

Textbooks: current research and practices, some markers

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This text provides an update on textbook-related research in 2021.

1. Introduction

Even if textbooks are often criticised, they maintain an important place in school systems. They are complex objects which appear in complex systems too within tensions that can be productive: digital or paper-based textbooks with links between texts, pictures or even audios and videos; exercises to discover, train, understand, evaluate; for a use in class or outside; for teachers or pupils, or even for parents...

The main difficulty in their design is to take the students heterogeneity and the large variability of situations into consideration. This is especially the case for paper-based textbooks, leading to questions about the underlying model on which to design them: a book with an internal structure, serving as reference text or a set of independent resources that are connected through metadata, a sort of Meccano. Should a new model be designed? There are many questions, and it is hard to provide clear answers. Research is being led, but also innovations and practices to produce other textbooks and educational resources proposed for pupils and teachers.

Much research has been devoted to textbooks. In particular, in the first decade of the 2000s, several research books were dedicated to them in the French-speaking world (Lenoir, Rey, Roy, Lebrun, 2001; Baldner, Baron and Bruillard, 2003; Moeglin, 2005; Bruillard, 2005; Lebrun, 2006). The International Association for Research on Textbooks and Educational Media (IARTEM), and its members are also very active: Johnsen's book (1993), Mikk's book (2000) and the proceedings of international or regional conferences (on [IARTEM website](#)). More recently, we can recommend the book which celebrates the 25th IARTEM's birthday (Rodr guez, Garcia, Bruillard, 2019), one on digital textbooks (Rodr guez, Bruillard, Horsley, 2015) as well as the report published by UNESCO (United Nations Educational, Scientific and Cultural Organization) (Mochizuki & Bruillard, 2019). Finally, the Georg-Eckert Institute's work should be noted (Pingel, 1999; Fuchs & Bock, 2018).

In this text, we will structure the presentation around three key points: the study of textbooks as objects; the procedures of textbook design and adoption; and the uses of textbooks as well as teacher training. This presentation is quite similar to the structure of Johnsen's book (1993), which is organised in three parts: (1) ideology in textbooks; (2) textbook use and (3) textbook development.

The following figure shows the main themes that organised the IARTEM conference (2017) in Lisbon (Bruillard, Anichini & Baron, 2019). The themes – in a grey background – are rather focused on textbooks as objects, including the studies linked to a discipline or school teaching, the tools used, “inside books” and digital ones. This last category is in a lighter grey, which means it may go beyond the simple analysis of digital items to look at different particularities in their design or use.

In white background in the first figure, we note the theme “inside schools” which refers to uses and the “resources management” theme which deals with the design and selection of textbooks.

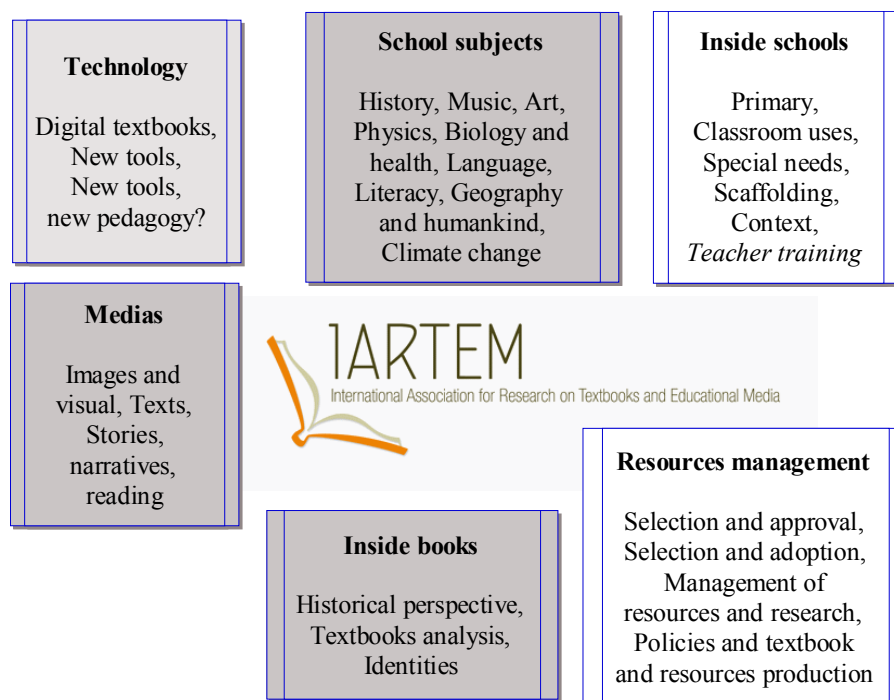


Figure 1. The main themes of the IARTEM conference in Lisbon (2017)

As for the IARTEM conference (2019) in Odense, the introduction of Stig Tøke Gissel is entitled “Researching Textbooks and Educational Media from Multiple Perspectives: Analysing the Texts, Studying their Use, Determining their Impact”. In the organisation of proceedings, the same structure can be found. The first theme represents the educational resources as texts, which analyses their structure and educational potential, or questions their conceptual or ideological organisation. The second theme is about the uses of students, teachers, and their methods of selecting educational resources. Finally, the third theme focuses on innovating designs and production processes of educational resources. Even though the textbooks’ choice is included in the second theme, the structures are quite the same as the Lisbon conference.

Taking such an organisation to study the research on textbooks (the item, its design and uses) is finally very classical and it is used in this presentation. Given the impossibility of a sufficiently complete review of current research, we will limit ourselves to provide some examples that seem interesting and characteristic, basing ourselves on the latest IARTEM publications which diversify the sources to confirm the international aspect of the issues studied.

II. Textbooks: multifaceted objects

Seen as objects, textbooks appear complex and may certainly not be seen as simple technical tool supporting the work in and out the classroom. According to Alain Choppin (2005), they have four important functions: referential; instrumental; ideological and cultural; documentary.

- 1 The referential, curricular, or programmatic function: a kind of “practical interpretation” of official programmes, the textbook is the main, even sometimes the only educational content medium.
- 2 The instrumental function: an educational tool which is inseparable from the goals and teaching methods of its time (Choppin, 1996), it shows learning methods, offers activities, and structures progressions. It cannot be considered independently of the

range of tools available to teachers (blackboard, projection system, pupil work tools...), and their degree of knowledge or training level.

- 3 The ideological and cultural function: “[...] spread with abundance among a young audience, [they] are necessarily the vectors of a system of values which is often implicit or of privileged reasoning modes. Thus, they contribute to the socialisation and acculturation process of the youngest generations” (Choppin, 2005).
- 4 The documentary function: the textbook provides a set of textual or iconic documents, where the observation or confrontation are likely to develop the pupil’s critical mind.

It is obviously around these different functions that research on textbooks will focus. We are going to start with the first, by associating the corresponding school disciplines.

Textbooks, curriculum, school disciplines

Textbooks, because of their “practical interpretation” of official programmes, are sometimes used by researchers to analyse evolutions in the teaching of a discipline over time. Their work may be dedicated to the prescriptions of educational authorities or to practices that are supposed to take place in classrooms.

In the first case, it analyses the official documents that disseminate the prescriptions. In the second case, since it is not possible to observe classes from the past, the study of old textbooks provides information on potential practices. Of course, there are significant differences with what might have taken place in the classrooms, the textbooks only present a kind of “abstract” trace. This can be added by the analysis of pupils’ exercise books, testimonies of the actors, audio, or video recordings, and so on.

Apart from a historical vision, the study of textbooks can give an idea of how a discipline is taught. It is less “expensive” than field surveys but not enough and even deceptive (textbooks aren’t really a reflection of practices), which means that it needs to be completed with other data.

The IARTEM conferences largely refer to such work, as well as the first one dedicated to music and school resources (Vicente and al., 2020). Two disciplines have especially been analysed by researchers who participate in the IARTEM meetings: history and science.

Thus, Nascimento and al. (2020) look for indicators of teaching evolutions in Brazilian science textbooks. They highlight the importance of elements showing the construction procedures of a physics didactic in the last decades.

Regarding geography, Péter Bagoly-Simó (2020) is very critical of the research on geography textbooks. He blames their discontinuity, methodological repetition, similarity, and orientation towards content analysis. He notices a decrease in the dimensions of the analysed corpus and the fact that a part of the research is led by the textbooks’ selection processes by national committees.

In fact, many studies on textbooks have been led in connection with national approval committees. Many countries have implemented these in order to choose the books to use or prohibit. In this way, analytical grids were created. Rodriguez (2019) provides an inventory of a few of them. Norms of all kinds have been set up, especially concerning the concordance with the prescribed programmes, readability standards, etc. The selection may be based on these grids, which legitimise a study on textbooks independently of any effective use in classrooms. Things are changing, apparently the regulations are disappearing in many countries because of the Internet and the correlative impossibility to control the resources that are used in training.

However, some forms of internal analysis of textbooks can give interesting outcomes. Wikman (2019) identifies three main factors for their evaluation: exactness (“truth”) - can the texts be trusted or not; coherence - are the thoughts in the texts linked in a comprehensible way; and ap-

appropriateness - does it correspond to pupils' skills. On these last two points, Arai and Kageura (2020) studied the connection between the extent of knowledge presented in textbooks and the one that requires the use of other texts. Based on a quantitative linguistic analysis of Japanese science textbooks of primary and secondary schools, they report the significant difference in the way knowledge is described. There are more explanations for each concept in elementary school where textbooks describe knowledge self-sufficiently in terms of concepts. However, with secondary school textbooks, readers may feel that there are concepts that are not made explicit. The authors believe that these textual features may affect learners' content understanding and may well be one of the causes of the learning gap between elementary and secondary school.

Textbooks: a controversial educational tool

When we look at the instrumental side of textbooks, we notice that it is often a controversial tool. The textbook presents the knowledge to be acquired and propose exercises in a structure designed to make their acquisition easier. The increasing heterogeneity of the classes makes such a design more and more difficult. In any case, using the textbook and following it blindly is probably not the best way to learn as it has been much criticized. The textbook has always been complemented by other types of resources.

In the sixties, teaching machines, such as those created by Skinner or Crowder (Ferster, 2014), managed the procedures of knowledge acquisition with textbooks that could also be "programmed".

However, the textbook, as a source of knowledge proposing pedagogical situations to be put in place, has long been in competition with newspapers, magazines, television, museums... and with the Internet which increases the offerings. In many countries, we have long since moved on to a situation of abundance, as described by Célestin Freinet more than half a century ago:

Things have completely changed. Knowledge sources have increased considerably until a point of becoming intrusive: illustrated newspapers for adults and children (the children's press, which sells tens millions of copies, is essential in some knowledge processes), radio, cinema, and television [...] Nowadays, an excess of knowledge tends to block understanding and culture. As a result, the teaching methods, perfectly valid 40 years ago, are now defective. We must now find a pedagogy of integration, of culture in depth that will allow us to appropriate for human formation the superficial achievements of civilization (Freinet, 1964)

According to a UNESCO report on digital educational resources (Mochizuki and Bruillard, 2019), taking into account the profusion of educational resources in many countries, it is necessary to develop textbooks that can play a structuring and opening role. This entails structuring the learning contents (and summarising the main concepts, topics studied) and acting as a knowledge organiser, stable and open to external resources, a place of activity for pupils, by implementing links with other interactive educational resources.

There is certainly a lot of research to be done to design textbooks that can adequately play this dual role.

Textbooks and values

Values, discrimination, and ideologies matters in textbooks have been extensively studied. Much of the current research is carried out with two main concerns: understanding how conflicts impact on textbooks and preventing them from contributing to the emergence of conflicts (Wikman, 2019). Indeed, textbooks explicitly convey an understanding of history and a worldview as well as social behaviour patterns, norms and values. They can have an important impact, especially on young pupils, and regulations are set up so that they reflect the world visions considered as "acceptable" in society.

For example, people talk about sexism when texts and illustrations in textbooks depict men and women in stereotypical roles that don't reflect the diversity of roles. However, despite the progress observed in France since the late 1970s, it seems that gender stereotypes remain in textbooks (Fiquet, 2009).

Sinigalia-Amadio (2011) reports a study (Tisserant & Wagner, 2008) including an analysis of 29 textbooks in various secondary school subjects, a teacher survey by a questionnaire (N = 190) and interviews (18 teachers, 34 pupils and 8 publishers) integrating real or presumed cultural matters, disability, old age, gender, and sexuality. She shows that gender relations still have stereotypes that do not favour the diversity of gender identification models.

The intersectionality notion, which refers to the more general interactions between gender and other discrimination situations, has gradually spread in textbook studies, especially under Knudsen (2006). This idea highlights there are several dominations and discriminations - gender, class, particularly race, but also disability or sexual orientation - that meet and sometimes strengthen each other.

In a recent study, Angerd Eilard (2019) showed a sort of “reversed gender roles” in Swedish primary school chemistry textbooks: men are represented as old and rather primitive whereas women are young and modern. She also identified a supposed white symbolic structure (ethno-racial), marked by many representations of white hands in iconography. In her participation at the last IARTEM conference, Eilard (2020) declared that similar results are found with later editions of the same textbooks. Thus, the illustrations confirm and strengthen the imprint of the white ethno-racial organisation. According to the author, even politically correct voluntary representations are challenged by the white structure that can lead to produce or reproduce opinions and attitudes, sometimes colonial and racial. In order to make such patterns and attitudes visible, it is essential to pay attention to blind spots or taken-for-granted perspectives, for example in textbooks and everyday communication. Here, this textbook study can reveal hidden operations that exist beyond this school item.

Less common in research is the work of how a religion is presented. Van Wiele (2020) considered Buddhism, in Belgian Catholic religious education before and after the Second Vatican Council. Buddhism is represented in textbooks as a belief, code, community, and cult. After Vatican II, its representation changes from a dark mirror of Christianity to a partner in dialogue.

Documents associated with textbooks

For a long time, publishers have been developing the documents in textbooks in order to make them more attractive and to provide various learning situations. The first impact is the increase of costs, and according to Bonn  ry (2015), an important difficulty for pupils is that they are used far beyond a simple illustrative function. In fact, at an early age, pupils must question themselves on their own different documents, connect diverse elements (images and texts, different activities or works...) to reason, compare, conclude, etc. However, the materials contain much implicit information with activities that confuse the students. They assume that the cognitive dispositions necessary for their realisation have been acquired by pupils and don't accompany them in their acquisition, a process left to teachers. According to the author and his colleagues, “there are so many traps for working-class children and for teachers”, leading to strengthen inequalities. As long as they aren't aware of the influence of textbooks, they cannot change this situation.

The iconography in textbooks may raise other questions. For example, historical paintings have often played a political role and sometimes give a distorted and reduced picture of the events they are supposed to represent. When they are used in textbooks to enrich them and when they are present in historical and non-artistic sections, paintings become pedagogical tools, but they cannot be sufficient in themselves to become “historical evidence”.

Anne Chauvigné (2020) analyses paintings combined with the landing of Christopher Columbus in America, in Spanish (foreign language) textbooks used in France. She highlights alterations and modifications of the paintings (such as the disappearance of characters) not specified in textbooks. Generally, the latter don't demonstrate that historical paintings are fictions where content should be revised by the educational speech, whereas what is present for pupils in the textbooks is supposed to be "true". It is up to the teachers, who are experts in the teaching of a foreign language and not in art history, to re-establish a more informed vision!

III. Textbook creation and adoption

As mentioned earlier, the context of textbook management has changed in recent years, especially due to the dissemination of educational resources through the Internet, which cannot be easily controlled. Georg-Eckert Institute maintains [a database](#) that provides information on national regulations in various countries of the world.

Modifying the adoption procedures may affect the design methods because the "objectives" for textbook publishers change and it is important to take into account constraints and market operations.

In France, several studies show a large similarity between textbooks (Baldner and al., 2003) despite an open market supposed to allow for a diversified offer. There are many reasons why: the constraints of the official instructions; the dynamics of textbook creation (Ratka, 2009) with the constraints linked to paper and the demands of different actors; and the market constraints for publishers. It is necessary not to confuse teachers, not to be too far ahead and to be in phase with the innovations having captured a sufficient audience

How do publishers and editors understand the curriculum instructions and introduce them into their textbooks? Han-Yu Li (2020), in the context of Mandarin language learning in high schools in Taiwan, carried out interviews with textbook editors to find out how they react to a request from school authorities for a skill-based approach. He noticed that when they responded to this new "requirement", they kept their design ideas and added some creative elements, especially in selecting new texts to cover interdisciplinary issues and stay up to date. According to one person surveyed, the competency-based approach was most clearly articulated in the teacher's guides because these can better introduce the competence concept and are subject to fewer restrictions than textbooks.

Therefore, a certain continuity in textbooks' design prevails. Textbook publishers don't make the programmes and don't determine teacher practices, although they certainly guide them. However, in low-income countries, there's a greater dependence on textbooks with less educated teachers who have had little or no initial training. "Putting the pedagogy on the page" can be very important. This is why research on the relationship between pedagogy and improved learning outcomes has much to offer to textbook authors both in low- and high-income countries (Smart, 2019).

The digital technology development is introducing new actors into the production of textbooks. These actors have a digital culture that is quite different from the one of traditional school publishers. The impressive international success of Wikipedia, an encyclopaedic project that has now won its place in education, is inspiring several achievements, through its collaborative development and its free and open-source model.

A French start-up, [Le LivreScolaire](#), launched in 2010 and bought in January 2020 by Hachette-Livre, the first French publishing group, claims a publishing pattern based on three ideas: collaborative (interactive contribution of hundreds of colleagues in the textbook production process), free (free online textbook) and digital (textbooks in the form of a website with additional features such as interactive maps and a dyslexic-friendly mode). The economic model is based on the sale of paper books and premium digital subscriptions. Authors are paid through royalties. In order to produce paper and digital textbooks co-created by a large number of teachers (more than 3,000),

a well-adapted organisation has to be implemented. With the support of a book director and a scientific committee, different roles are designated: author, harmonising author, co-author, and digital contributor. Research should be conducted to better understand the type of operation put in place.

Many teacher organisations or communities produce educational resources and sometimes textbooks (such as the [Sesamath](#) or [APSES](#) organisations), with strict operating rules in order to achieve their work and guarantee their quality.

In contrast, the Ed-Tech publishing company named [LeWebPédagogique](#) claims to be a “community of teachers”, but more through a marketing strategy and an economic model, showing its ability to interest teachers and to induce them to make content for schools (Carton, 2019).

In Italy, teachers in the *Avanguardia* Educative community, taking advantage of the fact that since 2013 the adoption of textbooks is no longer mandatory, have decided to self-produce their own. Anichini and Parigi (2019) studied the reasons they give: first, a certain pride in being among the “innovative” teachers of a self-production practice that is difficult to spread, but above all, a response to the heterogeneity of classes and the differences between learning methods and cultural tools of pupils. School is seen as a place for knowledge construction where themes emerging from the classroom or the local context can exist.

The development of OER (Open Educational Resources) provides additional free resources and opens the way to new economic models and new forms of textbook development. In addition, digital technology enables a review of the processes of textbook production, to redesign the production lines, to get distant groups of teachers to work together, and so on. It makes it easier and more localisable to publish paper textbooks. Sébastien Hache, one of the Sesamath founders, is setting up methods to quickly develop locally licensed textbooks (Hache, 2018).

With regard to digital educational resources available through the Internet, Bonilla and Rodríguez (2019) identify four main types of platforms having each its own features: (1) institutional portals set up by an educational administration; (2) portals of teacher networks that contain materials upgraded by teachers and handled by different people; (3) portals that aren’t designed for formal education controlled by different structures; and (4) commercial platforms managed by a publishing company. In fact, different entities (educational authorities, school publishers, teachers, pupils, and families) participate to the offers and digital resource uses.

With these platforms, it is possible to structure an incremental development of textbooks. Such a project was carried out in Hungary (Kojanitz, 2019). New textbooks and digital resources were created and made available to teachers, pupils, and parents through a public portal. Following a three-year testing process, during which teachers could evaluate each lesson (text, activities, page layouts, illustrations...), final versions have been produced.

Even when digital resources are developing, education cannot ignore reality. For example, we notice the development of card games for use in training and even educational board games. Radjkovic and colleagues (2019) present a case study based on the design and evaluation of historical board games. They show that this kind of approach can help students to acquire and learn historical knowledge. Games can be found in numerous fields. For example, [ALEAS](#) is a game that prepares pupils for work experience (in the field of civil engineering project management).

IV. Terms of use change according to level, discipline, and culture

Understanding how textbooks are used is becoming increasingly important. It focuses on the uses by pupils - in classrooms or at home - the different activities carried out by teachers on educational resources (selection, creation, modification, exchange...), but also on the training of textbooks and educational resources dedicated to future teachers.

Students and classroom use

According to Macgilchrist (2019), this is an emerging field of research, which is developing with the diversity of educational digital items and services being offered and used. It can be organised around three axes, by extending the textbook notion to educational media:

- 1 Media impacts: impact of textbooks and educational resources on pupils and particularly on their learning results, most of the time in comparative visions between diverse technologies.
- 2 Media use: what do users do and what do they say about what they do, based on surveys, interviews, or analysis of digital tracks (especially with online textbooks).
- 3 Media as practices: as pupils are “in” the media, it deals with analysing rather “the tangled webs, junctures, flows, doings and general messiness of social life”. The studies carried out tend to take into consideration wealth and the activities’ complexity, with observation methods similar to ethnography.

Research is being led on specific contexts like rural areas, or pupils with “special needs” who suffer from various types of disability or are hospitalised. This leads to reflections about the more local design of textbooks, including local specificities and breaking the uniqueness of textbook for a whole age group in a country. In this way, Souza and Garcia (2020), analysing the functioning of a classroom in a rural community in Brazil, show how the teacher combines texts and images from the textbooks with local knowledge, experienced by these people in their community, as well as with knowledge that comes from media resources. According to the authors, the contribution of elements which belongs to the local culture is crucial for the classroom dynamics, in line with the statements of Italian teachers who self-produce their textbooks (Anichini and Parigi, 2019).

Nancy Romero (2019) analyses the current uses of educational material in Argentinean primary schools. By adopting an ethnographic perspective, she describes the cultural change in classrooms with the use of educational resources. Nancy Romero confirms the key role of textbooks for preparing lessons, but she also shows that their place as a resource for teaching and learning is shared, more and more, with a heterogeneous set of materials. She highlights the role of teachers in creating classroom contexts based on many decisions related to time, space, equipment, children’s motivations, academic purposes...

The relationship between the student and the textbook is strongly mediated by the teacher, and that leads to investigate how teachers use textbooks and associate them with other resources that are available or created, especially for preparing their lessons.

Strong connections between teachers and their educational resources

Indeed, textbooks are one element of the complex equipment of resources managed by teachers. It is well documented that they use textbooks by adapting and integrating them with other media in many countries (e.g. in Brazil, Luiza de Souza and Garcia, 2019). In France, Camille Roux Goupille (2019) showed how biology teachers have a great agency, adapting resources to their local conditions and relying on communities of practice to which they participate. When there are no or few textbooks - with uncertified teachers and sometimes old and out to date resources, such as the artistic disciplines (e.g. in the Czech Republic, Makovský, 2019) - teachers look for other teaching tools for lesson preparation. We could multiply examples and case studies.

An interesting point is the notion of turnkey resources, resources that can be employed directly with students without requiring adaptation. Surveys demonstrate (Bruillard, 2019) that this notion is rejected by most of the teachers. To them, adaptation is required: (1) to the curriculum; (2) to pupils, in the classroom; (3) to pupils’ progress; (4) to habits, preferences, education philosophy of teachers.

Furthermore, teachers need to regularly assume ownership of the educational resources they use to have an extensive knowledge of them, be able to answer pupils' questions, create links... Turnkey resources may be useful for beginners in new programmes or in non-mastered parts, but only in a transition period. Such resources are also useful as an activity support in which they are debated and probably criticised.

To conclude, the links between teachers and their educational resources are far from being technical. Magali Loffreda's work (2019) underlines several dimensions: a practical dimension; a creative one; an affective, biographical, and personal one; a professional and social one. These four dimensions enable teachers to act on their environment and to develop their confidence in their capacity to teach in front of pupils. In an ethnographic survey in a secondary school, also interviewing teachers in their homes, she shows the importance of the material management of resources by teachers, which plays a very essential role in their professional development.

Textbooks in teacher training

In their study of future music teachers, Vânia Ferreira and María-Carmen Ricoy explain that teacher qualifications do not include any training in the use of textbooks. Teachers often train themselves and no special attention is given to an educational tool that should be well known to teachers. To Reints (2013), future teachers are not trained in how to evaluate learning materials (including textbooks) and how to use them so that they actually support learning.

Indeed, it may be observed that the stakes of textbook training have been the subject of few proposals, as if their use were obvious and didn't require any support. Bruillard (2019) recalls the ideas developed by Alain Choppin, which had found a very positive response in the research community associated with IARTEM. An attempt to implement resources for initial teacher training, which was supported by the Savoir Livre organisation in 2005, failed and the proposals were not followed by any significant effect in France. It is not sure that school publishers are interested in training teachers on textbooks. This remains a mere preoccupation as multiple training offers on textbook writing and selection have been put in place.

There's still a need for a continuing reflection on teachers, because they are actors, designers, consumers of textbooks and educational resources at the same time. Can one be a good teacher without creating, or at least changing, many of the educational resources that one uses?

V. Perspectives

The new educational platforms, through the services they offer, introduce essential changes. They promise wonders: immersion thanks to virtual reality, fun and competition thanks to gamification, fine personalization thanks to the processing of the myriad of data they have been able to collect, adapted coaching thanks to artificial intelligence... If the platforms handle the interaction with students, how will teachers develop their own resources? To what extent will they be dependent on these platforms? How much control will they have? There's a risk that the exclusion of teachers will be multiplied with resource service platforms.

Some time ago, the textbook was a book that children could take home, when there were no books at home, the textbook being the only one available for learning. The emergence of libraries was highly supported, so that a large population could have access to books and education. Educators were concerned that education be limited to a single book while there were other knowledge sources, exercises, less "academic" activities connected with life. The textbook has tried to adapt by integrating documents, trying to take into account classroom heterogeneity by suggesting diversified paths. Postmodern visions of education have led to a distrust of national narratives and an openness to a multiplicity of sources and viewpoints. The advent of the Internet brought with it the promise of offering this multiplicity and opening up to a "universal" education, pushing textbooks into the dustbin of outdated tools. However, the Internet has proved to favour restricted communities sharing a single point of view and disseminating fake news, while

educational platforms have offered free services in order to build customer loyalty and to marginalize their competitors. Back to square one or backward evolution?

It is essential to develop research on textbooks according to the different dimensions of analysis that have just been presented. In fact, these objects or services are still present in classrooms or at home and into the resources used by teachers for their preparation. Through the changes they undergo or accompany, a better understanding of what they convey and how they participate in teaching and learning is still an important challenge.

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