what they know, and they wipe out the initial deficit.

The teacher thinks that the quality of his teaching could improve if the administrative load placed on teachers were lowered. He meant, for example, mass mailing or inserting marks into the information system. Paradoxically, the load has increased with digitalisation. He would see as beneficial if the number of students decreased to 25, ideally to 20. He perceives the direct teaching counting 21 to 22 lessons per week as adequate, if the administrative load were lowered.

The teacher adds spontaneously that he would be happy with the salary of CZK 40,000 (approx. EUR 1,400), ideally CZK 60,000.[17] Let's add that this teacher teaches, besides in this school (14 lessons), also in an elementary school (12 lessons). If he taught only in one school, it would give him more time to work.

3 Conclusion and discussion

The results presented in Sections 2.1 and 2.2 were, thanks to the interviews with the teachers, enriched, in Section 2.3, with opinions and interpretations of the teachers. Let's first summarise the findings regarding the first research question. We can answer the question if *the parameters of the teaching quality of physics of the selected teachers changed over the period of eight years* that *they changed relatively minutely*. When quantifying this conclusion, the occurrence frequency of the observed parameters changed only in 4 out of 51 possible cases, i.e. in less than 10% of cases. However, there were differences between the teachers (none, one negative, and three positive changes regarding particular teachers). If we compare the arithmetic means for the parameter scales, we find out that there were chang-

[17] The average salary of teachers in the Czech Republic is approximately CZK 25,000, i.e. EUR 900.

es in 8 out of 48 possible cases, i.e. in less than 20% of cases. Again, the teachers differed – there were five negative changes, no change, and three positive changes.

It is clear that when making conclusions, it is important to be really alert, because it is a question as to whether 10% or 20% is really little. If we consider that teachers work for about 40 years, and that the observed period of eight years is a fifth of this period, the trivial extrapolation takes us to the values of 50 or 100%. This approach is rather problematic, for example, it is not possible to assume that the changes would take place evenly (the same number of parameters would change every eight years). As there was the curricular reform taking place in the investigated period (implementation of FEP and SEP[18]), and therefore the teaching before and after the reform was compared, the expectation could be that the changes would be more dramatic, which would be reflected in the observed parameters of the teaching quality of physics. However, such changes were not identified.

On the contrary, the research showed that the physics teaching of particular teachers have almost unchanged characteristics over time, but the teachers differ from each other. For example, as has been mentioned in Section 2.3, Teacher 1 showed high physics expertise and first quality lecturing, Teacher 2 uses aids and links physics with practice, Teacher 3 conducts experiments less often and stresses active learning. This finding about the teaching stability, mainly if we consider teachers' activities, i.e. teaching, corresponds very well with findings made by Seidel and Prenzel (2006, p. 238), that individual teaching routines are resistant to change. This stability cannot be generally assessed as solely negative or solely positive. Some of these routines, probably, contribute to the teaching quality, while others do not. For example, in classrooms with a high quality of class work, which, according to Seidel, Rimmele and Prenzel (2003), have indicators such as questioning the students, function of student statements, teacher feedback, the students find themselves to be more self-determined, motivated, and they keep their interest in physics over the course of the school year (Seidel et al., 2003).

The second research question *in what way do the teachers perceive these parameters, their (un)successful implementation in their teaching, and their possible changes in time* was answered in Section 2.3. Let's discuss and summarise some of the findings. Between 2004 and 2013, which represent the end points of the observed time period, a curricular reform took place in the Czech Republic. It seems that *the curricular reform, basically, did not influence the changes of the teaching quality* of the observed teachers. Significant changes in teaching quality were not observed, and even the teachers did not make the reform a topic in the interviews (only one teacher spontaneously mentioned it). After interviewing how the teachers perceive the reform, it was revealed that *they perceive it neutrally, or rather negatively* (see also Vašutová & Urbánek, 2010, p. 87). It can be supported by the below mentioned opinions of the teachers.

[18] Abbreviation for School Education Programme (in Czech: Školní vzdělávací program, abbreviation ŠVP).

For example, Teacher 1 understood the implementation of the FEP and the creation of the SEP as a "shock", "stupidity" and "tables remake" (compared with Janík et al., 2011, p. 406). The teacher sees one disadvantage in the reform implementation in the fact that a particular topic is presented to students in different schools in different periods. Then, it can happen that if students change schools, they miss some of the topics. The teacher defends the previous curricula under the condition that 20% of the content would be optional. According to Teacher 2, the teaching has not, essentially, changed since the reform implementation, the changes were rather formal. She stated that, for instance, physics teachers agreed with geography teachers on teaching astronomy in physics lessons in Year 1, as the topic is common to both subjects. They also discussed what to teach in Year 4 (transfer between lower secondary and upper secondary education level). As an impulse arisen from FEP, a project in which students should design and realise a route from their school to a museum by public transport was implemented in Year 2. However, there were no serious discussions, and the teacher thinks that it could be explained by the fact that the school is big, and mutual discussions are more difficult. She also mentioned another aspect, that there are older teachers. Teacher 3 mentioned that their school was a pilot school during the curricular reform, and the reform was connected with certain hopes. The creation of the SEP was accompanied by intensive work, as well as with feelings of despair. The teacher criticises the content side of the FEP, which contains some of the new physical topics, but, at the same time, almost all of the traditional topics. He thinks that some traditional topics should be omitted, as students would forget them anyway. As physics is compulsory at the upper secondary educational level in this grammar school for only three years, it was necessary to reduce the subject matter ("there was a fight what to omit"). The teacher sees as a benefit of the curricular reform that "it brought us together and made us discuss it". Discussions concerning the changes of physics teaching were sped up, but the teacher thinks that it was not the primary aim of the reform. The above mentioned opinions correspond with other findings, expressing a certain aloofness or rejection of the curricular reform by teachers (especially in the Czech environment Janík et al. 2010, p. 22–27). The resistance of the teachers to external changes, e.g. the requirement to implement the curricular reform, does not have to be perceived negatively. Moreover, it can express an effort to reach a dynamic balance (compare with Fullan, 2000). On the other hand, the finding that the implementation of the curricular reform has not significantly changed the quality of teaching may be seen, basically, as unflattering for the reform.

The teachers also notice various actors who influence the teaching quality. Naturally, these actors are *students*. One of the teachers' observations is that students in the given school have worse knowledge and skills than some years ago (concretely, they mention worse mathematical skills[19], literacy, inability to make a continuous

[19] This observation of the teachers corresponds with the PISA research, where the results of Czech students were statistically significantly worse in 2012 than in 2003 (Palečková & Tomášek, et al., 2013).

written text). The teachers also mention more generalised judgements about today's grammar school students (e.g. "short-cutting generation")[20]. It is interesting to talk about the moment of *overloaded students*. While Teacher 1 perceives it as a students' excuse (supported by the school management), Teacher 3 mentions it as a fact. Teacher 3 and his colleagues are trying to find ways to reduce the subject matter. They see the overload to be caused by the subject matter extent, which the students should master, and also by the time consumption (the students have many optional subjects in this particular school). They spend more time in the school, and they are not able to relax. The concrete reaction of the teachers is that the number of physics lessons will be reduced throughout the whole study, and the teachers know that they will have to teach in a different way. This could be considered as an emancipated reaction of teachers, because Czech teachers mostly require as many lessons per week as possible in the given subject (compare with Lepil & Svoboda, 2007, p. 32). Considering the awareness of the situation in this school, there is a hope that an interesting teaching project will arise there, and it would be sensible to investigate it in the future.

When talking about the students, a certain diversity was implicitly mentioned (Teacher 1). This teacher observes that in his classes, recently, there have been students with different knowledge and skills. It is obvious that this diversity is negatively perceived by the teacher. The question arises as to whether it is possible to create certain conditions to take advantage of this diversity, which would be beneficial (for all, or at least for the majority) of students, and teachers would consider it as positive.[21]

One teacher also mentioned the role of other actors who do not participate in his lessons. Teacher 1 opened the topic of *school management* that exerts pressure on teachers to assign less homework and fewer written tests (see Section 2.3). The same teacher brought up a concrete example of *parents'* influence in his school. The parents of some talented students try to transfer their children to different grammar schools, where they have to face higher demands. So it is in a way paradoxical that the original effort to keep as many students as possible by lowering the demands ends up with a loss of some of the students.

The teachers also mentioned in their answers and considerations the topic of *information and communication technologies* (ICT). This is one of the topics in physics education which has been discussed for a long time. Let's remember that some Czech authors think that today's physics education is so significantly influenced by information and communication technologies that they suggest calling the current approach to didactics of physics as *informational-communicative* (Nezvalová, 2011, p. 176; Lepil, 2012, p. 8). Still, there is the question, what is hidden under the

[20] For example, Carr (2011) claims that the addiction to clicking, which is typical of information presentations on the Internet, leads to a decrease of longitudinal concentration of people. Posnick-Goodwin (2010) talk, in this sense, about generation Z.

[21] Regarding this, Sukhnandan and Lee (1998) point out that grouping students according to the same academic achievement does not influence their performance, but it ruins their motivation and self-confidence.

utilisation of ICT in the teaching (of physics). In our research, we declared that the teachers use computers for presentations in their lessons (Microsoft PowerPoint, videos, animations), when their students use computers during laboratory work, or, for example, when using the class registers. One teacher did not mention ICT as a relevant topic in relation to teaching quality. Another teacher pointed out that the technical equipment in schools cannot guarantee better teaching quality. The teachers' opinions could be, simply speaking, summarised that *ICT in teaching should not be overrated*.[22] In connection with this, we should mention the conclusions of German researchers, that new media themselves do not support learning, but that it is necessary to take into account the teaching objectives anytime when we want to use them (Bayrhuber et al., 2004; compared with Dvořák et al., 2012, p. 328–329).

The teachers came with suggestions as to how to remedy the lacks of a technical, administrative, and organisational nature – e.g. the need of a person who would repair broken teaching aids, the requirement for diminishing the administrative load, the reduction of lessons in full-time engagement, the reduction of the number of students in classes, pay-rises. These suggestions support our assumption that the teachers, when making self-reflection of their teaching, are aware of the fact that the quality depends on other factors. These factors are perceived by different teachers in a different way.

It is clear that the teachers see the limits of the teaching quality mainly outside themselves. Only exceptionally do they admit that they are aware of their internal determinants (Teacher 3 said he does not know well the world of today's young people). On the other hand, external and internal factors (these are not precisely defined in this work) cannot be unambiguously separated, because, for example, a pay-rise could motivate teachers, the decrease of the administrative load may bring more time, which could be used for lesson planning, etc.

The research methodology and the fact that only three teachers were investigated in this study prevent us from making general conclusions. The ambition of the study is different; it should point out a wider context, which may influence the teaching quality of a particular subject, conducted by a concrete teacher, in a concrete school. This context, for sure, includes school management (the principals) whose decisions may significantly influence everyday teaching. Behind their decisions, there are often various economic factors, so we get from the level of teaching a particular subject and a given school to the level of the state administration. The context in which the teaching takes place is also co-made by students' parents. It is their decision whether their children will study in the given school. Their decision is not definitive (some parents arrange a transfer to another school during the studies).

During the interviews, it was revealed in what way the teachers see the quality parameters of their teaching and potential changes. We should remember that

[22] This opinion corresponds with many research studies comparing teaching without the use of ICT and computer based instruction (or eLearning). For instance, Bernard et al. (2004) and Mayer & Clark (2008) claim that there are almost no differences in the results of such teaching.

these are only reflections of the teachers and their interpretations, which cannot be considered as objective judgements. However, it seems that their reflections are relatively complex. This conclusion could be made because of the finding that the teachers' interpretations fall into the majority of areas which could be considered as relevant in the research of science education (Lee, Wu, & Tsai, 2009; Tsai & Wen, 2005) – teaching; learning (conception, context); objectives, education policy, curriculum and assessment; culture, society; history of science; information technologies in education (compare with Dvořák, Kekule, & Žák, 2012, p. 327–328). The teachers mention these, generally defined, areas in a different way, and it is satisfactory that they do not connect teaching quality solely with, for instance, students' learning, but they take into account a broader context. This is additionally evidence of what has been mentioned in the introduction, that the selected teachers possess a relatively developed reflective competence.

The question is in how to reflect these and other findings, if they prove to be relevant, in the initial teacher training or, possibly, in the further education of teachers, and how to deal with them in teaching practice in schools. Another question is if the topic of the influence of school management and parents, generalised ideas of teachers about today's generation of students, etc. captures enough attention in (future) teacher education. We emphasize that we reached these general topics organically when investigating the teaching quality of a concrete field (physics), and therefore it seems that topics of subject didactics are inseparably connected with, for instance, school management, communication with parents, etc. Therefore, all this could be taken as an argument to see topics of subject didactics from a broader perspective, and in a broader context than we are often willing to admit.

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The Development of *Standards for the Use and Development of Classroom Teaching and Learning Materials*

Mike Horsley

This paper describes the development of standards for the use of classroom teaching and learning materials. The draft standards included in this paper have been developed by International Association for Research on Textbooks on Educational Media (IARTEM). The standards were developed in Australia but have been discussed in a number of international forums, including the 2013 IARTEM conference at the University of Ostrava (Czech Republic). At this conference the standards were shared for feedback, validation and further research refinement and revision. Data was collected from IARTEM members about the standards and Professor Arno Reints from the University of Utrecht is leading an international IARTEM project to further develop the standards. Feedback on the standards can be made on the IARTEM website at any time – http://iartemblog.wordpress.com/have-your-say/.

The paper is divided into a number of sections:
A. Origin of the standards
B. Process of standard development
C. Purpose of the standards
D. The standards continuum
E. Development of the domains
F. The domains
G. The standards

A. Origin of the standards

These standards and propositions grew out of:
- concerns about the level of classroom teaching and learning resources to support national curriculum;
- concerns about the limited attention given to access and use of classroom teaching and learning materials in teaching standards;
- concerns about capturing best practice in how teachers access and use classroom teaching and learning materials to match student learning needs and, as a result, enhance student learning outcomes;

- concerns that current teaching standards neglect the role of teaching and learning resources and materials, and also neglect the complexity of selecting, preparing and using teaching and learning materials.

These standards draw their inspiration from an approach which regards individual and collective teacher qualities and characteristics, as shaping, but also responding to and reflecting, the school context. Teaching practices and teaching quality emerge from the complex interactions between resources, teachers and schools.

In this view, teaching quality reflects not just the qualities of individual teachers and teaching teams, but also the parameters of teachers' work in their schools. These parameters include:

- planning time and planning opportunities;
- the classroom teaching and learning resources available at schools;
- teachers' workloads and activities;
- the nature of students in teachers' classes.

As a result, the standards also draw inspiration from the view that it is the way that teachers use classroom teaching and learning materials that is critical in affording or constraining student learning. However, teachers use and mediation of classroom teaching and learning materials is also dependent on access to classroom resources.

B. Process of standards development

The process of developing the draft standards propositions reflects the steps undertaken in previous standards development work. These steps include:

1. teacher discussions to explicate key domains and potential standards;
2. teacher consultations and feedback to refine the domains and initial draft standards;
3. teacher explorations and feedback to consider the draft domains and standards;
4. stakeholder consultation and feedback on the shape and structure of the domains and standards;
5. validation of the standards.

C. Purposes of the standards

The purposes of the standards are to:

- promote best practice in accessing and using classroom teaching and learning materials;
- make teaching quality in accessing and using classroom teaching and learning materials more explicit;

- promote curriculum leadership to support the curriculum;
- raise the profile and importance of the role of classroom teaching and learning materials in quality teaching.

D. Standards continuum

Discussions with teachers and analysis of research revealed three levels of capability in relation to the standards developed.

At the lower level of capability, it was proposed that *novice teachers*:

- were more resource driven in their planning and less curriculum or student need driven;
- had fewer skills in matching resources to their learners;
- were more likely to favour digital over print resources;
- were more likely to use teachers' guides and similar support materials in their planning;
- were less likely to demand and/or agitate for classroom resources;
- spent as much time as experienced teachers in locating and selecting and preparing resources;
- demonstrated less understanding of the learning affordances and constraints in classroom teaching and learning materials;
- were less skilled in scaffolding the use of classroom resources by their students.

At the *experienced/expert* level of capability, there was widespread agreement that expert experienced teachers:

- are planning, rather than resource, driven as they focus on accessing and selecting resources to the level and interest of their students through their knowledge of content, their pedagogical content knowledge and their knowledge of students.

At the highest level of capability, there was widespread agreement that *classroom teaching and learning materials leadership* was displayed by a range of teachers who developed resources for other teachers. These creators of new resources included:

- textbook authors and publishers;
- creators of school based classroom teaching and learning resources for groups of teachers;
- curriculum writers and unit writers from education systems and curriculum authorities, who created new classroom resources to support curriculum development.

The standards developed are not presented in a continuum to reflect these three levels of capability.

E. Development of draft domains

In developing the draft standards domains extensive discussions were held with teachers. These discussions were focused on the way that the selection, use and adaptation of classroom teaching and learning materials were central to the core business of teachers work. Teachers reported that gaining access to teaching and learning materials and providing these resources to their students was a central teaching and learning activity. As well, evaluating and selecting the appropriate teaching and learning resources and planning to use them in the classroom were core teaching activities. In the same way, using teaching and learning materials in the classroom, based on their understanding of them, were also seen as critical in teaching and learning by teachers. Often using teaching and learning materials in the classroom requires their customisation and adaptation by teachers, and sometimes their development of new teaching and learning materials. These activities in relation to classroom teaching and learning were described by teachers as core aspects of classroom teaching and learning. These core aspects of classroom teaching and learning reflected the teacher, their school context, and the schools resources and traditions.

The domains reflect:

- the crucial role of teaching and learning materials in teaching;
- the relationship between teacher planning and access to and planning for use of teaching materials;
- the role of teachers in adapting, customising and mediating classroom teaching and learning materials for their classes;
- the effective use of classroom teaching and learning materials;
- the characteristics of classroom teaching and learning resources that present learning affordance and constraint.

F. The domains

(1) Accessing classroom teaching and learning materials.
(2) Planning to evaluate, select, use and develop classroom teaching and learning materials and preparing (producing) them.
(3) Understanding the characteristics of teaching and learning materials that may afford or constrain learning.
(4) Customising and adapting teaching and learning materials for the students in the class.
(5) Supporting curriculum.
(6) Using classroom teaching and learning materials in teaching and learning.
(7) Creating and developing new classroom teaching and learning materials.

G. The standards

1 Access

Teachers:

- ensure that all students have access to individual copies of appropriate teaching and learning resources both print and digital for use both at home and school;
- should seek budgeting models, that promote individual teacher autonomy and, at the same time, support strategic investment;
- ensure that multiple print and digital classroom teaching and learning resources should be available for every topic they teach;
- agitate for a minimum level of classroom teaching and learning resources per student, class and school;
- create their own teaching and learning resources for their students, where appropriate;
- supplement school resources when they are lacking through their own classroom resource purchase and/or development;
- balance the print and digital resource needs of their classrooms;
- exercise autonomy by selecting the appropriate teaching and learning resources for their students, both individually and in collegial groups;
- exercise autonomy by making all the decisions about accessing and purchasing teaching and learning materials for their students;
- demonstrate responsibility in caring for existing class and school resources, and adding to them.

2 Planning

Teachers:

- seek access to a wide corpus of teaching and learning materials in the planning process;
- evaluate all the available teaching and learning materials for a unit of work/topic in the planning process;
- access professional development on the corpus of existing classroom resources;
- access appropriate planning time;
- access appropriate planning resources;
- focus planning on selecting teaching and learning resources based on matching resources to the students in their classes;
- ensure planning processes are curriculum, unit, concept and topic driven, rather than resource driven;
- focus planning on using and adapting published teaching and learning resources, rather than initially creating and producing them;
- focus planning on students and their contexts; this child, this classroom, this school, this community;

- align resource selection processes to how the resource will meet the aims of the unit and the curriculum within the student context;
- consider environmental consequences in the production of class teaching and learning resources;
- reflect the regulatory framework in the production of class teaching and learning resources;
- balance planning time between accessing, seeking, evaluation, planning for use and preparing and producing class teaching and learning resources

3 Characteristics of classroom teaching and learning materials

Teachers:

- understand the linguistic and literacy features of classroom teaching and learning materials;
- assess the conceptual and reading demands of print and digital classroom resources on their student readers;
- understand the multimodal demands current classroom teaching and learning resources make on student learners;
- understand how classroom teaching and learning resources represent disciplines and subjects and position textual and disciplinary communities;
- assess the learning affordances and constraints in the structure and design of the materials and their preparation;
- understand how the teaching and learning materials reflect community and social values;
- understand the pedagogical underpinnings of classroom teaching and learning resources;
- understand the way one classroom teaching and learning resource links and complements other teaching and learning resources;
- understand how classroom teaching and learning resources match individual students in their classroom at different levels of capability.

4 Customisation and adaptation

Teachers:

- make adaptations to make published print and digital resources more comprehensible and more interesting to learners;
- enhance existing classroom materials with current, up to date materials;
- adapt teaching classroom teaching and learning materials for their own pedagogical and teaching philosophies and dispositions;
- make adaptations so teaching and learning materials are responsive to cultural diversity and multiple identities;
- explicate the metaphors found in teaching and learning materials;

- differentiate print and digital teaching and learning materials for individual students;
- position teaching and learning materials to promote active citizenship and pluralism;
- make adaptations to teaching and learning materials to meet the needs of students with different type of learning disabilities.

5 Curriculum support

Teachers:
- access predominantly national curriculum resources for the national curriculum;
- contribute to the trialling and development of new classroom teaching and learning resources;
- share use and evaluation of new classroom teaching and learning resources created for the national curriculum with other teachers;
- understand that successful curriculum implementation will depend in part on digital and print resources constructed at the class, school and local level as well as the national one.

6 Use of teaching and learning resources

Teachers:
- create learning environments through the way they use print and digital classroom teaching and learning materials;
- articulate the learning environments they have created;
- understand that the quality of the learning environment depends on their use of print and digital classroom teaching and learning materials;
- use a wide range of print and digital resources as the basis of lessons;
- create effective learning environments by using teaching and learning resources for direct instruction, and for collaborative and creative learning;
- use different classroom teaching and learning resources in ways that provide opportunities to afford student learning.

7 Creation

This aspect of the domain requires further development with national publishers and the international publishers association.

IARTEM Conference post script

The standards were the subject of a round table discussion at the 12th IARTEM conference at the University of Ostrava involving 75 researchers, educationalists and publishers from 19 countries. Data from the round table is still be analysed. However, a number of themes were recognised in the responses to the standards.

These included: comments on the role of teaching standards development in national education systems; comments on the nature of textbooks and educational media and their different importance in different national education systems; general agreement that the standards represented an important aspect of teaching and learning; discussion of the potential importance of such standards in teacher education; and considerations of the alignment of the standard to different national systems of education. As well a survey has been developed to validate the standards and provide data for their further refinement. Some twenty participants from the conference completed the survey.

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Results and Prospects of Textbook Research in the Czech Republic

Jan Průcha

Abstract: The paper presents a survey of studies and research approaches concerning Czech textbooks that have been performed to date. In fact, the first analyses of school textbooks and primers were accomplished during the 1930s by Czech educationists and psychologists (V. Příhoda and others). Recently, this analytical trend has continued, and is being intensively further developed in a number of studies. This is evidenced in a number of monographs and papers published by Czech researchers in several faculties of education, among them at the University of Ostrava. The most remarkable research findings concern the following topics: Parameters of textual components of textbooks; measuring text difficulty for pupils; content representation in textbooks; utilization of textbooks in learning and teaching; selection of textbooks by teachers and schools. However, some new problems have arisen that have as yet not been profoundly studied, among them especially the role of printed textbooks vs. new educational ICT media.

Keywords: textbook research, structural components of textbooks, text difficulty, utilization of textbooks, selection of textbooks, new educational media

The main aim of the paper is to present brief information to colleagues from other countries concerning what has been done in textbook research by Czech researchers. The reason behind it is to show that textbook research has been developed quite intensively to date in the Czech Republic (formerly in Czechoslovakia), and that it has been substantially influenced by research approaches and methods coming from Eastern European as well as Western countries.

Therefore, the paper consists of three parts:

- The first part is a brief look into the history of Czech textbook research. I want to remind you of some approaches and methods applied since the 1920s and 1930s, which might be of some interest even nowadays.
- The second and main part of the paper presents a survey of research studies on Czech textbooks that have been published during the last several years. The survey focuses first of all on the topics of the research and on methodological issues.
- In the last section I intend to offer some proposals concerning the future research on textbooks in conditions of the "electronic age", and with respect to learning and teaching in schools.

Naturally, the presentation as a whole cannot go into details, due to limited space of presentation, so it can offer only basic information.

1 A look into the history of Czech textbook research

The actual roots of Czech textbook research can be found in the 1920s and 1930s. In that time, educational studies in some European countries and in the USA were developing quite intensively, being focused on empirical studies on children (so-called *pedology* influenced by works of W. Stern and others). Some educationists were interested in research on the development of child speech and its impact for learning and teaching in schools. Václav Příhoda, the founder of educational psychology in Czechoslovakia, after his study at the well known Teachers College (Columbia University, New York) was probably the first one of those dealing with Czech textbook research. Let's briefly explain his approach.

Problem area (1): The relation between children's vocabulary development and the vocabulary of primers and first schoolbooks

The main idea of Příhoda's concept was such that the construction of primers and all other schoolbooks has to take into account the development of children's language. For this purpose, it is necessary to measure, among other things, the size and composition of children's vocabulary, especially at the age when children start their school attendance. Therefore, in his project *Měření slovní zásoby u dětí* (Measurement of Child Vocabulary) Příhoda (1927) analyzed the vocabulary of several primers used in Czech primary schools, and compared the data with the vocabulary of 6 year old children. Of course, he found discrepancies which, however, were even greater in higher ages of children.

It appears today as surprising that the postulate of a necessary correspondence between the development of children's language and the language of textbooks is often not respected even nowadays. The main reason for this is that we have no exact data about the characteristics of child language in particular school ages (i.e. in the population of Czech children).

Problem area (2): Overloading of curricula by the amount of information and the consequences of it for textbook research

Paradoxically, the Czech (Czechoslovakian) research on textbooks gained impulses for its development in the 1970s and 1980s due to the sharp criticism of the curricula of that time. The main criticism was aimed at the fact that the subject matter in basic education (i.e. in primary and lower secondary schools) was so extended and overloaded by details that it became inadequate for pupils. This situation was also apparent in textbooks for particular school subjects – some of them more resembled encyclopaedic handbooks than didactic media. The problem was more serious because no exact evaluations of textbooks were conducted, and the respective methods were not known.

A radical change came after the Czech and Slovak educationists started to become acquainted with new theories on textbooks, and with methods of textbook evaluation that were developed abroad. First of all, the publications dealing with

textbook research by some Soviet and German (GDR, i.e. East Germany) authors were accessible at that time. Perhaps the following important sources should be mentioned:

One of the most influencing contributions to the theory of the textbook was the monograph *Školnyj učebnik (The Schooolbook)* by the Russian author D. D. Zujev (1983; 1985 in its Slovak translation). This book presented a systematic conception of the structure of the textbook with a detailed description of particular structural components and their function. Zujev's concept became the basis for Czech and Slovak works in textbook research.[1]

The other main inspiration for us was the works of the Estonian researcher Jaan Mikk, especially his publication *Optimizacija složnosti učebnogo teksta (The Optimization of the Complexity of Educational Text)* (Mikk, 1981). For us, this small book created an impulse for our effort for the exact evaluation of textbook parameters. Mikk constructed various methods and formulae for the measurement of text complexity, which he later even more profoundly elaborated in his monograph *Textbook: Research and Writing* (Mikk, 2000).

A lot of inspiration also came from the former GDR, where textbook research was conducted in the *Zentrum für Schulbuchforchung* (Pädagogische Hochschule, Köthen). The group of researchers (M. Baumann, K. Nestler et al.) performed not only various measurements of textbook parameters, but they also verified experimentally how particular textbook characteristics can affect learning processes in pupils. As a whole, the findings of the German team were presented in the monograph *Lernen aus Texten und Lehrtextgestlltung* (Baumann et al., 1982) which deserves interest even today.

Only after the political changes since 1990 have the works on textbook research published in the West become more accessible for us, e.g. works from the *Georg-Eckert-Institut für internationale Schulbuchforschung* (Braunschweig) or from Scandinavian countries, the USA, and elsewhere. But this is already the present-day situation which I am dealing with now.

2 The research on Czech textbooks at present

Textbook research in the Czech Republic has been developed in three main areas during the last several years:

- Evaluation of parameters of texts in textbooks by means of quantitative methods.
- Studies on how textbooks are used in real processes of teaching at schools.
- Selection procedures of textbooks applied by schools and teachers.

At present, the most important studies in textbook research are conducted and published by two universities: at the Institute for Research of School Education,

[1] By the way: This monograph was later positively appreciated by E.B. Johnsen (1993) in his critical overview of international scene in textbook research: "*As basic systematic research, Zujev's book is unparalleled in the West.*" (p. 76)

Faculty of Education, Masaryk University, Brno (Maňák & Klapko, 2006; Maňák & Knecht, 2007; Janík et al., 2007, and other works) and at the Faculty of Education, Ostrava University (Červenková, 2010; Sikorová, 2004; Sikorová, 2010).

Besides, some other studies on textbook research were produced by individual authors at other places, not, however, as team projects. I will briefly describe the most relevant works, with a focus on problems under investigation, and the methods applied.

2.1 Measurement of educational texts

The prevailing part of the Czech research on textbooks has been focused on evaluations of text parameters. It rests on the concept that every textbook is an educational medium, with its own specific properties which

(1) can be identified,
(2) can be evaluated by means of quantitative measures,
(3) one can develop predictions about what probable effects might be elicited in learning & teaching by certain characteristics of texts (this approach was developed and applied by Průcha, 1987, 1998, 2006).

Various empirical studies on Czech textbooks have been focused to the following problem:

Problem area (3): Do the new textbooks for Czech pupils possess such didactic properties which can secure their potential positive effects in pupils' learning? The starting point here is a model of structural components that should be reflected in any correct textbook (Figure 1)

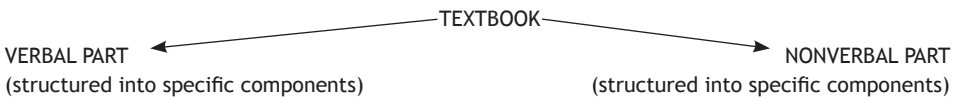

Figure 1 Structural components of the textbook

Both main parts have a certain number of components (36 altogether) which are different, as to their special functions:

- function of *exposing* the subject matter (e.g. explanatory text, summary of the new subject matter, etc.),
- function of *regulating* the learning (e.g. questions and tasks for pupils, etc.),
- function of *orientation* in a textbook (e.g. distribution of lessons, etc.).

Based on the calculation of the occurrence of particular functional components, the coefficients of the respective functions can be measured as for any textbook (Průcha, 1998). Therefore, the so-called *didactic potentiality* (in Czech terms *didaktická vybavenost)* of a textbook can be evaluated. This procedure has been conducted with a number of Czech textbooks for different subjects and grades of the

lower-secondary and upper-secondary school. The general finding is that textbooks differ significantly in the rate of didactic potentiality, not only as to various grades of school, but also in textbooks for the same grade. For example, Czech history textbooks reveal, as a rule, a lower mean rate of didactic potentiality (E = 36–44%) than biology textbooks (E = 69–75%) (data in Průcha, 2006; Jůvová, 2007).

Another example is the comparative analysis of some of the most frequently used mathematical textbooks in the Czech Republic (N = 10) and in England (N = 9). Though the average value of didactic potentiality in both samples of textbooks was rather similar (around E = 55%) textbooks in England reveal a slightly higher coefficient of orientation in the text (Šlégrová, 2009).

Besides, the didactic potentiality of textbooks has also been evaluated by other procedures, such as the analysis of scientific concepts in textbooks. This has been applied e.g. by Knecht (2007) who measured the occurrence of scientific terms representing social geography in a sample of twelve Czech geography textbooks. The author found great differences in utilization of the respective terms, as well as of other text parameters, causing the variability of didactic potentiality among the textbooks.

Problem area (*4*): What are the causes of an inadequate difficulty of a didactic text for pupils? How can the difficulty of a text be decreased?

The crucial question linked with all textbooks is whether their text is accommodated adequately as to the cognitive and linguistic abilities of pupils of different ages. As is already well-known, in textbook research, there are a number of methods and formulae serving for the measurement of text difficulty. They were developed and applied by Mikk (1981, 2000), Harrison (1982), and many others. The substance of the methods is a quantitative evaluation of some linguistic and/or nonverbal elements of texts.

In this framework, a similar method was developed in the research of Czech textbooks, called formula (*T*):

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

where $T(s)$ is syntactic complexity of the text, $T(p)$ is semantic complexity.

The values of $T(s)$ and $T(p)$ should be calculated from several text characteristics, as e.g. length and complexity of sentences, occurrence of scientific terms, etc. (details of the method and instructions of its application are described in Průcha, 1987, 1998, 2006).

During recent years, about two hundred Czech and also Slovak textbooks of different subjects and school grades have been measured for text complexity, applying formula (*T*) (some recent findings are published in Maňák and Klapko, 2006; Maňák and Knecht, 2007; Janík et al., 2008; Hodis, 2009, and elsewhere). Generally, it appears that

- in most textbooks, text difficulty for pupils is caused rather through the semantic components (esp. an abundant occurrence of scientific terms) and less through the syntactic components,

- correlation between an average complexity of various textbooks and the age (grade) of pupils is rather low (Pearson r = < 0.30) which means that textbooks' authors are not sensitive enough to respecting the true cognitive capacity and linguistic competence of children.

As a whole, measure (*T*) can be used as a relatively objective instrument for the assessment of text complexity in textbooks. Its validity was approved, among others, by experiments with large samples of German pupils, accomplished by Nestler (1976). In a similar way, it was carried out by Mikk (2000) for his measures of text complexity.

Problem area (5): How are textbooks utilized in actual learning & teaching? What are the activities of pupils and teachers with textbooks?

Certainly, empirical findings concerning various characteristics of textbooks have a high value as such. They can be used e.g. for corrections of newly constructed textbooks in the stage before they are published. On the other hand, it is as important to explain how textbooks function in actual learning & teaching processes in schools. In some previous studies, it was found that teachers utilize textbooks first of all as a basis for their planning of the subject-matter that should be presented in particular lessons. Therefore, it seems desirable to find out what pupils and teachers are actually doing with textbooks in classrooms. In Czech textbook research, such investigations were performed mainly at Ostrava University, by Sikorová (2010) and Červenková (2010).

In her research, Sikorová (2010) observed 52 teachers in 155 lessons of the 8th grade in 10 basic schools (lower secondary stage). Besides, she performed interviews with teachers and administered questionnaires to teachers. The main findings indicate that

- almost all teachers use textbooks as the resource of the subject-matter and resource of tasks for pupils,
- textbooks and other educational texts were used in 86% of lessons,
- generally, teachers' utilization of textbooks in lessons differs substantially due to the type of subject and individual teacher's style of teaching.

The same sample of lessons was analyzed by Červenková (2010) with respect to pupils' activities with textbooks. The research was based on various methods: class observation; interviews with pupils; questionnaires for pupils. The main findings are as follows:

- Textbooks and other text materials are used quite extensively by pupils: Traditional textbooks were used in 76% of all lessons. Other text materials (workbooks, worksheets, readers, maps, etc.) were used in 38% of the entire time of instruction.
- Pupils learn from textbooks most often during the stage of presentation of new topics, and during exercises and recapitulation.

- The majority of pupils do not periodically learn at home from textbooks. Most teachers do not explain how to work with a textbook at home.

Some important findings concerning the role of textbooks in classroom learning & teaching have also been gained from other types of research: Namely *video studies* that enable the recording of all activities by teachers and pupils, including activities with textbooks and other text materials. For example, several video studies conducted by researchers at Masaryk University in Brno (Janík et al., 2007) show that in subjects such as physics, the use of textbooks is rather limited.

Problem area (6): How are textbooks selected by schools and teachers? What are the criteria used in this selection?

A new phenomenon in the Czech Republic since 1990 is that several different textbooks exist for each school subject, whereas before 1990 there was always one obligatory textbook for a particular subject. It means that, at present, schools and teachers can influence education in schools just by selecting a particular textbook from a number of those offered in the textbook market. Publishing the textbooks produces a big profit for the publishers and, consequently, the offer of textbooks to schools is rather extensive.

Sikorova (2004) describes her research focused on the selection procedures used by teachers who select textbooks for their pupils. The research sample was represented by 784 primary, lower secondary, and higher secondary teachers in the Ostrava region. The methods applied were questionnaires for teachers and individual interviews with teachers. Therefore, the researcher gained data on ways by which 2590 textbooks were selected by teachers. The main findings are as follows:

- Teachers reveal that they have quite a large opportunity to participate in textbook selection.
- The prevailing procedure used in textbook selection was teachers' collective decision-making in a particular subject department.
- Among external factors influencing the textbook selection is, first of all, approval by the Ministry of Education; the economic situation of a school also plays a role.
- Most of teachers would welcome some kind of help from experts in textbook evaluation.

Also important is the finding that teachers obtain information about textbooks first of all from the publishers' advertising offers. Such information is, of course, often distorted, due to the commercial interests of publishers, so that teachers have to select textbooks without having at their disposal any evaluation of textbooks by researchers.

This is, in a brief survey, the state-of-the-art of Czech textbook research. Naturally, though the situation concerning the research looks relatively positive, new tasks are emerging.

3 New topics and tasks for further research

Czech textbook research must be extended as for themes, subjects under investigation, and must be also co-ordinated. The necessary tasks can be briefly expressed as follows:

- The research should cover not only textbooks and their various characteristics, but it has to also include learners in its scope. It means to make confrontations between objective parameters of textbooks and the *linguistic competencies* of learners. Therefore, it seems necessary to also develop more intensively studies explaining what the ways and factors of educational text *comprehension* are (cf. studies by Mikk, 2000; Gavora, 1991, and others).
- It seems useful to get some knowledge about what the real *effects* of learning from textbooks are. It means to explain what knowledge the pupils actually acquire from textbooks. A good example here could be the study by Knecht and Lokajíčková (2013), trying to find how much the new geography textbooks create opportunities for the acquisition of competencies by learners which are required by Framework Educational Programme for Basic Education.
- As for teachers, it seems useful to explain not only how often teachers utilize textbooks in their lessons, but also how they *modify and communicate* the subject-matter content to pupils in comparison with the subject-matter presented in textbooks.
- A less than easily solved task is to explain the place and function of traditional printed textbooks in relation to a number of *new ICT media*. The main question is how textbooks should be accommodated in this competition in order to remain a vital educational medium.
- Besides, it is necessary to establish a *Centre for Textbook Research* in the Czech Republic, similar to those working in some other countries. One of its tasks should be to co-ordinate investigations on textbooks that are at present conducted almost without any co-ordination.

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Jan Průcha and His Outstanding Contribution to Educational Research in the Czech Republic

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Professor Jan Průcha (27 November 1934), whose significant anniversary is celebrated this year, is an author of numerous specialised publications, encountered undoubtedly by everyone taking a deeper interest in the field. His works constitute a goldmine of Czech educational science. Since there is not enough space to outline all of Průcha's important papers in a short summary of his work, we will only focus on the main areas Průcha has turned his attention to.

While studying philology at the Faculty of Arts of Charles University in Prague, Průcha was already interested in interdisciplinary relations and related fields. Having returned from his research fellowship in Moscow, he translated L.S Vygotsky's *Thought and Language*, and published papers on psycholinguistics. During his career at the Institute of the Czech Language, he had an opportunity to concentrate on mathematical linguistics; however, he was more and more drawn towards pedagogy and psychology as manifested, for example, in his *Research into Children's Speech* (1974) and *Language Education, Analysis and Prospects of the System* (1978). After going over to the J. A. Komenský Institute of Pedagogy of the Czechoslovak Academy of Sciences, he focused on educational psychology and educational science.

Surveying Průcha's work chronologically is rather challenging, because he tends to elaborate and build on his previous papers over the course of time, and therefore they are often published in further editions. These extended issues serve as evidence of widespread interest in his work, which serves as a source of required information. Průcha's focus on current issues of educational science grew when he moved to the Faculty of Education Charles University, where he later became a head of the Institute of Educational and Psychological Research, until becoming an independent expert and consultant.

Textbooks and learning materials are an area Průcha aims his long-lasting focus on, and publishes his papers on (see his paper in this issue of Orbis Scholae journal). Over the course of several years, many a paper and book by Průcha has been published, the most prominent ones being his *Learning from Text and Instructional Information* (1987) and *Textbook: Theory and Analysis of Educational Medium (1998)*. The subtitle of the book is *A Handbook for Students, Teachers, Textbook Authors and Researchers*. This way, Průcha highlights his mission to pass on and transform the research results to practice in the form of know how. This approach is elaborated on in another one of his publications: *Educational Research*

and Educational Policies – Building up Bridges (1997). This aim is also implicit in his *Introduction to Educational Science,* which serves as a sought-after source of information for future teachers.

Since he endeavours to convey scientific knowledge to as many readers as possible, Průcha aims to publish comprehensive compendiums, as well as dictionaries, for example his *Educational Dictionary,* developed together with E. Walterová and J. Mareš, which has already been published in seven editions. Amongst other publications in this area, there is the *Educational Encyclopaedia* (2009), as the most comprehensive one. Over a hundred co-writers were invited to contribute to this publication. It is a considerable piece of writing, which Průcha worked on for several years, as he himself admits, and its quality easily complies with international standards.

Over the course of his professional career, Průcha has never lost his focus on educational research. On the one hand, most of his papers are based on research. In addition, he is interested in the theory of research, which he tackled in several papers and monographs, such as *Educational Research: Introduction to Theory and Practice* (1995) and *Educational Politics and Educational Research* (1997). A comprehensive chapter on the state and perspectives of educational research is also a part of his *Modern Educational Science* (1997), which has been published in five editions. He emphasises the importance of research-based knowledge and the research results projected to reality as the basis of the approach to educational phenomena, as opposed to a normative approach. Jan Průcha bolstered Czech educational research in terms of its organisation as well, because he founded the *Czech Educational Research Association (CERA),* and integrated it into the European context. Průcha summarised the 20 years of *Czech Educational Research Association's* existence and work in the field of educational science in his paper published in *Pedagogická Orientace* 6/2013 journal.[1]

Even though this overview of Průcha's work in the field of educational science claims to be rather concise, we must not omit a group of his publications focusing on specific areas of educational reality. For example, *Evaluation in Education* (1996), *Alternative Schools* (1996), *Multicultural Education* (1996), *Comparative Educational Science* (2006), *Intercultural Psychology* (2007), *Intercultural Communication* (2010), *Dictionary of Adult Education* (with Veteška, 2012), *Pedagogy of Pre-School Age* (together with Koťátková, 2013), *Adult Education Research* (2014), and others. These titles often provide an insight into parallel fields of educational science, as well as serve as valuable sources of information on the fields less covered by literature so far.

This overview of professor Průcha's work is an attempt to outline the areas of his main focus during his lifetime. Certainly not all his work enriching educational science and serving as a gold pool for educational theorists as well as practicians has been mentioned. We have predominantly concentrated on the main areas of Průcha's

[1] Available from http://www.ped.muni.cz/pedor/archiv/2013/pedor13_6_p848_20years_prucha.pdf.

work, and attempted to highlight the most important publications. This profile only aims to emphasise the great contribution the author has made to educational theory and practice, as his work lives on and aids in increasing the quality of education. What's left is to wish professor Průcha good health and a creative mindset for the years to follow.

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