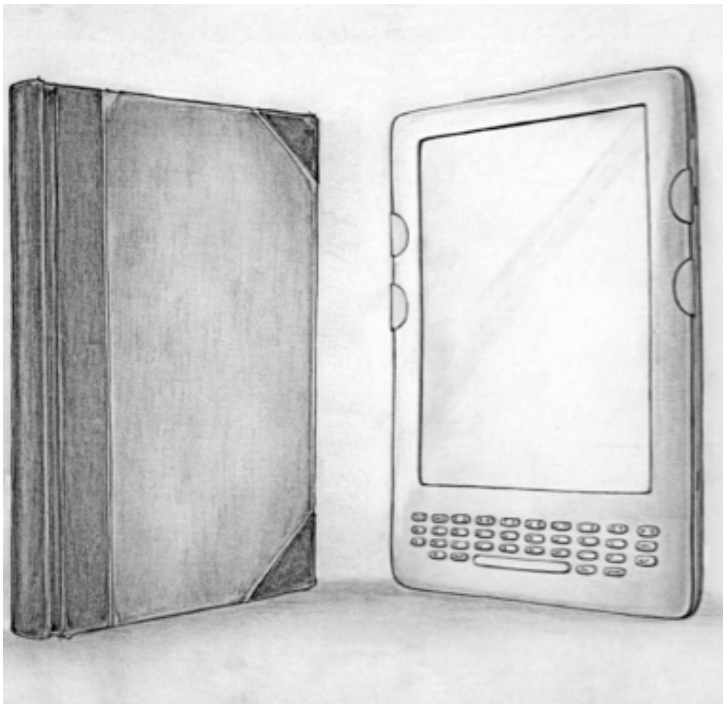
# Digital Text in Education



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## 1. Introduction

Currently, the world is moving increasingly into the digital sphere. Knowledge transmission and reading have been involved in this process too, fundamentally changing the reading experience, the kinds of texts that are being produced and the ways of accessing them. From the 'Order of the Book' – the tradition of the paper book and all conventions it entails – we are now moving towards a new, digital order.[1] New writing and reading technologies are developing, also bringing along 'new ways of meaning making, and these challenge the authority of the book and the page as dominant sites for representation'.[2]

Ironically, people did not think so much about the structure of the traditional book before new possibilities came: 'It is only in comparison with new concepts currently developing that we have begun to question [the conventional book]'.[3] The linearity of books, for example, was never viewed as such, until new forms of linearity (or non-linearity) came into existence, like hypertext.[4] As Hillesund wrote, '[d]igitalization of the word obviously represents a transformation. It changes all parts of the text cycle and it even changes the text itself'.[5] Text is becoming more fragmentary, spread out over the Web, for example. Traditional structures are being challenged and are making way for modularity and multi-linearity.

This change in textual structure and presentation also affects educational material. The educational field is moving more and more into the digital realm, offering online material and sometimes completely digital learning materials like e-textbooks. Research into the effects of digital learning materials on learning outcomes is being conducted, but is very new and often trailing behind the actual developments. No radically positive effects have yet been proven, and there are sounds of many negative effects as well. This should make

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[1] A. van der Weel, *Changing Our Textual Minds: Towards a Digital Order of Knowledge* (Manchester/New York: Manchester University Press, 2011), p. 1.
[2] G. Merchant, 'Digital Writing in the Early Years', in J. Coiro et al. (eds), *Handbook of Research on New Literacies* (London/New York: Lawrence Erlbaum Associates, 2008), p. 753.
[3] J. Kircz and A. van der Weel, 'The Book Unbinding', in J. Kircz and A. van der Weel (eds.), *The Unbound Book* (Amsterdam: Amsterdam University Press, 2013), p. 8.
[4] J. Kircz and A. van der Weel, 'The Book Unbinding', p. 8.
[5] T. Hillesund, 'Digital Text Cycles: From Medieval Manuscripts to Modern Markup', *Journal of Digital Information*, 6.1 (2005), n.p. <https://journals.tdl.org/jodi/index.php/jodi/article/view/62/65> (26 September, 2014).

people think well before they introduce so much digital material into education. However, this does not always seem to be the case. Publishers and schools are moving full speed ahead and the government does not yet have any policies for this.[6]

Writing for an electronic textbook, or more generally, digital learning materials, requires different strategies from writing a paper textbook. Questions of how people process digital material, what ways of presenting information are the best and whether serious gaming might work are all relevant in composing new, digital materials. Cross-referencing, for example, is much easier in digital text.[7] Moreover, the screen is such a different presentation form than paper that reading happens differently as well. Generally, the screen is less suited for deep reading, a way of reading that is important in the educational process.[8] Therefore, research into new ways of presenting text and information is absolutely necessary for the digital environment.

There are several reasons why digital learning materials could benefit education. Students nowadays are reading less, among other reasons because they feel that they can pass their exams without reading all of their books. Moreover, they are of a new generation that spend much more time on a computer than reading books.[9] A conclusion might be that authors and publishers need to come up with new, stimulating ways of compiling study materials, so that students will actually use them.[10] There might be a certain vicious circle here, of lazy students, but also of education that is gradually adapting to different study habits, asking too little of students, and perhaps also of qualitatively less well-composed educational materials provided by publishers. A clear policy for educational material remains

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[6] A. van der Weel, 'Digitaal lezen en de toekomst van onze geletterde mentaliteit', <http://www.let.leidenuniv.nl/wgbw/research/Weel_Articles/DigitaalLezenToekomstGeletterdeMentaliteit_Speling_2013-4.pdf> (26 September, 2014).

[7] J. Kircz, 'Voorbij het educatieve boek', *kb/ magazine van de nationale bibliotheek*, 1.2 (2011), p. 9.

[8] T. Hillesund, 'Digital Reading Spaces: How Expert Readers Handle Books, the Web and Electronic Paper', *First Monday*, 15 (2010), n.pag. <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2762/2504> (26 September, 2014).

[9] J. van Loon and G. Steeneken, 'Wat moet de internetgeneratie met een schoolboek? Heeft het boek op school z'n langste tijd gehad?' in *Jaarboek voor Nederlandse boekgeschiedenis* 14 (2007), pp. 112-113.

[10] J. Stoop, P. Kreutzer and J.G. Kircz, 'Reading and Learning From Screens Versus Print: a Study in Changing Habits. Part 2 – Comparing Different Text Structures on Paper and on Screen', *New Library World*, 114.9/10 (2013), pp. 381-382.

difficult, since education is part of the political process and can therefore change every few years.[11]

Besides motivating students, digital learning materials also offers innovative ways of knowledge transmission, which could improve the way students learn from the educational material offered to them. New ways of composing and presenting the information might actually correspond better to the workings of the brain.[12] This change in knowledge representation is the focus of this thesis. The main goal of education should be learning, and so the best ways of doing so should be constantly researched as new forms of learning come into existence.

An important aspect of digital text, and why it can also be useful for education, is that it can easily be searched. Instead of leafing through a book, skimming to find the right passage, readers can now find what they need with one click. This aspect will be touched upon slightly in this thesis, but is not part of the main subject matter, which is the structure and presentation of digital text. The access to digital texts and the possibility of sharing them are other important features that should be named here, but that will not receive full attention in this thesis.

For now, most digital learning materials are a direct copy of a paper book and therefore only differ from it in terms of access. New structures of text and presentation, accommodating new learning patterns, are only starting to come up now.[13] A difference between regular non-fiction and non-fiction in the form of educational texts is the goal of the text. A reader of educational texts 'not only consumes the material, but must be able to internalise the content and also be able to reproduce it'.[14] The material needs to be set up in a fundamentally different way, offering a clear coherence and guidelines for working with the material, test questions, illustrative material, etcetera, whereas regular non-fiction does not necessarily need to have this clear structure. Readers of regular non-fiction are free to read whatever they want from a text. Although it may be nice for them to have a sense of

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[11] S. Dehaene, *Reading in the Brain: the science and evolution of a Human Invention* (New York: Viking, 2009), p. 327.
[12] E. Bleeker, *On Reading in the Digital Age: Establishing the Paradigms in a Hyperbolical Discussion* (Amsterdam: Stichting Lezen, 2010), p. 22.
[13] J. Stoop, P. Kreutzer and J. Kircz, 'Reading and Learning From Screens Versus Print: a Study in Changing Habits. Part 1 – Reading Long Information Rich Texts', *New Library World*, 114.7/8 (2013), p. 285.
[14] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 1', p. 287.

the entire text as well, it is not a prerequisite. Students, however, all need to learn the same in basic according to a didactic method.

In this thesis, the developments in digital non-fiction texts will be discussed, with a specific focus on education. Many new kinds of publications are being brought forward in regular non-fiction publishing, containing interesting new elements of digital text. These initiatives all change the reading experience in their own way, all of them using new digital features in an attempt to optimalise the reading process. In this research, a connection will be drawn between these regular innovative non-fiction texts and possibilities for text in education. The focus is on knowledge transmission and on how text can be structured and presented in the best possible way to facilitate effective knowledge transmission in education.

This thesis does not attempt to give concrete recommendations to education. These can only be given after extensive empirical research to test new educational theories and features and to see their result on both the short and the long term. Instead, this thesis aims to give some examples of possibilities and to assess these based on previous knowledge of reading in general and reading in education. Firstly, a framework will be given in which knowledge and the representation of knowledge will be discussed. Text and digital text will be defined and several important elements of digital text will be expanded upon. Different kinds of text and reading will be touched upon, to illustrate the different tasks education needs to accommodate. An important part is the discussion of how medium, genre and purpose interact: what form should a certain text be given and why?

Secondly, after this framework of text and knowledge representation, a number of cases will be shown, with different examples of digital knowledge representation and the rationale behind them. Thirdly, research regarding educational texts will be discussed, in order to make an informed assessment of the particular advantages or disadvantages of the specific cases. Finally, based on the theory, examples and suggestions given, an attempt will be made at assessing a number of features of digital texts and their possible use for education.

The term education is used relatively broadly in this thesis. Some examples of secondary education and higher education are given throughout the text, because the subject matter is non-fiction text of a certain level. Primary education is left out of the discussion, and so are scholarly publications for the most part.

*The presentation of this thesis*

Following the subject matter of this thesis, an attempt has been made to present it in an optimal way in terms of reading conditions. A serious but easy-to-read font has been chosen and the text has been structured so as to make navigation easy, with headings, subheadings and a detailed table of contents. However, the text is a sustained argument, so it will not do to just read part of it. In terms of layout, the text on the page has a limit; the lines do not run on indefinitely but the text is organised with enough white space around it for the pages not to be crowded. Ideally, this text should be read on paper, so that readers do not strain their eyes.

## 2. Knowledge representation in education

### 2.1 Knowledge

It is difficult to come up with a precise definition of knowledge, since it has several different aspects. Knowledge is about knowing and understanding something. Most generally, knowledge is something that you can gather through research or experience, and that can be captured in words and be recorded in writing.

However, here is a difference between 'knowing that' and 'knowing how'.[15] Knowing how usually means that you have a certain skill. To learn a skill, practice is needed instead of reading about it. This is called procedural knowledge. Knowing that, on the contrary, refers to information that you can read about, remember and convey to others.[16] This second type of knowledge, which is called declarative knowledge, is the focus of this thesis. It is the type of information that can be written down and transmitted to others, who can learn from it by reading and discussing it. This declarative knowledge plays the largest part in general education. The information is presented and structured in such a way that students can learn from it.

Information and knowledge do seem to be different things. Information or data, which can be referred to as 'descriptive content', still need to be interpreted in order to be turned into knowledge.[17] This is what happens in knowledge production through research. Through facts, an understanding is created of a problem or solution. The mere facts alone cannot be called knowledge, but the conclusion that is drawn from them can. Moreover, some research requires input from and discussion between numerous scholars before the outcome can be seen as valuable knowledge.[18]

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[15] A. Stroll, 'The Nature of Knowlegde' in 'Epistemology', *Encyclopedia Brittanica*, 12 May 2014 <http://www.britannica.com/EBchecked/topic/190219/epistemology/247946/The-other-minds-problem#toc247948> (7 September, 2014).
[16] A. Stroll, 'The Nature of Knowlegde'
[17] J.B. Thompson, *Books in the Digital Age*, p. 321.
[18] A. van der Weel, 'New Mediums: New Perspectives on Knowledge Production', in W. van Peursen et al. (eds.), *Text Comparison and Digital Creativity* (Leiden: Brill, 2010), p. 266.

Learning can happen through various ways. It 'requires knowledge transformations from many different types of experiences, media-related and others'.[19] Knowledge does not only result from reading and processing pieces of information, but also through experiencing activities and viewing examples by others, so as to both develop the 'knowing what' and 'knowing how'. Knowledge is developed by connecting and processing different kinds of information and instilling them into the brain so that they can be used actively. The brain consists of numerous knowledge networks, within which people place new information.[20]

Most important for the discussion in this thesis is the development of declarative knowledge. This kind of knowledge has a different aim, and thus a different representational structure from other types. It accommodates the student who wants or needs to learn something and will be tested to see how much they have remembered and understood.[21] Knowledge is a cumulative thing. During reading or learning, the student draws on already acquired knowledge to make sense of the new information and add this to their repertory.[22] Therefore, texts that convey knowledge for educational purposes need to be structured in a certain way and accommodate the precise level a student has, as will be seen later.

**2.2 Representing knowledge**

Knowledge has been presented through written text ever since the invention of writing, and this boomed after the invention of the printing press. Before text existed, knowledge was transmitted orally. Gradually, there has been a shift from the oral tradition towards a new written tradition, around which the western world revolves completely now. 'Text is knowledge represented as matter: visible and revisitable, portable and measurable.'[23]

The standard way of representing knowledge in education has so far been mostly through stretches of linear text, accompanied by extra materials and stories told by

[19] S. Neuman, 'The Case for Multimedia Presentations in Learning: A Theory of Synergy', in A.G. Bus and S.B. Neuman (eds.) *Multimedia and Literacy Development: Improving Achievement for Young Learners* (New York/London: Routledge, 2009), p. 48.
[20] S. Neuman, 'The Case for Multimedia Presentations in Learning', p. 49.
[21] J.B. Thompson, *Books in the Digital Age*, p. 324.
[22] R.B. Ruddell and N.J. Unrau, 'Reading as a Meaning-Construction Process: The Reader, the Text, and the Teacher', in R.B. Ruddell et al. (eds.), *Theoretical Models and Processes of Reading*, 4th ed. (International Reading Association, 1994), p. 998.
[23] W. van Peursen, 'Text Comparison and Digital Creativity: An Introduction', in W. van Peursen et al. (eds.), *Text Comparison and Digital Creativity* (Leiden: Brill, 2010), p. 20.

teachers. A shift is visible in this tradition now, caused by the arrival of digital possibilities.[24] New ways of presenting knowledge are being experimented with and might offer advantages for several types of students, or perhaps for the entire education system. Because it is such a new area of research, however, not much is known about the consequences and especially the long-term effects. To take a small step forward in this research, this thesis aims to bridge general non-fiction reading and reading for education and assess which ways of representing knowledge are possible and which might be beneficial for educational purposes.

According to Kircz and Den Boef, in educational texts 'the text is a point of departure or an ingredient for further study and understanding'.[25] In other words, the text is the first carrier of information, and by working with the text and finding other materials, a reader gradually acquires knowledge. Now that different kinds of media are increasingly used in knowledge transmission, in education too, they should be seen not just 'as mere conveyors of methods [but] as facilitators of content and knowledge and meaning-making for different learners'.[26]

In representing knowledge digitally, a distinction should be made between born-digital representation and digital representation as a translation from information on paper. In born-digital form, information has more freedom to be represented in new, innovative ways, free from restraining frameworks we know from paper and books. However, this truly innovative development is difficult and can happen only gradually. For this to happen, the traditional framework of the book should be left behind as the starting point. In this thesis, the focus is more on information that is translated from its presentation on paper to a different presentation digitally. Most new developments are still rooted in paper conventions, although they are trying to break out of those conventions. This thesis will show a few examples of different attempts.

Specifically for education, knowledge needs to be represented differently than it would be offered to a general audience. There are great differences between regular non-

[24] J. van Loon and G. Steeneken, 'Wat moet de internetgeneratie met een schoolboek?', pp. 111-112.
[25] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era: Hamlet in Hyperborg', in J. Kircz and A. van der Weel (eds.), *The Unbound Book* (Amsterdam: Amsterdam University Press, 2013), p. 139.
[26] S. Neuman, 'The Case for Multimedia Presentations in Learning', p. 53.

fiction texts and non-fiction text specifically tailored for education. That difference will be seen in this thesis.

## 3. Digital text

This chapter will give an overview of the elements of digital text and of text and reading in a more general sense. First, definitions of text and digital text will be given to clarify the exact terms. Next, certain important aspects of digital texts will be discussed in order to see new opportunities and challenges. Then different kinds of texts and different ways of reading are touched upon to draw an image of the different possibilities a text can offer, in general and for education in particular. Finally, the relationship between medium, genre and purpose will be discussed. This is an important discussion when using new media and, for example, when translating paper text into digital text. From this discussion, conclusions can be drawn regarding sensible ways of using new media for educational purposes.

### 3.1 Definitions of text and digital text

*Text*

Text can be given many definitions, broad and narrow. In this thesis, the distinction between printed text and digital text is key, and so here an attempt will be undertaken to present a definition of both. The main property of text in all forms is that it conveys meaning that is supposed to be spread by reading the text.[27] In other words, texts are 'objects of transmission'.[28] They present a message that can be anything, from a children's story to a newspaper article to an entry in an encyclopaedia.

In Hillesund's words, 'a text is a visual representation of verbal information'.[29] In his description, he combines the textual content with the text as a product that is presented in a certain way. The term 'text' can be applied semiotically to many different forms of representations, like written words, but also images and music. However, he focuses on 'texts produced and represented in written forms'.[30] Very broadly he writes that 'text is laid out in space and read in time, and that text always deals with some kind of subject matter'.[31]

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[27] T. Hillesund, 'Digital Text Cycles', n.p.
[28] D. Crystal, 'The Changing Nature of Text: a Linguistic Perspective', in W. van Peursen et al. (eds.), *Text Comparison and Digital Creativity* (Leiden: Brill, 2010), p. 232.
[29] T. Hillesund, 'Digital Text Cycles', n.p.
[30] T. Hillesund, 'Digital Text Cycles', n.p.
[31] T. Hillesund, 'Digital Reading Spaces', n.p.

Discussing different representations of messages, Van der Weel uses the term 'modality' and defines this as 'a data type'.[32] Text is one of the modalities, next to still and moving images and sound.[33] Van der Weel describes text as 'a system for the inscription of linguistic utterances by means of characters, that both pre-dates the book and survives it'.[34] In this light, text itself remains the same as a modality, but 'its materialisation as a *medium* has taken a variety of forms'.[35] The book is only one form – one medium – of the now many different forms a text can take.[36] More on this will be discussed further elsewhere in this thesis.

Van Peursen sees text 'as a record of ideas, a means to construct author(ity), and a material carrier of communication between humans'.[37] He adds a new dimension to the understanding of text, introducing text as a document, encompassing both the meaning of the text and its typographical presentation.[38] In printed text, these two elements are tightly interwoven, whereas in digital text they have become more separated. More on this will follow.

For this thesis, text will be regarded as a representation of knowledge in written form, presentable in different ways on different mediums, so separate from its typographical presentation. Text is the mere written content, which adapts in terms of presentation to the medium it is presented through.

*Digital text*

Digital text is more complicated and takes text to a new level. Taking into account all possible options of digital text, a description becomes expansive and can include basically any 'digital composition'[39] made up of words and images:

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[32] A. van der Weel, *Changing Our Textual Minds*, p. 59.
[33] A. van der Weel, *Changing Our Textual Minds*, p. 60.
[34] A. van der Weel, *Changing Our Textual Minds*, pp. 3-4.
[35] A. van der Weel, *Changing Our Textual Minds*, p. 4.
[36] A. van der Weel, *Changing Our Textual Minds*, p. 3.
[37] W. van Peursen, 'Text Comparison', p. 20.
[38] W. van Peursen, 'Text Comparison', p. 6.
[39] G. Buccellati, 'Digital Text', *Urkesh*, February 2008 <http://www.urkesh.org/hi-links/sub312i.htm> (26 September, 2014).

> A digital text may be a linear text in digital format […], a nonlinear text with hyperlinks […], a text with integrated media […]; and a text with response options […]. In some cases, text represents a single text, but more often text includes multiple texts, and can be a Web site, a collection of Web sites, etc. The digital text may be client-side and closed (e.g., a CD-ROM Living Books story), or networked and either constrained or open (e.g., accessed via a server, which may or may not provide access to the Internet). Text is not restricted to written prose; text can be primarily visual, such as an animated graphic, video clip, photo slide show, or image with little accompanying verbal information, and verbal information may be presented in auditory rather than written format.[40]

What makes digital text different from print text is mainly that digital reading requires a way of accessing the text. Software is needed before a reader can access a text.[41] Moreover, different modalities come together closer digitally, and so texts will compete with or be combined with those.[42]

This leads to the notion that text in a digital environment is visible at different levels, for both computers and the human reader.[43] It is represented 'in memory, at machine level, abstractly using the digits 0 and 1, in character codes, as communication signals and as pixel patterns temporarily forming letters on screen'.[44] In the digital sphere, text is virtual and is therefore not tangible and not always visible.[45] Naturally, in this thesis, the focus will be on that part of the text that is actually visible on screen, but an illustration of text without these underlying levels would not be complete.

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[40] B. Dalton and C. Proctor, 'The Changing Landscape of Text and Comprehension In the Age of New Literacies', in J. Coiro et al. (eds), *Handbook of Research on New Literacies* (London/New York: Lawrence Erlbaum Associates, 2008), p. 300-301.
[41] A. van der Weel, *Changing Our Textual Minds*, p. 52.
[42] A. van der Weel, *Changing Our Textual Minds*, p. 220.
[43] A. van der Weel, *Changing Our Textual Minds*, p. 52.
[44] T. Hillesund, 'Reading *Books in the Digital Age* subsequent to Amazon, Google and the long tail', *First Monday*, 12.9 (2007), n.pag <http://journals.uic.edu/ojs/index.php/fm/article/view/2012> (26 September, 2014).
[45] A. van der Weel, *Changing Our Textual Minds*, p. 145.

An important element of text that is changing is its unity. In print texts we have grown accustomed to one coherent text in a book that is a unity.[46] However, in the digital space, texts or parts of texts can be everywhere, linked together but on separate 'pages' in different locations. The sense of textual unity is changing immensely. Everything is still connected, but in a very different way. Where the book is a 'verbal unit',[47] digital text is more scattered, fragmented, not really one unit at all. Specific features of digital texts will be discussed further on.

Perhaps digital texts will, in due course, change the way text is regarded. As we have seen, print and digital texts differ in their identity. Text keeps changing and will continue to do so, perhaps the more rapidly in the coming years when new technologies will emerge. In writing about text transference, Chartier claims that, in general, '[w]hen the 'same' text is apprehended through very different mechanisms of representation, it is no longer the same'.[48] More about the connection between text and medium will be discussed later in this thesis.

It is yet to be seen how the development from print to digital text may or may not fundamentally change the way text is regarded. Readers might continue to value linearity and fixity so that the book as we know it will remain in existence, or perhaps new forms offer good alternatives, which makes the move to new, yet unknown, forms of texts likely.[49] Text is changing rapidly and the future will have to show how this will affect our notion of text and our reading habits more generally.

In short, digital text will in this thesis be seen as a digital representation of written text. Knowledge representation is central and the supporting typographical elements can differ in different digital representations. In this definition, it does not include other forms one might see as text, such as animations or videos.

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[46] J.D. Bolter, *Writing Space: Computers, Hypertext, and the Remediation of Print* (Mahwah: Lawrence Erlbaum Associates, 2001), p. 10.
[47] J.D. Bolter, *Writing Space* (2001), p. 10.
[48] R. Chartier, *Forms and Meanings: Texts, Performances, and Audiences From Codex to Computer* (Philadelphia: University of Pennsylvania Press, 1995), p. 2.
[49] A. van der Weel, *Changing Our Textual Minds*, pp. 214-215.

### 3.2 Elements of digital text

Digital text contains crucially different elements compared to paper text. For instance, the fact that it is usually presented online gives it several added possibilities like new ways of access, easy manipulation and updating of the text, new ways of dissemination and an audience at a greater scale.[50] It also gives text of especially websites – not PDFs or ebooks in this case – a more conditional, not permanent existence. Online text becomes unstable because of this possibility to continually change it.[51] Content may be updated, design features may be changed, etcetera – every time readers return to a text they run the risk of finding it changed.[52] Multimedia can be added, which can support the text with video and audio – convergence of different modalities is central in digital reading.[53] Reading online becomes a more social activity since passages can be shared and discussed. It is increasingly interactive since readers and authors can be in direct touch, texts are part of a larger network and ultimately, a digital text can 'tailor itself to each reader's needs'.[54] Regarding textual structure and presentation, some aspects are of particular relevance, like hypertext and navigation. These and other features will be discussed in more detail below.

Researchers distinguish several ways of digitising texts. A simple option is to directly copy the text into a digital version, either retaining the layout (PDF) or merely placing the text with no specified layout in an html format. Another option is to digitise text with minor adaptations in terms of structure and navigation, so as to create a better overview of the text and therefore a more convenient reading experience. Finally, a text can also be entirely rewritten so as to be specifically suited for digital reading. Text is then adapted to the screen and might use specifically digital features like hypertext.[55] This last option takes more time and effort to create, but will result in much better readable digital texts. So far, digital texts have mostly been shaped like print texts, imitating the typography to create a text within the boundaries of our familiar typographical frame. Many digitised texts are poured into a very similar form compared to their analogue equivalent. The best-known example is PDF, in

[50] J.B. Thompson, *Books in the Digital Age*, pp. 318-320.
[51] A. van der Weel, *Changing Our Textual Minds*, p. 146-149.
[52] D. Crystal, 'The Changing Nature of Text', p. 240.
[53] A. van der Weel, *Changing Our Textual Minds*, pp. 4-5.
[54] J.D. Bolter, *Writing Space* (2001), p. 11.
[55] M. van de Ven, *Nieuwe Media en Lezen* (Amsterdam: Stichting Lezen, 2000), p. 24.

which the digital document is merely a digital copy of its analogue counterpart.[56] However, new enterprises and software show that much more is possible digitally. A certain amount of out-of-the-box thinking is required, and readers will have to take some time and effort to get used to new presentations of texts, but new ways of presenting texts are popping up and are gaining ground more and more quickly. New presentations try to optimalise the reading experience, using specific digital features to present the text as efficiently as possible. However, not much research has been done on the effect of digital reading in terms of new layouts and presentations, and also – a completely different but not less important issue – in terms of reading on screen.

An important issue regarding digital text is that the texts are usually shorter. Reading long texts onscreen is less comfortable than on paper and attention spans are shorter. The norm for readable texts onscreen is therefore shorter pieces of text.[57] Texts are also becoming more fragmentary, because short texts are used and reused all over the Web.[58]

An important difference between paper and digital text is that on paper, the text and the presentation are one and cannot be separated, whereas digital text is stored somewhere where it can be edited and later presented in a particular way. Presentation and storage are separated for digital texts, and only through presentation does the text get a visual output.[59] This also means that the same text can have different representations in different media. To the digital texts, elements of typography can be added through markup, indicating among others layout and other presentational features.[60] An interesting aspect is that digitally stored text can still be made into a print product, so the product itself does not necessarily change. The process of producing this product, however, is fundamentally different.[61]

A distinction for digital text lies in whether they are digitised, based on a print version, or whether they are digital-born with no analogue counterpart.[62] Formats might differ widely between these two options. It would be natural for digitised texts to be more conservative in their new formats since they are based on print, whereas digital-born

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[56] A. van der Weel, *Changing Our Textual Minds*, p. 53.
[57] A. van der Weel, *Changing Our Textual Minds*, p. 169.
[58] A. van der Weel, *Changing Our Textual Minds*, p. 172.
[59] T. Hillesund, 'Digital Text Cycles', pp. 3-4.
[60] T. Hillesund, 'Digital Text Cycles', p. 4.
[61] J.B. Thompson, *Merchants of Culture: The Publishing Business in the Twenty-First Century*, 2nd ed. (Cambridge: Polity Press, 2012), p 326.
[62] D. Crystal, 'The Changing Nature of Text', p. 244.

material starts with a clean slate and might therefore more easily adopt new formats. However, it is difficult to let go completely of old structures, since our tradition of texts has been so rooted in the same structures for centuries. Digital-born writing attempts to create new structures, which need to be agreed upon by developers since they need to be understood and accessible by all readers. The forms this will take are still being established. They will definitely be different from paper text, since they are of a very different nature.[63] The 'inherent possibilities' of digital text need to be explored without the constraints of the print structure that is so familiar.[64]

Questions that need to be asked time and again with these developments in electronic writing are: 'How does this writing space refashion its predecessor? How does it claim to improve on print's ability to make our thoughts visible and to constitute the lines of communication for our society?'[65] A number of features of digital text that might make difference are discussed below.

### 3.2.1 Navigation

Navigation is an important feature that differs on paper and on screen. In a book, the reader is accustomed to a certain kind of navigation that is mostly always the same. Readers can find their way through the table of contents, the index and by simply flipping through the book, scanning for relevant information. Digitally, this flipping is not possible. As Chartier writes, 'in place of the immediate apprehension of the whole work, made visible by the object that embodies it, [the electronic representation] introduces a lengthy navigation in textual archipelagos that have neither shores nor borders'.[66] Digital books can have a table of contents and an index, which are usually hyperlinked to link directly to the appropriate section in the book. Individual words can be found quickly with the search function most digital texts have. Navigation becomes faster, but good navigational structures are also more difficult to develop. A digital text does not offer the same level of overview of the entire text as paper does. This overview needs to be established in a different way, then, by using

[63] A. van der Weel, *Changing Our Textual Minds*, p. 201.
[64] A. van der Weel, *Changing Our Textual Minds*, p. 217.
[65] J.D. Bolter, *Writing Space* (2001), p. 13.
[66] R. Chartier, *Forms and Meanings*, p. 18.

hyperlinked indexes and providing the reader with other clear cues for moving through the book easily.

Lawless and Schrader 'view navigation as an active, constructive process'.[67] They say that it is both influenced by the design of a text or other information source and by readers' 'internal knowledge structures'.[68] Every reader has a different way of and proficiency in finding his or her way through a text. Navigation is an important aspect when changing the structure of the text. When a linear text on paper is translated to a non-linear digital text, clear navigational directions should be given to lead the reader smoothly through the text. A possible characteristic of digital reading is that readers can choose their own path through the text that is often fragmented, and so navigation is very important to show readers where they can find all the information, should they want to read it. Readers need to have an overview of the text in order to create their own mental map that helps in the knowledge acquisition process.[69]

A small, but very important issue in navigation is page numbering. On paper, referencing is easy because text can always be found somewhere on a certain page. Digitally, however, unless they are published in PDF form or something alike, texts do not have this easy referencing tool. Often readers need to scroll through a text, easily losing their place and being hampered in skipping to and from parts of texts. In some text presentations, like reflowable text, discussed below, there are certain kinds of pages, but they change depending on the screen size. Readers will be able to see that they are at 45% of a text, or at location 357 of 1089 – numbers that are only relevant to the individual device and setting.[70] No reference can be taken from this for future reading or collaborative reading.

Navigation between different textual elements can become easier digitally. For example, readers do not need to flip the pages of a book to find the endnotes to a chapter; they can just click a little link or icon to view them right away. The best way in navigational terms is to provide the required text in a pop-up window, so that readers do not need to

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[67] K. Lawless and P. Schrader, 'Where Do We Go Now? Understanding Research on Navigation in Complex Digital Environments', in J. Coiro et al. (eds), *Handbook of Research on New Literacies* (London/New York: Lawrence Erlbaum Associates, 2008), p. 269.
[68] K. Lawless and P. Schrader, 'Where Do We Go Now?', p. 269.
[69] K. Lawless and P. Schrader, 'Where Do We Go Now?', p. 270.
[70] J.L. Wright, 'What Enhanced E-Books Can Do for Scholarly Authors', *The Chronicle of Higher Education*, 21 April 2014 <https://chronicle.com/article/What-Enhanced-E-Books-Can-Do/145969/> (26 September, 2014).

jump around and lose their place in a text. This can be done with other things too, like videos, maps, illustrations etcetera.[71] A text can also provide a dictionary within the text this way, offering pop-up boxes for important or difficult words.[72]

In print material, much of the primary navigation is done through typography. The digital equivalent of this is markup. Both typography and markup offer ways of clarifying the main structure of the text.[73] It took a while for the current natural typography to be fully integrated, giving texts and books all the same familiar structure.[74] This task now lies before digital text as well. Digitally, one does not have to retain the same typography as on paper, although it is possible and still done in PDFs. Markup can make a text suited for the digital environment and adjustable to different screens and settings. With markup, the text and its presentation are essentially separated; typography can be determined independently from the text through specific markup encoding. Tags can be added to the text, which make it searchable in order to more easily analyse and interpret it. These features replace what typography does for print text – to make a text clearly structured and searchable.[75]

### 3.2.2 Hypertext

A feature of digital text, closely related to navigation, that was especially popular in the 1990s is hypertext, as coined by Nelson in the 1960s.[76] At the basis of hypertext are links, embedded in the running text, that direct readers to other pages with more information. It was felt that, through hypertext, the reader could be offered an enormous amount of information, getting an entire network on a plate in which the structures of human thinking were said to be imitated.[77] Bolter called hypertext 'the typography of the electronic medium'.[78] However, in the past few years, the assumed benefits of hypertext have been

[71] J.L. Wright, 'What Enhanced E-Books Can Do for Scholarly Authors'
[72] D. Wilk, 'Why it's Too Early for Publishers to Give up on Media-Rich Ebooks', *Digital book world*, 24 October 2013 <http://www.digitalbookworld.com/2013/why-its-too-early-for-publishers-to-give-up-on-media-rich-ebooks/> (26 September, 2014).
[73] A. van der Weel, *Changing Our Textual Minds*, p. 53-55.
[74] A. van der Weel, *Changing Our Textual Minds*, p. 187.
[75] A. van der Weel, *Changing Our Textual Minds*, p. 53-56.
[76] A. van der Weel, *Changing Our Textual Minds*, p. 120.
[77] M. van de Ven, *Nieuwe Media en Lezen*, p. 13.
[78] J.D. Bolter, *Writing Space: The Computer, Hypertext and the History of Writing* (Hillsdale: Lawrence Erlbaum Associates, 1991), p. 118.

countered. Hypertext has not proven to offer as many advantages as expected.[79] Now, writers and web developers are trying to incorporate hyperlinks in an efficient way. Hyperlinks are not always helpful and sometimes even hamper the efficient reading of a text. Links embedded in the running text distract the reader from that text, by inducing them to click on or even think about clicking on the link. Even when they do not follow it, they are distracted from the main text.[80]

In hypertext, the text no longer prescribes the right reading order. It presents different options for reading paths and leaves the reader partly in control of their own reading experience. This can be problematic however, since '[i]nstead of one linear argument, the hypertext can present many, possibly conflicting arguments'.[81] Every reader has a different reading experience in terms of order, content and length, depending on their own choices within the possibilities.[82] The delineation of text becomes blurry this way. With all these fragments that the reader can mix and match to their own preference and that are all stored somewhere different, 'where does one text end and another begin?'[83]

According to Kircz and Den Boef, a main obstacle for hypertext until now is that the links are not bidirectional. This means that a link refers to a different document or page, but not to a particular sentence.[84] In this way, it is more difficult to return to the place where you left off. Links are often broken too, leading the reader to a non-existing page, disrupting the reading process only further. Moreover, they say that linking several pieces of text or media 'should have a rhetorical meaning'.[85] It should not just refer to something else, just because it is possible, but because it complements the argument and adds value to the reading path. This is especially true for hypertext in education. Just linking to other information is not enough; all the different pieces need to contribute to the same message or argument.[86]

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[79] M. van de Ven, *Nieuwe Media en Lezen,* p. 13.
[80] P. Meyers, 'A Look at Links: Help or Hindrance to eBook Readers?' *A New Kind of Book*, 11 October 2011 <http://newkindofbook.com/2011/10/a-look-at-links-help-or-hindrance-to-ebook-readers/> (22 May, 2014).
[81] J.D. Bolter, *Writing Space* (1991), p. 117.
[82] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 134.
[83] A. van der Weel, *Changing Our Textual Minds*, p. 54.
[84] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 137.
[85] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 132
[86] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 136.

Opinions on hypertexts go two ways, according to Baggini. He says that, on the one hand, hyperlinks distract the reader from the text, but on the other hand they offer ways of more active reading and learning, which engage the reader more with the text.[87] An effective hypertext needs to be well-structured and coherent, and should only be read by those who have sufficient capabilities to work with such a text.[88] Background knowledge is required to make proper sense of a hypertext and to make the right connections. The multi-linearity as opposed to the narrative norms readers are traditionally familiar with can cause problems for less experienced readers.[89] Therefore, it is not always very well suited for educational purposes.

An alternative to hypertext is to place the additional information, otherwise found when the reader clicks on the link, at the side of the text, available for the reader when he finds a more suitable moment to review the extra comments. A similar solution is available for links to footnotes, which distract the reader since he has to move to the bottom of the text and then return to the right place where he left off reading. The plug-in Footnotify provides pop-up boxes at the place of the footnote in the text so that the reader does not have to scroll or click away. Another useful feature is a redirect button to bring the reader back to their right place in the text after they have visited the footnote section. Finally, publisher The Atavist offers links in their prose leading to additional information, images, maps and more through pop-up boxes. However, here, when readers do not want to be distracted, they can turn off this option and make all the links invisible for an uninterrupted reading experience.[90] Moreover, if you come across something interesting but do not have time to read it, you can save it and keep track of it through 'read later tools'.[91]

Still, all of these options for improving hypertext reading do not take away the fact that the reader needs to think about whether or not to read the extra text and what they might be missing when they turn off the option for additional information. The reader is still

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[87] J. Baggini, 'Ebooks v. Paper', *Financial Times*, 20 June 2014, <http://www.ft.com/cms/s/2/53d3096a-f792-11e3-90fa-00144feabdc0.html#axzz36ICkHkf7> (26 September, 2014).
[88] M. van de Ven, *Nieuwe Media en Lezen*, p. 15.
[89] M. van de Ven, *Nieuwe Media en Lezen,* pp. 16-17.
[90] P. Meyers, 'A Look at Links'
[91] P. Meyers, 'Sidelinks: Reducing Hyperlink Distractions', *A New Kind of Book,* 8 November 2011 <http://newkindofbook.com/2011/11/sidelinks-reducing-hyperlink-distractions/> (22 May, 2014).

in control in a way, when actually they might not want or need to be in that position. Especially for informative and educational texts, the text should be the basis and the developers should determine what the reader should read, since readers cannot always decide this individually. Thus, when creating digital texts, developers should always evaluate the need for hypertext and whether it helps to let the reader be in control.

### 3.2.3 Reflowable text

An element of digital text that is increasingly common is reflowable text. This means that the fixed layout of a page is discarded, allowing the text to adapt to the screen size it is read on. The text size remains the same (although it can be adjusted to personal preference), but the length of the lines is reduced as the screen size decreases. This means that layout is not fixed.[92] For small screens this is an advantage, since the reader does not need to drag the fixed page across the screen to be able to read everything. The length of a line usually does not have a limit, however, so for larger screens, lines are often too long to be comfortable to read. Also, images in between the text usually do not behave at their best in reflowable mode, since they move around unpredictably when changing the size of the screen – as is, for instance, possible on a laptop – and disappear altogether when the screen becomes too small.

Furthermore, books using reflowable text usually do not offer page numbers, which makes them very hard to navigate. Also, the reader's sense of fixed pages is undermined, which makes it impossible for them to remember where a particular piece of information could be found on a certain page. This 'anchoring' of information found in a particular place helps to commit that information to memory, according to Jabr.[93] Scrolling has the same effect: it 'impairs the spatial memory'.[94] The reader needs to have an overview of the text as a whole, and be able to place certain passages 'in the context of the entire text'.[95]

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[92] T. Hillesund, 'Digital Text Cycles', p. 6.
[93] F. Jabr, 'The Reading Brain in the Digital Age: The Science of Paper Versus Screens', *Scientific American*, 11 April 2013 <http://www.scientificamerican.com/article.cfm?id=reading-paper-screens> (26 September, 2014).
[94] J. Baggini, 'Ebooks v. Paper'
[95] F. Jabr, 'Why the Brain Prefers Paper', *Scientific American*, 309.5 (2013), pp. 48-53. <http://web.b.ebscohost.com.ezproxy.leidenuniv.nl:2048/ehost/detail/detail?sid=40ff48f5-2cb7-452b-bbb1-

Reflowable text is not necessary to use on digital devices. For some, mostly smaller devices, it can be better recommended than for others. Of course, text can also be presented in a fixed layout, retaining all elements of a page in their original places. For educational purposes, fixed layout seems to be better suited for a number of reasons. Usually, the entire page is important, since it not only contains text, but also illustrations that relate directly to the text. Next to that, page numbers are important to provide the teacher with a means to direct students to a particular place in the book. They also allow students to collaborate more efficiently. Orientation on a page is also important for committing information to memory more easily, so the page of an educational text should not be different on different devices.

It should be said, however, that with new technologies of among others the publishing format ePub 3, page numbers can be incorporated in reflowable text, also corresponding to the print text, should that be available. Digital text is developing quickly, but even though the concept of reflowable content is improving, it still does not seem best suited for educational purposes. It is difficult to 'keep the unity of text, illustrations, tables, white lines, etc. which are essential for comprehension of most art, educational and scientific books as well as many poetic works'.[96]

### 3.2.4 Screen versus paper

An important element of digital education is the screen: is reading on screen perfectly acceptable, or does it slow readers down, make them strain their eyes and forget what they've read quickly? Although this is not about textual structure directly, it is an element that could indeed affect digital textual structure and presentation and so cannot be overlooked when discussing the future of (digital) education. The screen 'changes methods of organization, structure, consultation, even the appearance of the written word'.[97] Some studies have pointed out that reading from screen has a bad effect on the reader's concentration and comprehension, and even on his of her sleeping patterns.[98] However, it is also said that the screen makes the reader read more slowly, which can result in a better

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4d503eeee6e4%40sessionmgr113&vid=0&hid=112&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=pbh&AN=91442503> (26 September, 2014).

[96] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 1', p. 289.

[97] R. Chartier, *Forms and Meanings,* p. 15.

[98] J. Baggini, 'Ebooks v. Paper'

contemplation of the text and thus actually a better comprehension. Bagganini differs in his opinion compared to other researchers, stating that reading on a digital device is less active (when there is only text and no extra features), but deeper.[99] Research should point out whether this is really the case; up until now, usually the opposite has proved true.

Jabr argues that the screen demands more attention from readers, although readers generally do not expect this and are not prepared for this mental effort when reading from screen, except perhaps when they are expert screen readers. Digital reading is generally done with a less serious and studious attitude than reading from paper.[100] Salomon calls this the 'amount of invested mental effort'.[101] Naturally, comprehension increases when readers make a greater effort while reading.[102] However useful digital aids may be for research and for people with reading disabilities, most people claim to read texts on paper when they really require focus. Jabr calls this the 'modesty' of paper: it is simple, does not direct readers' attention elsewhere and does not offer anything beside the text itself. This is an important strength that cannot yet be found elsewhere.[103] What follows from this is that, to be taken seriously, text seems to have to be published on paper and not digitally.[104]

Marshall conducted a 'Pocket PC study', in which she found that users of electronic devices carrying text were mostly used to read short texts quickly and to skim text instead of reading it deeply.[105] Carr confirms this in his book *The Shallows*, in which he claims that digital reading induces more shallow reading and that the texts read onscreen are indeed shorter, since long texts are simply less suited for screen reading.[106] Moreover, if more effort needs to be spent on orientation and navigation, 'less mental space may be left for retention'.[107] Especially in an educational setting, the screen seems to be an obstacle to effective learning. According to Jabr, '[w]hen reading on screens, people seem less inclined to engage in what psychologists call metacognitive learning regulation – strategies such as

[99] J. Baggini, 'Ebooks v. Paper'
[100] F. Jabr, 'Why the Brain Prefers Paper'
[101] S. Neuman, 'The Case for Multimedia Presentations in Learning', p. 47.
[102] S. Neuman, 'The Case for Multimedia Presentations in Learning', p. 47.
[103] F. Jabr, 'Why the Brain Prefers Paper'
[104] A. van der Weel, 'Digitaal lezen', p. 3.
[105] C. Marshall, *Reading and Writing the Electronic Book* (Morgan & Claypool, 2010), p. 21.
[106] N. Carr, *The Shallows*, (New York: W.W. Norton & Company, 2010).
[107] A. van der Weel, 'Memory and the Reading Substrate', p. 3.

setting specific goals, rereading difficult sections and checking how much one has understood along the way'.[108]

In short, the screen is a different medium for presenting text than paper, and so it should also be treated differently. Research is not yet conclusive on how screens are affecting reading behaviour, but it may be seen as natural that it induces a different way of reading compared to paper. So necessarily, adjustments need to be made to the presentation of text, and possibly the structure of text, to accommodate the new reading setting. Before this, however, more research into the effects of screen reading on reading behaviour and knowledge acquisition is necessary. Only then can it be decided whether digital reading is beneficial for education and, if so, how digital text can really accommodate reading and knowledge transfer in its own appropriate way.

### 3.3 Different kinds of texts

There are numerous different kinds of texts through which a message can be conveyed. For this thesis, different kinds of writing are relevant, since the research will look at different textual structures. Text can be built up using a narrative, argumentative or expository structure, for example. These compositions are all units as a whole. An example of a collection of short expository texts is the encyclopaedic structure that reference works can have. For every educational text, it is important to determine what the purpose of that text is and in what form it should thus be presented for the best learning results.

An important way of conveying knowledge, especially used in higher education and published in the form of, for example, journal articles or monographs, is through 'sustained argument'.[109] This way of writing, like narrative and pedagogical knowledge presentation, is done by gradually building up an argument towards a conclusion. There is progression in the text and you generally have to read it from beginning to end to understand the entire argument.[110]

In informative non-fiction texts, even though they usually contain a linear structure, readers can read the bits of the texts they want and jump from one to the other. However, according to Bolter, 'they do so at their peril; they must always be conscious that the book

[108] F. Jabr, 'The Reading Brain in the Digital Age'
[109] J.B. Thompson, *Books in the Digital Age*, p. 324-325.
[110] J.B. Thompson, *Books in the Digital Age*, p. 326.

itself defines the preferred reading order'.[111] Some new digital books and texts now try not to predefine a reading order at all, but it remains to be seen how effective this will be for a good reading experience. It might actually give a feeling of peace, control and certainty when there is a certain visible structure to fall back on. Within that structure, it might be nice for the reader to have a degree of freedom. Complete freedom, however, might result in chaos and an unsatisfying reading experience. The same goes for hypertext, a relatively new textual form, as already discussed earlier.

The encyclopaedic structure offers a different way of finding and conveying information. Pieces of information are collected and presented separately from each other, traditionally in alphabetic or thematic order. Digitally, the encyclopaedia does not have such a fixed organisation. The reader can enter a search term and a specific article will come up, leaving the others invisible and showing only those that are, for example, thematically relevant. Moreover, the reader can search on many more levels than in a print encyclopaedia: not just on a thematic or alphabetical level, but also on the level of individual words. On the other hand, readers have less overview of the entire encyclopaedia than on paper, so perhaps also less control over their search attempts.[112]

Every individual kind of text has its own characteristics that may or may not be suitable for being published digitally. It remains to be seen which kinds of texts will flourish digitally and which new kinds of texts will appear.[113] Many critics believe that sustained argument and other long-form texts will remain important for learning, even though these texts are not supported well digitally due to issues like screen reading and layout conventions.[114] Reference works such as encyclopaedias and dictionaries, however, work better online. This is because digitally they can be updated faster and more regularly, they provide quick and easy search methods, they are compact and allow for easier support from multimedia resources.[115]

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[111] J.D. Bolter, *Writing Space* (1991), pp. 109-110.
[112] J.D. Bolter, *Writing Space* (1991), pp. 93-98.
[113] J.B. Thompson, *Merchants of Culture*, p. 351.
[114] Van der Weel in an interview, conducted by me on 11 June 2014.
[115] J.B. Thompson, *Merchants of Culture*, p. 346-347.

### 3.4 Different ways of reading

Reading, along with knowledge representation, has changed immensely since the invention of the printing press. The written word has become central and available everywhere.[116] In reading different kinds of texts, different ways of reading are used to accommodate the text type. In determining what kinds of texts and text structures and presentations are best for educational purposes, different ways of reading need to be discussed, to find which ways are best for learning purposes. Hillesund states that 'the way we read is dependent on technologies, implement design and text compositions'.[117] It matters, for example, whether the physicality is a book or a screen. Therefore, in order to allow for a successful learning experience, the different ways of reading dependent on these designs and compositions need to be discussed.

According to Rumelhart, '[r]eading is the process of understanding written language' with the purpose of getting 'a definite idea about the author's intended message'.[118] Ruddell and Unrau add that it 'is a process of *constructing*, of knowledge integration, of building meaning'.[119] Reading is vital in present day education and in the transfer of information in general. Through reading, readers add to their knowledge.

A clear distinction can be made between deep and shallow reading. Deep reading also means to actively engage with a text, whereas shallow reading is only 'passive consumption'.[120] Shallow reading is the kind of reading mostly associated with digital text. According to Mangen, it is hard to really become immersed in digital text, because of the different reading setting and the many distractions, like hyperlinks.[121]

Another distinction is that between continuous and discontinuous reading. Mostly this is seen in a spatial sense: continuous reading is reading a text as a whole, linearly from beginning to end, whereas discontinuous reading is reading fragments and skipping from one to the other without following the set order. Another way of discontinuous reading is reading bits of different texts, for example when browsing print or digital pages. Hillesund

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[116] A. Van der Weel, 'Digitaal lezen', p. 7.
[117] T. Hillesund, 'Digital reading spaces', n.p.
[118] D.E. Rumelhart, 'Toward an Interactive Model of Reading', in R.B. Ruddell et al. (eds.), *Theoretical Models and Processes of Reading*, 4th ed. (International Reading Association, 1994), p. 864.
[119] R.B. Ruddell and N.J. Unrau, 'Reading as a Meaning-Construction Process', p. 1019.
[120] T. Hillesund, 'Digital reading spaces', n.p.
[121] T. Hillesund, 'Digital reading spaces', n.p.

also calls this kind of reading 'fragmented reading'.[122] Digitally, reading is often discontinuous because of hyperlinks. All these links together break with the linear text pattern that is normal on paper, and make digital text multi-linear. This results in discontinuous reading, going from one web page to another, for example. According to Hillesund, '[i]n a Web environment, text boundaries are no longer obvious, and in a sense the entire Web is one enormous, interconnected text'.[123]

Reading can also be seen in a temporal sense, reading for long stretches of time as opposed to reading with many interruptions. The first kind is referred to as 'sustained reading'.[124] What seems to be the best way of reading for educational purposes – so for internalising and critically reviewing a text – is 'immersive reflective reading', which can be seen as a combination of deep, continuous and sustained reading.[125] Readers really need to be absorbed in a text through a combination of recognisable information and new challenges.[126] However, this kind of reading done by scholars is often 'characterised by discontinuous and treacherous reading', meaning that they move back and forth in and between texts, annotate and write in between reading and only read those parts that interest them.[127]

In educational terms, there is a difference between reading and studying. Reading is done on a more continuous level, perhaps more passively, whereas studying is done on a discontinuous level, going to and fro in and between texts and working actively with texts. To accommodate these kinds of learning, text needs to be presented in certain ways. For reading it is important to have a comfortable reading setting without many distractions and extra 'options'. For studying it is necessary to facilitate good navigation options as well as annotation and highlighting options.[128]

An important distinction for reading, and especially reading for educational purposes, is between active and passive reading. Active reading contains elements of deep, but also discontinuous reading, since the reader does not just read a text but also works with it,

[122] T. Hillesund, 'Digital reading spaces', n.p.
[123] T. Hillesund, 'Digital reading spaces', n.p.
[124] T. Hillesund, 'Digital reading spaces', n.p.
[125] T. Hillesund, 'Digital reading spaces', n.p.
[126] T. Hillesund, 'Digital reading spaces', n.p.
[127] T. Hillesund, 'Digital reading spaces', n.p.
[128] T. Hillesund, 'Digital reading spaces', n.p.

taking notes and comparing different texts, for example. One does not learn much from passive reading, which is perhaps best characterised as continuous but shallow reading. Active reading, on the contrary, can be seen as 'a higher degree of critical interaction with one's reading' and 'as being in perpetual analytic dialog with the writer'.[129] This is especially important when reading textbooks or other instructional materials.

Increasingly, new ways of active reading are stimulated, especially in educational texts. With multimedia and other features, innovative developers are trying to make educational material more interactive, requiring input from readers through exercises, for example, and offering extra material in different formats. This way, students are not passive readers but will actively engage with the text. According to Marshall, active reading is always required if the reader is to learn or remember something from the text.[130]

The ideal in education is deep reading, resulting from immersion in long-form texts. However, besides this deep reading, many different kinds of reading are taking place too. Different people read differently and different kinds of texts. Reading digitally automatically changes reading and seems to be less suitable for deep reading. People increasingly read shorter pieces of text, which indicates that regular deep reading is gradually diminishing. This might hold true especially for long argumentative texts, since people are becoming more used to narrative and shorter texts.[131]

Different reading strategies also result from how informed a reader of educational writing is about the subject matter of the text. Ranging from informed and partially informed to uninformed, these different readers have a different approach to a text and read it as a whole in a linear fashion or only choose certain parts in a fragmentary way.[132]

### 3.5 Medium, genre and purpose

Following Marshall McLuhan's claim, 'the medium is the message',[133] this section will explore the correlation between different mediums and different messages. Depending on a certain genre or purpose of the text, a specific medium might be chosen in order to convey the intended message in the best way possible. Consequently, starting with the medium, the

[129] C. Marshall, *Reading and Writing the Electronic Book*, p. 16.
[130] C. Marshall, *Reading and Writing the Electronic Book*, p. 16.
[131] A. Van der Weel, 'Digitaal lezen', pp. 5-6.
[132] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 133.
[133] M. McLuhan, *Understanding Media: the Extensions of Man* (London: ARK, 1987), p. 7.

kind of text and message needs to be selected that fit that medium best and uses its potential to the maximum. As Chartier puts it, '[w]hen the 'same' text is apprehended through very different mechanisms of representation, it is no longer the same'.[134]

First, a definition of the word medium is in order. Van der Weel defines a medium as 'a construct consisting of a tool or technology with its (explicit) technical protocols and any implicit social protocols with the purpose of communicating information expressed in one or more of the modalities of still text, images, sound, and moving images over time and/or space'.[135] Thus, there are different mediums that, each with their own characteristics, offer a particular way of conveying a message.

The catchphrase 'content is king'[136] is used increasingly to place content first, followed by presentation through different kinds of mediums. So far, the best way of providing content has been through the printed book, but in the future another form of presentation could prove to be better suited for specific kinds of content.[137] Especially for educational texts, it seems only logical that the content comes first. It first needs to be decided what needs to be learned; only afterwards can developers think of the best way in which to present this material.

With current trends mostly moving towards digitisation of reading materials, attention should always be given to 'graphic translatability'.[138] According to Crystal, 'it is not possible to take a paper-based text and put it on a screen without rethinking the graphic presentation and even, sometimes, the content of the message'.[139] The question is again what should come first: the medium or the message? From this starting point, the entire nature of the publication should be determined.

The graphic presentation consists of paratextual elements, which always need to be taken into account when choosing the medium for a certain kind of message. These encompass the presentation surrounding the text, like the physical carrier (a book, an iPad), layout and other physical details. Depending on its paratextual elements, 'the text is, as it were, making (subjective) assertions about itself, saying for example how seriously it should

[134] R. Chartier, *Forms and Meanings*, p. 2.
[135] A. van der Weel, *Changing Our Textual Minds*, p. 63.
[136] J.B. Thompson, *Books in the Digital Age*, p. 314.
[137] J.B. Thompson, *Books in the Digital Age*, p. 314.
[138] D. Crystal, 'The Changing Nature of Text', p. 243.
[139] D. Crystal, 'The Changing Nature of Text', p. 243.

be taken, or what genre it may be'.[140] For books, these conventions are well known, but for digital texts they are still developing.

The purpose of a text also determines what form a text should get in terms of genre. Deep immersion is most often reached through narrative storytelling, whereas processing information might work better through expository text in which one can mark and annotate passages.[141] Different types of text induce different levels of immersion; this knowledge can be used in composing suitable educational texts.[142]

Text that is directly copied from print to digital does not generally take into account the characteristics of the new medium. The text is simply copied to a digital environment, but retains all print characteristics, for example in a PDF file. These characteristics, however, do not function the same in a digital environment; a text should, mostly in terms of presentation, but possibly also in terms of content or at least the structure of that content, be adapted to fit the new medium through which it is presented.[143] Each medium has its own inherent characteristics, and for text to be presented optimally, these characteristics should not be overlooked.[144]

For text that first existed in print, it is perhaps harder to be translated to a digital version than for text that is completely digital-born. The latter has as its starting point the digital possibilities, whereas a text that was first printed needs to change to adapt to the new medium. Of course, even with digital as the starting point, the innovative level of a digital text depends on how digitally skilled the producer of that text is.

With some digital text environments, the '[p]urpose [of a text is] less obvious, as websites often have multiple goals, layered and overlapping, overt and covert, in ways not typical of print'.[145] For educational texts, however, the purpose needs to be very clear and everything in and around the text should contribute to that purpose – usually presenting knowledge and fostering understanding. Composing and designing texts, especially educational texts, the following questions need to be asked: '(a) *Reading what and where?*

[140] A. van der Weel, *Changing Our Textual Minds*, p. 51.
[141] E. Bleeker, 'On Reading in the Digital Age', p. 23.
[142] E. Bleeker, 'On Reading in the Digital Age', p. 24.
[143] M. van de Ven, *Nieuwe Media en Lezen*, p. 24.
[144] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 133.
[145] B. Dalton and C. Proctor, 'The Changing Landscape of Text', p. 298.

(b) *Reading how?* (c) *Reading why?* and (d) *Reading with what possible consequence?*'[146]

Maurice de Hond, involved in iPad school projects, also says that using a new medium to do something old with it, is of no use.[147] New mediums should be used taking their own features in mind and should not be projecting features of a different medium to it, just because those are familiar.

With the increased digital reading, the same text may be accessed on different platforms and devices. Careful attention should be given to the difference in presentation on, for example, large computer screens and the smaller iPads. The project Treesaver has developed a Javascript framework for presenting digital text on different devices. When programmed into this framework, the layout of the text automatically adjusts to the device it is viewed on, so as to provide the best reading conditions.[148] This means that, for example, page size is adaptable and the organisation of text and possible images is adjusted depending on the size and shape of the screen.[149] This adapting to different devices is increasingly possible.

If the digital medium is used in a wrong or less suitable way for reading, it will not lead to positive results. Every medium has its own limitations and should be used to its own best effect. Examples of using the digital medium in an unsuitable way are creating 'screenfuls of unbroken text, paragraphs which scroll downwards interminably, or text which scrolls awkwardly off the right-hand side of the screen'.[150]

For education to be transferred entirely to the digital medium, much research into the consequences is still to be done. Most new developments currently are experiments. It is a complicated road for education, since you cannot just experiment – the level of education

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[146] C. Wyatt-Smith and J. Elkins, 'Multimodal Reading and Comprehension in Online Environments', in J. Coiro et al. (eds), *Handbook of Research on New Literacies* (London/New York: Lawrence Erlbaum Associates, 2008), p. 902.
[147] M. de Hond, 'Gebruik wel een ipad op school, maar dan goed', *Maurice de Hond*, 19 February 2014 <http://www.maurice.nl/2014/02/19/gebruik-wel-een-ipad-op-school-maar-dan-goed/> (26 September, 2014).
[148] A. Campi, 'Treesaver Documentation', *GitHub,* 21 October 2012 <https://github.com/Treesaver/treesaver/wiki> (26 September, 2014).
[149] M. Calore, 'Meet Treesaver, a New HTML Magazine App', *Wired*, 11 August 2010 <http://www.wired.com/2010/08/meet-treesaver-a-new-html-magazine-app/> (18 October, 2014).
[150] D. Crystal, 'The Changing Nature of Text', p. 234.

always needs to be the best it can be. However, only when you let go entirely of the traditional print medium, will new possible structures really become visible.[151]

It is clear that the new digital medium requires different considerations concerning how to present text. Ideally, the genre and purpose of a text should be the starting point and then the best way of conveying the message of that text should be chosen, through for example print or digital text. This is an important issue for education: now often developers are thinking from the starting point of the possibilities of the digital medium. However, for education, the content remains the most important element in learning material, and so new ways of presenting that material should be very carefully considered.

[151] J. Kircz in an interview, conducted by me on 17 June 2014.

## 4. Case study

### 4.1 Example cases

Digitised texts come in different formats, ranging from PDFs, directly copied from the print version, to elaborate apps that present text (knowledge) in an innovative, often interactive way. An example of the former is the digitised version of the *Encyclopaedia Britannica*; the text remained almost the same, adding only basic search and access options.[152] Sometimes texts are broken up into separate pieces, like with Safari Flow and Inkling, where the reader can buy separate chapters of books, depending on the specific information they need.[153] Still, this does not change anything specific about the presentation of the text itself. The examples below illustrate different ways of how this presentation can be changed. In the following examples, elements of digital text that have been discussed above are applied for reasons of trying to change and, if they prove to do so, optimalise the reading process. Each case exemplifies a different feature of presenting text digitally, in terms of for instance the structure of the text, its navigation and is presentation on the screen. They show very different ways of using digital text for the transfer of knowledge and together they make up an overview of some of the major possibilities. The characteristics of these examples and the rationale behind them will be discussed. Later on, a connection with educational aims will be drawn.

#### 4.1.1 Citia

The start-up company Citia is an example of how books can be completely refashioned following digital possibilities. This is the more difficult way of digitising texts, so to say, since it has been attempted to leave the framework of the traditional book behind. Citia takes print non-fiction books and changes the presentation of its ideas fundamentally. An example of an instructive book they have transformed is David S. Rose's *The Gust Guide to Making Money & Having Fun Investing in Startups*.[154] Citia accepts all kinds of text forms and subject

[152] A. van der Weel, *Changing Our Textual Minds*, p. 197.
[153] D. Streitfeld, 'Out of Print, Maybe, But Not Out of Mind', *The New York Times*, 1 December 2013 <http://www.nytimes.com/2013/12/02/technology/e-books-hold-tight-to-features-of-their-print-predecessors.html?pagewanted=all&_r=2&> (18 April, 2014).
[154] <https://citia.com/content/title/citia/what/success-stories/angel-investing-gust> (18 October, 2014).

matters, also transforming for example blog articles and the multimedia story behind one of Snoop Dogg's albums into cards.[155] Instead of its linear narrative, the main ideas of the book are selected and presented as individual pieces of content on so-called digital 'cards'.[156] The reader can browse through main ideas and pieces of information and click on them to reach more detailed information belonging to a particular theme. This way, the information conveyed through traditional linear narrative is transformed into a highly structured presentation through which the reader can find his own way.[157] David Schoenberger from Citia calls it an 'immersive game-like navigation'.[158] Every idea can be regarded both individually and as part of the whole 'book'.[159]

The rationale behind this is that it takes much less time to learn the most important ideas in a book. In a linear narrative, the reader needs to read from start to finish and dissect the important parts himself, at the risk of missing them completely, whereas now those parts are presented directly, which saves the reader much trouble and time. Basically, Citia offers a summary of the book.[160] The pieces of text are written from a third-person perspective, recounting what the author has written in a formal writing style.[161]

Citia 'books' are fashioned into apps that can be accessed on different devices. The contents can also be shared via social networks. Citia books can be bought via the Apple iTunes store. Customer reviews for Citia's first project, digitising Kevin Kelly's *What Technology Wants*, offer different views of the newly structured books. One comment is positive, saying that 'Citia improves the reader's experience by presenting the 'meat' sans

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[155] <https://citia.com/content/title/citia/what/success-stories/julianne-wurm> (18 October, 2014) and <https://citia.com/content/title/citia/what/success-stories/reincarnated-snoop> (18 October, 2014).

[156] M. Shatzkin, 'Citia Apps from Semi-Linear; a Whole New Way to Present High-concept Non-fiction', *The Shatzkin Files*, 28 May 2012 <http://www.idealog.com/blog/citia-apps-from-semi-linear-a-whole-new-way-to-present-high-concept-non-fiction/> (26 September, 2014).

[157] D. Streitfeld, 'Out of Print, Maybe, But Not Out of Mind'

[158] D. Schoenberger, 'Why Flip or Swipe a Card (Instead of Turning a Page)', *Citia Zendesk* <https://citia.zendesk.com/entries/21539653-Why-flip-or-swipe-a-card-instead-of-turning-a-page-> (28 May, 2014).

[159] M. Shatzkin, 'Citia Apps from Semi-Linear'

[160] D. Streitfeld, 'Out of Print, Maybe, But Not Out of Mind'

[161] R. MacManus, 'Reimagining Books: How Citia's iPad App Compares to a Paper Book', *ReadWrite*, 17 June 2012 <http://readwrite.com/2012/06/17/reimagining-books-how-citias-ipad-app-compares-to-a-paper-book#awesm=~oAQy55HMlTR6D0> (11 May, 2014).

the unnecessary 'garnish''.[162] Another is positive in general, but expresses a dislike for the absence of the author's narrative: 'Sometimes I wanted to get the author's voice, his/her organization, the structure of the book'.[163]

The digital cards on which Citia is based are appearing increasingly online. Already in 1987, Apple launched their HyperCard software based on the same principle. It could be used for among others programming, presentations and games based on a card design and structure. However, it came too early and was not adopted successfully.[164] Only now are cards starting to grow in popularity. The current Facebook interface, for instance, is also based on this design principle, presenting every individual post on a card on your wall or timeline.[165] Besides just functioning as a design feature, cards can help structure information by cutting it into bite-sized pieces. Mike Edelhart writes that '[c]ards are small, malleable, comprised of a brisk, flexible mix of many elements. They work on any screen, can be abstracted from larger content chunks or built up from smaller units. We stand at the brink of the Age of the Card'.[166] Paul Adams calls this new way of reading an experience: the development of cards 'is driving the web away from many pages of content linked together, towards individual pieces of content aggregated together into one experience'.[167]

A question that arises when looking at Citia is whether the content is really structured enough as to give the reader a proper guidance through the material. Readers are very free in browsing through the information and will easily spot the main ideas of a book. However, they might in this way miss the underlying structure of the narrative, connecting all the ideas together into a logical stream of thought. Is a summary sufficient to convey everything a book has to offer? The CEO and founder of Citia, Linda Holliday, does not think

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[162] Oscar The Erudite Pug, 'Avid Reader', *CITIA customer reviews*, 12 June 2012 <https://itunes.apple.com/us/app/citia-what-technology-wants/id527251397?mt=8> (8 April, 2014).
[163] F. Har, 'Where's the Book?', *CITIA customer reviews*, 12 June 2012 <https://itunes.apple.com/us/app/citia-what-technology-wants/id527251397?mt=8> (8 April, 2014).
[164] J. Coventry, 'Apple's Revolutionary HyperCard', *Low End Mac*, 1 May 2014 <http://lowendmac.com/2014/apples-revolutionary-hypercard/> (19 October, 2014).
[165] P. Adams, 'Why Cards are the Future of the Web', *Intercom Blog* <http://blog.intercom.io/why-cards-are-the-future-of-the-web/> (26 September, 2014).
[166] M. Edelhart, 'The Future of the Internet may be in Cards', *Huffington Post*, 8 October 2013 <http://www.huffingtonpost.com/mike-edelhart/the-future-of-the-interne_1_b_4065989.html> (26 September, 2014).
[167] P. Adams, 'Why Cards are the Future of the Web'

so. She says that 'Citia apps won't replace the books they're based on. Instead the aim is to complement the author's book and lead people to buy it, should they want to explore the ideas more deeply'.[168] This way of presenting knowledge, then, offers a quick overview of what a book has to offer, but in order to fully comprehend the author's point, the linear narrative in the original book still seems to function best to transmit the message.

### 4.1.2 The tap essay

A tap essay, a concept introduced by writer and media and technology experimenter Robin Sloan, is a text presented through an app in which the reader needs to tap the screen to move on to the next sentence or part of the text. The narrative or argument that is presented is linear and just like a normal (print) essay. The crucial difference lies in the presentation.[169] The app plays with reading speed, depth and the processing of the reading material by guiding the reader very gradually through the entire text.

By presenting bits of text separately, the app takes the reader by the hand, basically showing them how to read the text. The app also introduces an interactive element, since readers determine for themselves when they are ready to move on to the next 'page'. They are both being guided in reading the text as it was intended and involved actively in that process. In the presentation, special focus can be awarded to specific words or sentences. Presenting them separately, in a different font size or colour, all help to highlight important parts in the argument. The text is read more carefully and with more immersion because of its presentation. You cannot go back once you have tapped to go to the next 'page'. This way, the reader is required to be more conscious of every sentence they read, since the argument builds up with every next tap and nothing can be reread, except when you start the app again from the beginning. It is almost like Citia's cards, where every new screen is a new card with selected information offered to the reader.[170] Except with the tap essay, you cannot choose where to click, you are guided much more than in Citia's book apps. Another

[168] R. MacManus, 'Reimagining Books'
[169] J. Bridle, 'Fish, the App that Thinks It's a Book', *The Guardian Observer*, 8 April 2012 <http://www.theguardian.com/books/2012/apr/08/ebooks-fish-iphone-app-review> (11 May, 2014).
[170] D. Dobbs, 'At Last – A Clean, Mean eBook App: Robin Sloan's Fish', *Wired*, 9 April 2012 <http://www.wired.com/2012/04/at-last-a-clean-mean-ebook-app-robin-sloans-fish/> (11 May, 2014).

difference is that the tap essay works well for argumentative texts, whereas Citia is better for expository texts that simply inform, no matter which path through the text is chosen.

The tap essay is a strategic way of involving the reader in the text more than passively, but not too actively. It is simple and offers no distractions from the text. However, the text must also be good in itself; the presentation cannot do everything. As David Dobbs writes, '[c]ontent must be slave to design – design in a strategic sense, not just in how a thing looks', here meaning that the presentation forces the author to think well about the content, since it should be catchy and convincing in itself already.[171] Robin Sloan himself believes that text is still the most efficient means of transmitting a message: 'It's not the case that words are outdated and we need to replace them with interaction and videos and birds flying in outer space, no words are still a great technology and we don't have to go searching for something new'.[172]

The tap essay Sloan published is called 'Fish' and is about looking closely at something small, in this case a fish. The closer you look, the more new things you will find. Sloan uses this as a metaphor for the fleeting internet behaviour of the current digital generation. Readers look at web pages for a short time, save them for later, or click away entirely, without having had a close enough look to really grasp the contents and think about them.[173] In order to really understand a text, it needs the reader's full, close and unwavering attention and an active attitude that allows the reader to interact with the text, to process its subject matter more effectively. The tap essay is one way in which this might be realised.

A similar approach of presenting text can be seen in the online poems of Tonnus Oosterhoff.[174] The lines of his poems are presented to the reader at a specified speed, one after the other, and with some you can even see the text being written letter after letter. This is not interactive like the tap essay, however. Oosterhoff determines his own speed of presentation and the reader – or, should we say, viewer – simply has to wait for the next line to appear. This way of presenting poems can, when done in the right way of course, add to

[171] D. Dobbs, 'At Last – A Clean, Mean eBook App: Robin Sloan's Fish'
[172] R. Sloan quoted in J. Moe, 'An App to Teach You to Love Instead of 'Like', *Marketplace Tech*, 26 March 2012 <http://www.marketplace.org/topics/tech/app-teach-you-love-instead> (11 May, 2014).
[173] D. Dobbs, 'At Last – A Clean, Mean eBook App: Robin Sloan's Fish'
[174] <http://www.tonnusoosterhoff.nl/menu/index.html> (26 September, 2014).

the force of the poem as an art form not just in its text and imagery, but also in its metrics and eloquence.

### 4.1.3 *Our Choice*, a multimedia e-book

This example of multimedia e-book is more common and is slowly becoming more adopted in education already. Apple and other companies have been developing interactive e-books for iPads and other devices for a while and are adding more and more multimedia features. They are also focusing on textbooks for educational ends, claiming that educational material should be offered through the media that students are most familiar with. At this point, that is digitally through tablets and computers.[175] Whether the students' familiarity with the type of medium is most important when choosing the right medium for knowledge transmission, however, can be highly questioned.

One of the first e-books published in this way was Al Gore's *Our Choice: A Plan to Solve the Climate Crisis*. This book was published both in print and for iPad, but the iPad version contains many additional multimedia features, enriching the reading experience. The main structure is still that of a print book, with chapters and a linear narrative argument. Additionally, multimedia features like images, videos, interactive maps and charts are available for the reader to use if they like. These additional features do not necessarily interrupt the text, since the reader can choose to open or activate them by hand.[176]

Together, the text and multimedia content present Al Gore's argument for solutions to the climate crisis. The reader can browse through the text by means of a visual table of contents and includes Al Gore's own audio commentary and additional documentary material.[177] In this app, the fundamental reading activity through text remains the same as in print. However, the extra features exemplify and further explain the points made in the text. James and De Kock call this a 'rich 'story' experience'.[178] This kind of experience is more and more common in everyday reading online, whether it is an online newspaper or a Facebook

[175] R. James and L. de Kock, 'The Digital David and the Gutenberg Goliath: The Rise of the "Enhanced" E-Book', *English academy review: Southern African journal of English studies*, 30:1 (2013), p. 109.
[176] R. James and L. de Kock, 'The Digital David and the Gutenberg Goliath', pp. 109-110.
[177] Push Pop Press Inc., 'Al Gore – Our Choice: A Plan to Solve the Climate Crisis', *iTunes Preview*, 18 September 2013 <https://itunes.apple.com/za/app/al-gore-our-choice-plan-to/id432753658?mt=8> (12 May, 2014).
[178] R. James and L. de Kock, 'The Digital David and the Gutenberg Goliath', p. 110.

page. It is expected that this way of presenting knowledge will gain ground quickly and prove to be especially successful in education.[179] Whether this is true, of course, remains to be seen; for now only assumptions can be made.

Perhaps the multimedia content actually distracts too much from the running text. However, the traditional expository text structure, complemented by well-dosed illustrative material, might prove to be a good mix. According to Mayer in his interpretation of dual coding theory, knowledge transfer is actually more successful when students are offered both verbal and visual input and are stimulated to combine these, also with the help of their long-term memory. He states that the connection of these types of knowledge transfer stimulate problem-solving more than just offering one of the types.[180]

### 4.1.4 Spritz reading

The technology of Spritz reading transforms the process of reading fundamentally. Their aim is to increase people's reading speed, since supposedly, an increased reading speed also increases the amount of information committed to memory. They try to achieve this by presenting only one word at a time at a continuous speed, for example 350 words per minute. In every word, one letter is given a red colour, so that the reader has a point to focus on.

Just like with reflowable text, this technology is especially developed for small screen readers, who otherwise have to drag, scroll and resize the page continually. Moreover, the developers of Spritz write that, since the eyes can keep focusing on the same point, readers become less tired than when they have to move across pages of text. According to their website, Spritz can even incorporate visuals like photos and videos.[181]

Scientific research into speed reading, however, has shown that readers need time to process what they have read before they move on to a next section. Spritz does not allow for this. On a superficial level, the software works better than other speed-reading techniques, but on a deeper level comprehension is actually not aided when the reading speed is set too fast. Answering the question whether Spritz reading benefits reading, Andrews states that

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[179] R. James and L. de Kock, 'The Digital David and the Gutenberg Goliath', p. 110.
[180] R. Mayer and V. Sims, 'For Whom Is a Picture Worth a Thousand Words? Extensions of a Dual-Coding Theory of Multimedia Learning', *Journal of Educational Psychology*, 86.3 (1994), p. 390.
[181] <http://www.spritzinc.com/#> (26 September, 2014).

'[t]he claims about extraordinary increases in reading speed with training in standard approaches to speed reading have not survived scientific scrutiny, but the skimming strategies they teach are useful in many reading contexts'.[182]

For reading stretches of text faster and more effectively, this technology might be beneficial. However, it should include an option for pausing the reading and the text should also be available as a whole, on fixed pages including page numbers, so as to facilitate actual working with the text through teaching and collaborating.

### 4.2 Discussion

The above cases all show interesting developments in possibilities for text and the reading experience. All four show very different elements that change a part of the reading process in an attempt to optimalise it. Citia offers an interactive summary, the tap essay offers a presentation that adds to the rhetorical power of a text, the multimedia e-book combines different modalities to offer an as complete and varied as possible view of the subject, and Spritz reading offers a way to speed-read your way through a text. With all four cases, developers have tried to make the reading experience more fun, more interactive and more efficient, increasing comprehension of the subject matter in all cases. Especially the level of efficiency, however, remains to be seen from user experiences and tests. The concrete possibilities for education of these cases will be discussed later, after having given some theoretical background concerning educational texts.

Like these example cases, there are many more that are trying to do the same. Comparable to Citia is Touchpress, a company developing interactive, informative multimedia apps.[183] Of the many multimedia e-books, another is *The Mozart Project*, an e-book that almost behaves like an app with many interesting and varied multimedia options.[184] These kinds of new products are being developed more and more. For a general

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[182] S. Andrews, 'Spritz and Other Speed Reading Apps: Prose and Cons', *The Conversation*, 18 March 2014 <http://theconversation.com/spritz-and-other-speed-reading-apps-prose-and-cons-24467> (18 October, 2014).

[183] <http://www.touchpress.com/#home-hero> (26 September, 2014).

[184] A. Kozinn, 'A Digital Mozart Book That Behaves Like an App', *New York Times*, 21 July 2014 <http://artsbeat.blogs.nytimes.com/2014/07/21/a-digital-mozart-book-that-behaves-like-an-app/?_php=true&_type=blogs&_php=true&_type=blogs&et_mid=683099&rid=246188936&_r=1> (26 September, 2014).

audience, this offers fun and interesting opportunities of discovering new possibilities of acquiring new knowledge and processing texts. For education, all these cases might offer something interesting as well. Whether the whole educational system should become revolved around one of these possibilities, however, remains to be seen.

## 5 Educational texts

In education, reading materials need to offer something besides just information. There needs to be an educational element, to facilitate not just consuming information but also actively stimulating the learning process. The example cases in the previous chapter illustrated non-fiction texts that present information in a certain way. When a text is made fit for education, not only extra materials like questions and tests should be available, but the text itself should be transformed into a well-structured, coherent entity. The goal of such a text and extra materials is to learn – to acquire knowledge through a pedagogical process. Something more is needed to achieve this than just the plain information. There needs to be more of a coherence and progress in the text, going from basic to more complicated and in-depth information.

This chapter by no means attempts to offer a complete overview of educational theories on knowledge representation and digital text as they have been composed so far. The aim is merely to offer an overview, so as to have an idea of what kinds of representations are common or could be useful in education. This way, a sounder conclusion can be drawn regarding inspiration for future digital educational texts.

### 5.1 Overview of research

With the youth of today becoming more and more familiar and occupied with technology, some people are claiming that education needs to adapt to incorporate means of learning through channels with which the current youth feels comfortable.[185] Whether or not this is true, it is worth taking a deeper look into. Perhaps education is not fit for being only digital at all. Perhaps it should not want to tie in directly with what the youth does in their free time. Education is something different from leisure. Yes, children nowadays continually use their digital devices. But should education incorporate these too, just because it has become the norm in leisure? What should come first is educational value of the material. Only after that a consideration is appropriate of the medium through which the material should be presented. It might however be true that students become more motivated when they get to learn digitally, because it comes closer to what they are familiar with and it can offer

[185] R. James and L. de Kock, 'The Digital David and the Gutenberg Goliath', p. 109.

different kinds of learning compared to paper. The importance of educational value and student motivation needs to be carefully considered when composing new learning materials, which have as their goal creating the best possible learning outcomes.

One thing that is clear is that directly digitising a paper textbook without changes considering digital possibilities is in no way useful for learning, since no digital advantages are used and on top of that, screen reading might actually hamper the reading experience, as has been discussed earlier. However, when the digital learning material is made interactive, is does seem to enhance learning and result in better outcomes than the traditional material.[186] According to Kircz and Stoop, educational publishers should consider what they want to achieve with their digital materials. It might just be a new way of summarising a book, or it might replace the paper book completely.[187] It is good to think about the underlying motives for using digital material, so it can be shaped exactly in the way it can be useful. This section will discuss educational theories connected to the digital elements mentioned in earlier chapters, roughly divided into subsections. These sections have a theoretical as well as a practical character, immediately offering suggestions for educational material.

### 5.1.1 Short/long-form texts

Research has shown that students prefer shorter pieces of text over one long text, even when those shorter pieces together form just as long a text. Thus, the structure of the presentation of a text can make a difference in how students experience such a text.[188] Therefore, provided that the structure of the text does not prove to have negative influences on learning, this way of presenting texts might be considered useful. Naturally, student preference should not be placed before educational value of a text. That value should first and foremost be retained. Moreover, a goal of education could actually be to teach students to read long-form texts. If this is indeed the case, then student preference should be of no influence.

[186] J. Stoop and J. Kircz, *De toekomst van (interactief) studeren*, (Amsterdam: Amsterdam E-boekenstad, 2011), p. 4.
[187] J. Stoop and J. Kircz, *De toekomst van (interactief) studeren*, p. 10.
[188] J. Stoop and J. Kircz, *De toekomst van (interactief) studeren*, p. 10.

Numerous researchers fear that non-linear reading and browsing happening often now will push away the linear deep reading, which, according to many, is a bad development.[189] Many, including Hillesund and Wolf, still make the case for 'long-form text transference'.[190] This would be good for cognitive development because of the 'sustained reflective as well as continuous imaginary reading' that this immersion in long texts brings.[191] Fragmented reading might in the long term deeply affect readers' concentration and interpretation capabilities.[192]

According to Hillesund, '[it] could have severe consequences if [digital teaching] material did not include easily readable long-form text in which detailed descriptions, long arguments and complex narratives are decisive, providing students with important frames of reference indispensable for deeper understanding'.[193] These long-form texts should continue to offer the possibility of immersed, sustained and reflective reading.

Of course, education knows many different levels, and every individual level benefits from a somewhat different kind of knowledge transference. Research has been done into instructional texts for vmbo-students, vmbo being the lowest level in regular Dutch secondary schools. This has pointed out that students like narrative texts better, but that they learn more from informative texts. Moreover, the researchers say that an active learning task motivates students more, but is less suited for a good understanding and memory of the text. They say that the text should have an explicit structure and should not be fragmented but be a unified text. Here instructors constantly need to ask themselves whether the student needs to remember something from a text or find joy in reading a text, and adjust the sort of text to this.[194] The same goes for the Dutch hbo (higher professional education) as opposed to university. Hbo students like to do more and read less, whereas university students are used to reading much. Hbo textbooks therefore are made up of shorter pieces of text and more attention has gone to design and layout.[195]

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[189] Leesmonitor, 'Wie lezen er non-lineair?', *Stichting Lezen* <http://www.leesmonitor.nu/page/10006/wie-lezen-er-non-lineair> (20 May, 2014).
[190] E. Bleeker, *On Reading in the Digital Age*, p. 20.
[191] E. Bleeker, *On Reading in the Digital Age*, p. 20.
[192] N. Bakker, *Digitaal lezen – wie doen het al?* (Amsterdam: Stichting Lezen, 2013), p. 4.
[193] T. Hillesund, 'Digital Reading Spaces', n.p.
[194] J. Land, T. Sanders and H. van den Bergh, *Wat maakt een studietekst geschikt voor vmbo leerlingen?* (Amsterdam: Stichting Lezen, 2006), pp. 14-51.
[195] J. Kircz in an interview, conducted by me on 17 June 2014.

Contrary to vmbo and hbo, other levels of education might be able to work with texts in a different way so that they do not always need an explicit structure and can be more fragmentary. However, a general rule in instructional texts is that there needs to be coherence and progression, for all age and proficiency levels. A text should also take into account the reader's background knowledge to determine how much needs to be explained explicitly. There should be clear causal and referential relations in the text so as to help readers in their comprehension.[196]

For students it might be good to have a certain structure as guidance. Typography usually takes care of this, dividing the text into different levels like chapters, sections and footnotes.[197] Moreover, and specifically from a printed book perspective, 'the linearity that facilitates argument and narrativity; the concentration and patience that reading requires; the solitary contemplation it promotes; the purely linguistic nature of text: these may all be ingredients' that provide an effective learning experience.[198] On the contrary, digital texts that are shorter, offer more distractions from other digital features and offer readers the ability to find their own reading path, might be seen as 'less conducive to discursive argumentation'.[199] Students should not just read facts, but get a sense of the wider picture and go into deep discussions about the material.

### 5.1.2 Multi-linearity, modularity and hypertext

According to some, digital aspects such as multimodality and non-linear formats can improve education immensely. Students will have to think more critically and work more actively with the material, will have easier access to materials and will be better able to collaborate with others.[200] On the other hand, such material contains less of the traditional textual structure, which can have disadvantages too, especially for education. When starting to read, students learn to work with tables of content, headings, bibliographies and other guiding elements for successful navigation through the text. When working with a clear

[196] P. van den Broek, P. Kendeou and M.J. White, 'Cognitive Processes During Reading', in A.G. Bus and S.B. Neuman (eds.), *Multimedia and Literacy Development: Improving Achievement for Young Learners* (New York/London: Routledge, 2009), pp. 58-62.
[197] A. Van der Weel, *Changing Our Textual Minds*, p. 52.
[198] A. Van der Weel, *Changing Our Textual Minds*, p. 100.
[199] A. Van der Weel, *Changing Our Textual Minds*, p. 169.
[200] R. James and L. de Kock, 'The Digital David and the Gutenberg Goliath', p. 119.

structure, the text offers space for deeper contemplation and critical thinking by the reader. Without this structure, readers are perhaps more occupied with finding their way through the text and have fewer possibilities to really focus on the contents. Digital text usually has different kinds of guideposts that readers need to become familiar with in order to get a proper grasp on the text.[201] This is not necessarily disadvantageous, but it does require a different orientation and a different kind of dealing with the text.

With digital possibilities, texts can be made to relate and cross-reference to each other easily. 'In an educational environment, this can lead to various reading paths within one structured resource: one reading along the main lines and supplementary reading paths, where more detailed discussions are available.'[202] This is the start of a more modular structure of educational material. Kircz and Den Boef see this new structure as an important and useful development.[203] These modules 'must be self-contained and comprehensive chunks of text'.[204] However, they write, 'modularisation might become too rigid a change of style, as repetition of an argument normally serves to enhance persuasion. This will be a serious issue in any attempt to make school courses modular; each module must in and of itself remain a comprehensive and self-contained exposé'.[205]

Related to this is the 'juxtaposition of a multitude of versions, studies, and elaborations of a story' that is digitally facilitated. 'This helps enrich the way we convey a message, as contextual and background information can grow in time, not making the original a so-called 'living document', but rather creating a living habitat for the narrative.'[206]

A simple example of multi-linearity is the paper book *Gravitation* by Misner et al. (1973), which works with two reading tracks – one basic track and a second more in-depth track for advanced readers. Digitally, such different tracks are easy to develop, especially in educational and scholarly texts. However, the digital realm offers different possibilities than paper and also requires different structures and 'a new set of tools'.[207] If digital learning were to become the norm, these materials should offer something extra, something that

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[201] S. Grimaldi, 'Text Structure in the Digital Age', *Massachusetts New Literacies Institute*, 15 July 2013 <http://mnli.org/2013/07/text-structure-in-the-digital-age/> (8 September, 2014).
[202] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 148.
[203] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 138.
[204] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 142.
[205] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 148.
[206] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', pp. 136-148.
[207] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 131.

makes readers prefer the digital over the paper version.[208] Several different reading tracks are recommended, but coherence should still be key and users should handle the tracks well.[209]

Hypertext in educational form is not yet very functional. The structure of hypertext creates many different pieces of text, between which coherence is not always clear. Links do not always work and are not sufficiently bidirectional, which only leads the students more off track. Moreover, an educational text is not only made up of pieces of information, but is also argumentative and building up to a certain meaning and conclusion. With hypertext, this is not (yet) achievable.[210] Kircz and Den Boef state that, 'in a digital environment, authors should not be allowed any longer to just enter a hyperlink to some other entity without explicitly saying why'.[211] Moreover, when enhancing a digital text with links, there should be an option to hide the links and just read the plain text, so as to protect the reader from constant distractions.[212] Authors of educational texts should constantly ask themselves what the consequences will be of placing links in their material and if they are really necessary. They need to add something valuable to make up for the distraction.[213]

Moreover, reading on the web in the form of hypertext should always be seen as an active way of critical reading and knowledge construction, in which students constantly need to evaluate what kind of knowledge they are looking for and how a certain web page will contribute to that. This critical attitude can teach the student certain important skills. Once those skills have been developed, a student is better able to deal with hypertext.[214]

Although in research, hypertext has already been cast aside as not the digital ideal it was expected to be, it is still used often amongst teachers and others in practice. Often it is heard, from both teachers and educational publishers, that links should be added to educational material to make it better. They think that this is one of the great digital possibilities – linking to other information. However, they do not always actively think of the

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[208] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 131.
[209] J. Stoop and J. Kircz, *De toekomst van (interactief) studeren*', p. 28.
[210] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', pp. 136-137.
[211] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 138.
[212] J. Kircz and A.H. Den Boef, 'Writing Differently in the Digital Era', p. 139.
[213] P. Meyers, 'A Look at Links'
[214] Kuiper, E. and M. Volman, 'The Web as a Source of Information for Students in K-12 Education', in J. Coiro et al. (eds), *Handbook of Research on New Literacies* (London/New York: Lawrence Erlbaum Associates, 2008), p. 248.

consequences. A gap can be seen here between research and practice – a gap that needs to be bridged in order to achieve better results in digital educational materials.[215]

The aim of all these new ways of structuring knowledge is to improve the learning experience for all types of students. Increasingly, everyone can be offered an individual learning path with the help of 'learning analytics'. In this kind of educational material, pieces of knowledge are built up as 'smart learning objects' that are offered to the student based on their individual learning preference and level. Martijn Luijks from educational publisher ThiemeMeulenhoff works to develop this kind of learning material. He stresses the importance of 'learning design': how to capture the theory as well as possible in a book or other medium. It is definitely not best to just give students separate pieces of knowledge; there needs to be more of a connection and coherence.[216]

How problematic these questions of coherence and efficient knowledge transmission may be will be seen when these projects gain ground in regular education. The philosophy behind them sounds plausible on the one hand, but they might create unwanted effects that cannot yet be predicted. With learning analytics, it is still the system that offers students their materials, starting from a basic point that is the same for everyone, and developing individually from there. But what will happen when students are free to choose for themselves how they read a text? Will they be able to make the right decisions and process the material in the right way?

Moreover, it is increasingly possible for teachers to compose their own material as well, collecting different learning materials and putting them together in, for example, a customised textbook.[217] Here too the question of coherence arises, although teachers should have more knowledge than students or other non-experts of how to produce proper learning materials. Still, the risk of fragmentation is present.

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[215] W. van der Steen in an interview, conducted by me on 30 June 2014.
[216] M. Luijks in an interview, conducted by me on 19 June 2014.
[217] DBW, 'Teachers Create Their Own Textbooks Through Apple iBook', *Digital Book World*, 14 May 2014 <http://www.digitalbookworld.com/2014/private-high-school-teachers-use-ibooks-author-to-create-e-textbooks/?et_mid=674067&rid=246188936> (8 September, 2014).

### 5.1.3 Multimedia

Increasingly, research is being done into the effects of multimedia learning. In terms of structure, multimedia brings variation to a text through, for example, illustrational videos in between paragraphs. For the reader this could bring a relief from reading long stretches of text, but it also challenges the brain more in that it constantly needs to switch from active reading to passive viewing. Becoming active again after having viewed a video might be more difficult than when they remain in the active state during the entire learning experience. This extra pressure on the brain is called 'cognitive overhead'.[218] This is also relevant for hypertexts, where readers constantly have to assess whether to click on a link and through that they lose their reading track and remember less of what they have read.[219]

What does seem to help process the information better, however, is incorporating test questions and a dictionary into the text. This makes it easier for students to process the knowledge right away, instead of first reading the text and then going on to digest it.[220] With the text complemented by other extra features, such as illustrational videos, audio and games, 'studying could become more of a 'total experience''.[221] However, these features should have a clear link to the text and only contain truly relevant information.[222] When this combination of different forms of input is set up well, Mayer states that knowledge transfer could be more successful compared to when only one form of input is used, as described before.[223]

Mayer has conducted research into multimedia and has come up with seven principles of how best to design instructional material. Even though this thesis is not directly about multimedia, a few of those principles are relevant here since they also concern textual structure and presentation. According to the 'multimedia principle', it is best to offer students both visual and verbal instruction, instead of only one of those.[224] The 'coherence principle' states that the instructional material should only contain relevant content and leave out anything extra, like embellishments such as pictures without a specific added

[218] N. Bakker, *Digitaal lezen – wie doen het al?*, p. 8.
[219] N. Bakker, *Digitaal lezen – wie doen het al?*, p. 8.
[220] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 2', p. 374.
[221] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 2', p. 375.
[222] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 2', p. 375.
[223] R. Mayer and V. Sims, 'For Whom Is a Picture Worth a Thousand Words?', p. 390.
[224] B. Dalton and C. Proctor, 'The Changing Landscape of Text', p. 314.

value.[225] In terms of coherence and integration, the 'spatial principle' and the 'temporal contiguity principle' say that corresponding elements such as text and illustrations should be placed closely together.[226] The 'signalling principle' says that crucial parts of the text, indicating the main steps in the argument for example, should be well marked so as to guide the reader through the organised text.[227]

The multimedia principle, however, is countered by others, who say that this switching between different kinds of presentation requires too much mental effort and is not fully effective.[228] Mayer's research focused on short uses of multimedia, not on in-depth reading. Moreover, the focus of that research was on university students, which is a very specific level. The results may differ in different circumstances.[229]

The level of engagement is important for a successful learning experience, and so some researchers recommend providing today's digital natives with engaging digital material that they are used to, using 'choice, interactivity, multimedia, and social networking'.[230] However, at the same time they say that this engagement means learning more superficially, and so it is still important to find the right combination and integration of this digital material in adequately composed learning materials.[231]

Learning with multimedia might, as said before, result in more shallow learning, also because the reader constantly needs to switch from active reading to passive viewing and because of all the different inputs, less mental space is left for actual learning. However, according to Van den Broek et al., 'successful comprehension depends to a large part on the amount of processing capacity or working memory a reader has available and on his/her ability to allocate this attention effectively and efficiently to the most relevant information in the text and their background knowledge'.[232] It just depends how well a student can cope with different kinds of media and the integration of multimedia and texts. This varies between different educational levels, but also individually. However, this does not just apply

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[225] R. Mayer, 'Multimedia Literacy', in J. Coiro et al. (eds), *Handbook of Research on New Literacies* (London/New York: Lawrence Erlbaum Associates, 2008), p. 365.
[226] R. Mayer, 'Multimedia Literacy', pp. 366-368.
[227] R. Mayer, 'Multimedia Literacy', pp. 365-366.
[228] A. van der Weel in an interview, conducted by me on 12 June 2014.
[229] B. Dalton and C. Proctor, 'The Changing Landscape of Text', p. 314.
[230] B. Dalton and C. Proctor, 'The Changing Landscape of Text', p. 319.
[231] B. Dalton and C. Proctor, 'The Changing Landscape of Text', p. 319.
[232] P. van den Broek et al., 'Cognitive Processes During Reading', p. 65.

to digital text, but to reading on paper as well. Actually, digital text might be able to better adapt to every individual compared to print text, giving more background knowledge when needed, for example. This has to do with learning analytics and is still developing.

Multimedia can definitely help to form comprehension skills for beginning readers. Through sources other than text, they are freed from the constraints of decoding the words and can focus on the message, developing skills that will improve their reading strategies later. Multimedia therefore can have two purposes: to illustrate or complement textual material for a better understanding and to develop comprehension strategies.[233] Although multimedia requires more attention and mental space from the 'reader', it may help in making easier connections between different related elements in the material, since there is a less fixed sequentiality – elements can be repeated or placed closely together instead of mentioned in a strictly linear fashion in a text.[234]

### 5.1.4 Suggestions from critics

If it proves to be true that reading long-form texts is beneficial for cognitive development, then it should continue to be taught in education. The preference of the student is of no influence in that case. However, when long-form texts prove to alienate students since they do not fit their ways of thinking anymore, some changes might need to be made. Neither of these conclusions can yet been inferred from research, however, so it is important to take both sides into account.

Research amongst a group of higher education students of media, information and communication studies showed that students want digital material to be something completely different from a paper textbook. They want short pieces of text with a clear structure and presentation. The digital material should have different layers from a summary to in-depth material and examples. Instead of chapters and paragraphs, this material is structured into subjects, which can lead to more information when clicked on. What remains important is that they need to have a good overview of the material, to be able to see what they have already studied and what is still left and to not lose track. For the students in this research, the basic element of the learning material is still the text. This can be complemented with extra materials. The text gives a student control over their learning, so

[233] P. van den Broek et al., 'Cognitive Processes During Reading', pp. 66-67.
[234] P. van den Broek et al., 'Cognitive Processes During Reading', p. 68.

that, for example, they can read the information of their own choice at their own pace, which is not possible when watching a video.[235]

Normally, before starting to read, readers need to answer questions about their expectations of the text. With digital texts, readers increasingly also need to answer meta-questions regarding the text first: 'How should I navigate this information? How can I expect to interact with this environment? What is my role or task in this activity? How can I add to this body of knowledge?'[236] This requires a different way of understanding and working with a text. The reader has more responsibility towards a text and its medium, but also towards the technology, and needs to interact with them more, according to Giffard.[237] He states that '[r]eading is an act of attention' and that, in the digital substrate, the reader first needs to find a way to deal with the many elements that hamper this attention.[238] Moreover, there is the danger of cognitive overload. An important responsibility of readers of digital text is also to be critical and to distinguish quality from less reliable sources in the bulk of information.[239] All of these aspects show that digital reading requires a more active attitude from readers on several levels.

An overview of the entire text or size of the learning material is important too. In a textbook, you can obtain this overview easily by flipping through the book. Digitally, however, this overview is more difficult to establish.[240] Even a good table of contents cannot give the reader a sense of volume in a way the book can. Moreover, the different learning elements, such as text and video, should be presented in an integrated way, so that they fit the way of studying. All relevant material on one topic should be put together, so that the student has an easy overview of what they need to read, watch or listen to. If this material is spread out, students are less likely to read, watch or listen to everything.[241] The structure of the material therefore should fit the structure of learning. This integration of material, when it contains audio and video, is arguably done best in a digital way, since there you can simply

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[235] J. Stoop and J. Kircz, *De toekomst van (interactief) studeren*, pp. 11-12.
[236] Coiro quoted in N. Bakker, *Help! De woorden en zinnen ontglippen me!* (Amsterdam, Stichting Lezen, 2009), p. 27.
[237] A. Giffard, 'Digital Readers' Responsibilities', in J. Kircz and A. van der Weel (eds.), *The Unbound Book* (Amsterdam: Amsterdam University Press, 2013), p. 81.
[238] A. Giffard, 'Digital Readers' Responsibilities', p. 83.
[239] A. Giffard, 'Digital Readers' Responsibilities', pp. 84-86.
[240] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 2', p. 379.
[241] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 2', p. 381.

place the video in between the text, and not just the link or a reference to a website in a paper book. This requires the extra effort of going to a computer and following the reference, whereas in a digital book the video can be viewed instantly. This is possible in ePub, for example, but not in PDF.[242]

Apart from the content itself, the materials that convey that content are also an important aspect for students to get satisfaction from learning. Lanham writes that the average textbook actually makes students dislike reading, because of their ugly appearance and bland writing style.[243] Already in 1993, Lanham fantasises about the features of a new kind of textbook, moving along with all the new developments:

> 'What would such an electronic text look like? Well, we must begin by saying that our handbook cannot be a textbook at all, not a book at all, and that we have as yet no word for the multimedia entity into which it has metamorphosed. And its conception of 'text' is so different from print that we probably need another word for that, too. And the 'reader' or student—his or her role differs so from that of a print reader that we need a new word here, too. Both 'author' and 'authority' become softened and diffused as the reading event moves from a one-time exchange to a continuing conversation. Our new electronic nontext-nonbook will be 'published' in a different way, too. It will be a dynamic, open-ended information system, critiqued and updated on a daily basis by its users, both local and distant, both teacher and student.'[244]

It becomes clear from this that so many things are changing that we cannot rightly predict what future textbooks will look like and whether they will even still be books or something of a completely different form. Lanham takes his vision of the future quite far. Possibly, many aspects will change, but it is also well possible that most will stay the same, because what we have now simply offers the best learning experience yet. New experiments so far simply have not had a groundbreaking effect. Future research and experiences will show.

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[242] E. Gommers in an interview, conducted by me on 24 June 2014.
[243] R.A. Lanham, *The Electronic Word: Democracy, Technology, and the Arts* (Chicago/London: University of Chicago Press, 1993), p. 9.
[244] R.A. Lanham, *The Electronic Word*, p. 126.

Focus is an important aspect for students. The text or other kinds of learning material need to be central. Digital material can offer many distractions, since other applications are only one click away and sometimes messages of incoming e-mails, for example, even pop up while studying onscreen. This constantly deflects attention from the learning activity, whether this is text or something else.[245] Whatever the learning task is, focus is crucial.

It might also be good for students to be able to decide on their own pace of moving through the material. When they are presented with screenfuls of information between which they have to click to move forward, it is best to let them decide for themselves when they move on to the next page. This also holds for videos in several parts. According to researchers, students are better able to process the information in this way, being in control themselves.[246]

Meyers offers some suggestions for simple additions to non-fiction books that will give the reader more to hold on to. In a 'Best Bits' section in the book, the author could pick his favourite parts or the ones he thinks are most important. By presenting different 'Reading Paths' through the table of contents, readers can find their way through the text through numerous routes, for example topic-themed. This changes the navigational structure and lets readers decide which way they choose through a text. Generally, Meyers claims that the best way to develop digital material is to be 'adding less and instead instrumenting these digital documents so they help us do more'.[247]

Simple features might already improve the digital reading experience compared to what it often is now. For example, for comprehending the text properly, pop-up boxes with explanations could be programmed to pop up when the reader hovers over or clicks on a certain word. This would contribute to solving the distraction of having to move to a glossary elsewhere to find the information you need.[248] A comparable feature could be a pop-up box with information about a character or an event in a text, to remind the reader of the facts when they re-enter a text after having stopped reading for a while. This saves them the time of looking back through the text and makes remembering easier. Meyers claims that '[a] key

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[245] F. Jabr, 'Why the Brain Prefers Paper'
[246] S. Neuman, 'The Case for Multimedia Presentations in Learning', p. 48.
[247] P. Meyers, 'Ebook Enhancements, Take Two: Shorter, Less Sparkly, More Functional', *A New Kind of Book*, 5 May 2014 <http://newkindofbook.com/2014/05/ebook-enhancements-take-two-shorter-less-sparkly-more-functional/> (26 September, 2014).
[248] J. Stoop and J. Kircz, *De toekomst van (interactief) studeren*, p. 10.

part of understanding a book's meaning lies in remembering what the text says. We draw conclusions and pass judgements only when we're able to stash away mental nuggets: a character's actions, events in a country's history, and so on'.[249]

A useful addition to argumentative texts that are based on certain assumptions might be interactiveness with those assumptions. Changing the basic facts and figures of a claim, the reader can see the new results. By playing with this, adjusting and readjusting the numbers or assumptions, readers can get a better grasp of what is being argued and what alternative solutions might be. The same goes for mathematical examples. When the reader is able to change certain numbers or parameters, he might gain more insight into how, for example, an equation works.[250] An example of this is Victor's Explorable Explanations project. The documents are reactive, responding to what the reader is doing. The text is also readable as regular text, but active reading is made possible through the explorable features. Victor writes that '[t]he goal is to change people's relationship with text. People currently think of text as *information to be consumed*. I want text to be used as an *environment to think in*'.[251] To Victor, it is vital that the author 'guide[s] the reader, and provide[s] a structure for the learning experience. Only then can the reader respond, by asking and answering the questions that the author provokes'.[252]

### 5.1.5 Special education

So far, the discussion has only involved 'regular' students, since this thesis is mostly centred on textual structure and so on students who generally have no problems reading texts. Digital features that support this textual structure, however, can offer extra opportunities for other students, like those who cannot see well, who are dyslectic or who are slow and difficult readers. Students with impaired vision can benefit from digital materials that can read the text aloud (text-to-speech).[253] Dyslectic students read better when they can

[249] P. Meyers, 'What Readers Need vs. What Devices Can Do', *A New Kind of Book*, 10 July 2012 <http://newkindofbook.com/2012/07/what-readers-need-vs-what-devices-can-do/> (14 May 2014).
[250] P. Meyers, 'What Readers Need vs. What Devices Can Do'
[251] B. Victor, 'What Does it Mean to Be an Active Reader?' *Explorable Explanations*, 10 March 2011 <http://worrydream.com/#!/ExplorableExplanations> (26 September, 2014).
[252] B. Victor, 'What Does it Mean to Be an Active Reader?'
[253] T. Hillesund, 'Digital Text Cycles', n.p.

increase the font on an e-reader.[254] Slow readers can use text-to-speech features as well, including an overlay (a possible feature in ePub 3, for example) that highlight the words as they are being read aloud.[255] These features help students with difficulties to be able to read the same text as 'regular' students. Digital materials, then, need very different consideration in special education and for particular students in regular education. They offer extra opportunities for students with learning difficulties, but also for students who have a higher level and can be challenged more.[256] Through learning analytics, as said before, they can be offered material more suited to their level. Arguably, 'special' students can benefit much more from digital possibilities than others who just use it because it is possible and because it might offer some extra features.

### 5.2 Problems and opportunities

What has been mentioned about digital educational texts so far shows that

> 'electronic text-books and other electronic learning materials are much more than a collection of snippets of text linked to a database of pictures, videos and audio files. The new way of reading and learning, using electronic devices, allows for fast and comprehensive delivery of materials but also induces new ways of composing, structuring and mutually relating the various presentations of the underlying knowledge and instructions'.[257]

How effective these new ways of composing and structuring are will be seen in future experiments.

Digital learning materials offer very different opportunities compared to paper materials. Many have already been discussed in the previous sections. Another example is the fact that digital text offers the possibility for quick searches, to 'focus on short segments of a longer text and to navigate through an extensive set of familiar materials'.[258] This sort of reading is also important in education. At first, students should read their texts deeply to get

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[254] M. Young, 'How Are eReaders Affecting Our Children?', *TeleRead*, 30 June 2014 <http://www.teleread.com/ereaders/ereaders-affecting-children/?et_mid=680431&rid=246188936> (26 September, 2014).
[255] M. Garrish, *What is EPUB 3?* (O'Reilly Media, 2011).
[256] B. Dalton and C. Proctor, 'The Changing Landscape of Text', pp. 299-300.
[257] J. Stoop et al., 'Reading and Learning From Screens Versus Print. Part 2', pp. 382-383.
[258] C. Marshall, *Reading and Writing the Electronic Book*, p. 21.

a firm grasp of the content. However, afterwards, when studying for an exam or when using the material in a discussion, they might want to quickly search for a particular passage. In these different reading styles, both paper and digital text are of use for the different stages. For being able to reread passages without always carrying a heavy book around, a digital device with digital, searchable text is quite convenient.[259]

Digital texts that offer all kinds of information and links to other web pages are not the ones that readers will remember. An overload of elements will not satisfy students; it will frustrate them and make them lose track. Perhaps a simple, clear design with a few enhancements is better to create material that is good for serious, efficient study.[260] Texts should make the reader focus in order to remember the contents properly.[261] As Wright also says, 'a more streamlined and cleaner look [is] easier on the reader'.[262]

The present day in education is clearly a transitional phase in which experiments with new opportunities are carried out while materials are still rooted in the tradition of the book as well. Luijks for example develops the interactive learning app 'Schooltas', in which digital books are placed that are direct copies of the paper books. On top of that, an interactive layer is placed which contains links, multimedia, options for sharing with peers and more. Even though this is not the ideal form that digital material could take, it was a conscious decision for this publisher to develop it in this way. People need to be able to make good sense of the material, so you can only slowly include completely new features. This way, the steps to new material are small, but definitely present.[263]

One of the main constraints of digital learning right now is that the book has been deeply rooted in Western culture for so many years. Its physical form, its typographical norms and its ways of storing information are so familiar that it is difficult to leave this framework behind to think of truly innovative ways of conveying information. There must be new ways, possibly digital, possibly others that developers have not even considered, but they are hard to think up without keeping familiar frameworks in mind. There are always frameworks from which people form their new ideas; this is inevitable and crucial in cultural continuity. We still speak of 'pages', for instance, when discussing digital text. Traditional

[259] C. Marshall, *Reading and Writing the Electronic Book*, p. 21.
[260] J.L. Wright, 'What Enhanced E-Books Can Do for Scholarly Authors'
[261] P. Meyers, 'Sidelinks'
[262] J.L. Wright, 'What Enhanced E-Books Can Do for Scholarly Authors'
[263] M. Luijks in an interview, conducted by me on 19 June 2014.

concepts are inevitable in shaping thoughts of new concepts.[264] True out-of-the-box thinking is very difficult.[265]

For now, the framework of the book means that most digital learning products still contain central features from the book. The question is to what extent this really adds to the learning experience. Most likely, only a completely digital-born form of learning can actually make a difference in modern learning and teaching. At the moment, learning with books is complemented with more and more digital tools. However, perhaps a completely digital education – organised radically differently – could offer much more. This is something of which we cannot fathom the concrete shape it could take. Experiments take place, but these should really prove themselves in order to be accepted as useful learning tools.

Basically, anything is possible right now. However, teachers and schools should be careful just adopting anything new that sounds good and has potential. Education is crucial in the first part of every child's life, so it cannot just be played around with, just because there are digital features that *might* work and are 'cool' to work with. According to Young, '[t]he general consensus is that both print books and digital readers build separate skills for the young reader. Rather than choose one or the other, students should use both as complementary skills that will help them become well-rounded, effective readers.'[266]

Perhaps the current developments will lead to different cognitive skills concerning reading and learning. Our brains might be changing with all the new and different kinds of input they get. Attention spans may decrease, but the brain might be able to work faster because of multimedia. Just like the new digital age is different from the age of the book, the human brain will be different too. Perhaps it is simply not fitting to 'judge new minds by old values'.[267] Perhaps we should accept the changes, but that is still hard because many changes seem to have negative short-term effects. Change, however, is normal. Different kinds of text, for example, had different levels of popularity in different times. Where in the Middle Ages people mostly wrote letters, now the essay is a more common way of

[264] Van der Weel, *Changing Our Textual Minds,* pp. 21-22.
[265] L. De Brabandere and A. Iny, *Thinking in New Boxes: een nieuw paradigma voor creativiteit* (Tielt: Lannoo, 2014), pp. 14-15.
[266] M. Young, 'How Are eReaders Affecting Our Children?'
[267] Greenfield, quoted in A. van der Weel, *Changing Our Textual Minds*, p. 204.

conveying knowledge.[268] Ways of reading, and perhaps thus also ways of thinking and processing text, change.

An important question in the development of digital books and other texts should be what the added value of the digital version is. Publishers can move along with trends and comply with wishes from teachers and students, who are increasingly familiar with digital material, but they should not do so without basing their new additions to educational material on thorough research. It is not yet known whether and in what form digital material is either good or bad for learning on the long term. It changes the learning experience, perhaps making it more fun for students to work with, but the true benefits have yet to be proven. As Meyers also writes, '[r]ather than starting from what the iPad or EPUB 3 makes possible, we should instead think about where print fails to solve readers' needs. By keeping a simple question in mind regarding any enhancement – what's it for? – I think we can create digital books that are superior to print in some really tangible ways'.[269]

[268] R.A. Lanham, *The Electronic Word*, p. 127.
[269] P. Meyers, 'What Readers Need vs. What Devices Can Do'

## 6. Conclusion

### 6.1 Review of main points

Throughout this research, many examples of new structures of texts have been discussed. Digital developments are especially reflected in new ways of navigating texts because of new structures such as hypertext. These structures, but also the screen used for reading, the new forms of distractions and many other elements make digital reading very different from paper reading. There are many kinds of texts, with expository texts and sustained arguments seeming to be best suited for educational purposes. Texts for education should have a certain pedagogical structure that builds up the knowledge with material going from basic to more in-depth.

Interesting new developments can be seen that ask for further research into their effects on educational results. Based on research done so far, it is questionable whether going fully digital in education is a wise decision. Digital texts are often read less intensively; readers skim and look for important information rather than read immersively.[270] However, it has been seen that, for good learning results, deep and reflective reading are required, next to working actively with a text. Digital does bring advantages for other aspects of learning than deep reading: searching, navigating, accessing, sharing – these features add something new and useful to the learning process by stimulating active reading.

Important in education is to put the content first. It is key that a student acquires the appropriate knowledge in a way that is as effective as possible. The medium through which the material is offered to the student should be chosen by looking at the purpose of the content. Educational goals and didactic principles should always be kept in mind when creating new digital material. Moreover, every educational level requires something different, so texts should be designed to fit every individual level. For some levels, digital material might actually work better than print material because of the options it offers. For special education, this is definitely the case. Motivation can also be a factor influencing the new material; digital material might be more fun to work with, but it might bring less good learning results. However, motivation should not be a decisive factor; the quality of the learning material and its educational aims should come first.

[270] C. Marshall, *Reading and Writing the Electronic Book*, p. 21

It has been shown that directly copying print material into a digital form like an e-book does not result in anything well usable. As Siemens and Koolen put it, '[s]uch devices are, still, pale reflections of the models they attempt to mimic, and the content they provide does not yet afford the basic functionality, versatility, and utility of the printed page'.[271] Digital material should offer something new to complement the paper material. In all material, text seems to remain the most important element. And even though teachers, students, publishers and others in the educational field see the potential for revolutionary digital learning materials, they all still stress the importance of the text as the basic element and a certain degree of coherence and pedagogical progress in the material.[272]

Texts should thus be coherent and well-structured so that the reader has a good overview. Only relevant information should be given, and related units of information should be placed closely together. It should take into account the reader's background knowledge, to offer exactly the right amount and level of new knowledge. Increasingly, this is done in non-linear fashion through modularity, sometimes already with support of learning analytics to give every student an individual learning track.

Digital text and reader preferences influence each other and may be stuck in a vicious circle. Digital texts are often shorter than print texts, and thus readers are becoming used to shorter text units and have less great attention spans for longer texts. However, critics say that long-form texts are crucial for developing deep and critical reading skills and for interacting with an argument instead of just consuming short pieces of knowledge. If this is indeed the case, then the educational value of learning to read long-form texts should outweigh students' preferences.

Multi-linearity and modularity are other characteristics of digital text. These kinds of structures are interesting to experiment with, but should be developed very well to work for education. For now, hypertext has not proved to be that effective. It requires good orientation and critical reading skills from students, which they first actively need to acquire before being able to read hypertext properly.

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[271] R. Siemens, C. Koolen et al., 'E-reading Essentials in a Time of Change and Unfixity', in J. Kircz and A. van der Weel (eds.), *The Unbound Book* (Amsterdam: Amsterdam University Press, 2013), p. 110.

[272] In interviews with publishers E. Gommers and M. Luijks, teachers C. Paul, G. Koning, W. van der Steen, A. Hegeman and I. ter Halle, and professors J. Kircz and A. van der Weel, conducted by me on 12, 17, 19, 24 and 30 June 2014.

It has not yet been proven whether multimedia in an educational text increases learning results on both short and long term. It might increase students' motivation and activate more different ways of learning. A text containing multimedia should in any case be well designed as a coherent text with nothing but relevant information that is placed in the right places, with clear indications concerning the structure and important parts of the text.

Students need to have an easy overview of a text, should be able to focus and not be distracted by irrelevant elements, and might learn better when they can study at their own pace. A video, for example, does not support this, since it has a predetermined pace. Extra digital features might help, as long as they do not distract from the main purpose of the text or force the student to switch too often between levels of active and passive learning.

### 6.2 Review of case study

Looking back at the example cases in chapter 3, it can be concluded that, for now at least, the multimedia book is perhaps the best solution for a new presentation of text. This presentation remains quite similar to the traditional book, except it is presented digitally with multimedia features. This way, all the different learning elements are integrated and placed closely together exactly where they are relevant, which has been seen to be important in chapter 4. There is still a clear structure and a linear argument, which can be complemented with extra features. These features, however, should be relevant and of added value to the text and not just function as illustrational material.

A practical drawback for multimedia e-books so far is that not all digital readers support the extra features. A publisher can make a brilliant file containing all kinds of different multimedia and interactive features, but when readers cannot use these features, only the text remains, incomplete without the extra material. For now, there is no platform that supports everything and can be used easily by schools and students. The ideas are good and there are ways of programming available, for example in ePub, which is an important publishing format for fiction already. However, enriched ePubs cannot be opened properly in every reader, and therefore, to use them in education, improvements are needed so that everyone can access the material in the right way.[273]

[273] M. Beernink, 'Het e-book wordt volwassen: wat kan de EPUB-3?' *Het Boekenschap*, 4 March 2014 <http://www.hetboekenschap.nl/het-e-book-wordt-volwassen-wat-kan-de-epub-3/> (26 September, 2014).

Citia is more revolutionary and might offer some educational potential as well. An important condition there is that there should be enough coherence in the cards – the different pieces of text. For regular non-fiction, Citia works fine in that readers can find their own path through the text and focus on and skip what they want. For students, however, this is different: they basically need to read everything, except perhaps when some pieces of knowledge are already familiar to them. They could skip those, but the rest of the material still needs to be read and should be accessible in a clear way with good overview. A challenge for this kind of presentation is also how to make a reference to it, since page numbers do not exactly do the trick anymore. Would card numbers be a solution?

However, what Citia offers mostly is a summary of a book. This is how it could definitely be used in education, as material to freshen up your knowledge or to allow for a quick and easy overview of the material. The original text should then still be given as a whole too. However, then the question remains whether students will actually read the original texts, when it is easier to just read the digital summary. There is a certain trend that students read less, buy fewer books, and just work with summaries, and then teachers and publishers should carefully consider the consequences of offering such a summary.[274]

If learning analytics and modularity take flight and become more generally accepted in education, the idea of Citia could be combined with that. Yet, as said, the structure should still be clear.

The tap essay offers an interesting idea for text presentation, but is not well suited for all parts of education. Perhaps it might be interesting to use in poetry classes to examine ways of reciting, or to learn how to write a convincing argument or column. In this way, it could work more as a writing tool than a reading tool, since you can create your own essays in the app. However, for most texts, it is also important to have a sense of the structure – it is not just the rhetoric that matters. This way of presenting does, however, make reading more interesting as well, so perhaps certain texts may be suited to be presented in this way. But again, if students are to review and work with the text, they should have it in the original form as well so as to make reference to it.

Spritz reading can offer limited opportunities for speed-reading, when students have a large amount of reading to do. However, it has not proved to be beneficial in every way

[274] In interviews with publisher E. Gommers and teachers C. Paul, G. Koning, W. van der Steen and A. Hegeman, conducted by me on 19, 24 and 30 June 2014.

and it especially does not stimulate deep reading, so it should not be used as the sole way of reading. Moreover, when students want to revisit the text to review it, it should also be available as a whole, with page numbers and typographical cues. It is more of a tool for students to use individually if they should want, and not something through which education is possible on a systematic basis.

### 6.3 Conclusion and further research

Examples from digital non-fiction texts offer interesting inspiration for educational texts. However, they cannot be copied directly. Educational texts need to adhere to certain pedagogical demands, whereas non-fiction texts for a general audience do not. Therefore, there is less flexibility in playing with new developments in educational texts than in other texts. Education has the responsibility of providing students with proper material that is based on pedagogical theories and proven practical effectiveness. Experiments with digital material should not go too far without knowing whether it may or may not be harmful to learning results. There are definitely some opportunities for enhancing educational material with new features, but successes from regular non-fiction can definitely not be copied directly into educational material.

The cases presented in this thesis showcase several interesting possibilities of structuring and presenting digital text, and they can all be used in different parts of education. However, this should still be on a secondary level. However interesting a multimedia e-book appears, for instance, it should still be remembered that screen reading is less comfortable than paper reading. E-readers offer solutions for this, but they usually do not yet support multimedia. It perhaps offers good options for creating a coherent text with integrated multimedia material, so that everything is in one place and easily accessible, but in terms of reading comfort one loses certain important aspects. Moreover, these e-books are not properly accessible, with all their features functioning well, on all devices and in all reader software. Such constraints still make the case against wide digital learning: it does not yet function well enough everywhere to be fully accepted.

From all this, it appears that a paper text with a linear structure is still the best way of conveying the basic educational texts. No revolutionary digital structure has yet proven to provide better learning results than paper texts, long-form and unattractive as they may be. Reading long-form texts might even be a prerequisite of education on its own. An idea for

now might be to keep offering the paper text as a basis, and develop additional digital material next to it. This could be an extensive, easily accessible database containing online material with a clear structure and path. This way, the features of paper and digital are combined into a constructive, active learning experience. In a completely digital setting, the multimedia book would offer this exact experience. However, reading on paper still seems to be too important to let go of entirely.

However, with all the new possibilities, it seems a shame to leave it at this. Much more research needs to be done into short- and long-term effects of numerous digital learning initiatives. And to be able to fully develop these initiatives, the traditional framework of the book needs to be let go much more than it is now. Much potential lies in integrated learning environments in which all learning materials are combined. With screens becoming increasingly better and less eye-straining, other drawbacks can be overcome as well to move towards the education of the future. It cannot possibly be said what this will entail, but there are some interesting years of development ahead.

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