PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 46, 2012
66

NEUROSCIENCE, WORLD WIDE WEB AND READING CURRICULUM

Metka Kordigel Aberšek
University of Maribor, Slovenia
E-mail: metka.kordigel@uni-mb.si

Abstract

Neuroscience has proved a malleable nature of our brain. The way of thinking is changing lifelong and not only in early childhood. New media as television, video games, and the Internet change students' cognitive skills. New visual-spatial skills, such as iconic representation and spatial visualization are developed. But parallel to these changes new weaknesses occur. Those are in higher-order cognitive processes, as abstract vocabulary, mindfulness, reflection, inductive problem solving, critical thinking, and imagination (Greefield, 2009). Those are the reasons why reading curriculum in contemporary educational system should focus on two groups of aims: deep online reading and linear literature reading. By deep reading is meant the sophisticated processes that propel comprehension and that include inferential and deductive reasoning, analogical skills, critical analysis, reflection, and insight. By linear literature reading is meant primarily reading of fiction, which develops the imagination, inductive analysis, critical and abstract thinking

Key words: *cognitive skills, linear reading, neuroscience, reading curriculum, reflexive reading of fiction, World Wide Web.*

Introduction

For a long time scientists taught, that our mental meshwork, the connections formed among the 100 billion neurons, was largely fixed by the time we reached adulthood. But brain researchers have discovered that that's not the case. Recently neuroscience has proven the malleable nature of our brain. Even the adult mind "is very plastic." Nerve cells routinely break old connections and form new ones. "The brain," according to James Olds, "has the ability to reprogram itself on the fly, altering the way it functions." (Carr, 2008)

Thanks to the ubiquity of text on the Internet, not to mention the popularity of text-messaging on cell phones, we may well be *reading more* today than we did in the 1970s or 1980s, when television was our medium of choice. But it's a different kind of reading, and behind it lays a different kind of thinking. The question 'what kind of brain is the Web giving us' will be the subject of a great deal of research in the years ahead (Carr, 2011). Existing studies by psychologists, neurobiologists, and educators point to the same conclusion: When we go online, we enter an environment that promotes cursory reading, hurried and distracted thinking, and superficial learning. The Internet grants us easy access to vast amounts of information, but it is turning us into shallower thinkers, literally changing the structure of our brain.

Two Kinds of Changes, the Positive and the Negative Ones

The most used tool for observing and measuring the capacity of human brains (before inventing modern neuroscience tools) was the IQ test. Comparing the results of this test of last 100 years shows the continuing global rise in IQ performance. This rise, known as the Flynn effect, is concentrated in nonverbal IQ performance (mainly tested through visual tests) but has also occurred (in fact in lesser extent) in verbal IQ. (Flynn, 1994, 1998). This could be a

ISSN 1822-7864

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 46, 2012

consequence of different factors: the increasing levels of formal education and urbanization were particularly important in the United States and Europe in the first half of the 20th century, while the technological changes are a more important factor in the second half of the 20th century. (Greenfield, 2009).

Greenfield (2009) describes three types of positive changes in human brains as a consequence of expose to new media and especially to video games: *basic visual literacy, divided attention*, and *multitasking,* defined as carrying out more than one task simultaneously. All this could be evaluated as a positive change. New generations of Homo sapiens – the future workers will be/are able to concentrate on many tasks simultaneously. This should increase the effeteness of their work/learning/problem solving dramatically. But studies of cognitive effects of multitasking show into two directions.

- The *first direction* shows the study of the cognitive effects of multitasking that used CNN headline news to simulate a socially realistic and important cognitive task: understanding the news. While speakers were presenting the news by talking, weather forecast icons, sports scores, stock quotes, and textually delivered news appeared at the bottom of the screen. To process these simultaneous stimuli requires multitasking. A significant difference among generations was established: while younger viewers (18 – 34) declared such formats as pleasant, older viewers (over 55) disliked them most (McClellan, Kerschbaumer, 2001).

- A control study shows into the *second – opposite direction*: The distracting information exacts cognitive costs, even from the younger generation, who has had more experience with multitasking. College students recalled significantly fewer facts from four main news stories in CNN visually complex environment than from the same stories presented in a visually simpler format (Bergen, Grimes, Potter, 2005).

Human's brain has obviously adapted to new media in a way we can evaluate as a positive and as a negative development. The changing balance of media technologies had led also to loose – in the field of scientific thinking, in the capacity to imagine and in the area of abstract taught (Greenfield, 2009):

- *Scientific thinking* - although visual literacy is a tool in scientific thinking, scientific thinking goes beyond the techniques provided by visual literacy, highlighting the importance of a number of other qualities: reflection, inductive analysis, critical thinking, mindful taught.

- Imagination – visual element in television leads to weaker imaginative responses, defined in the creation of original elements and not found in preceding stimuli.

- And back to the scores of IQ tests: While the scores on nonverbal and verbal rose simultaneously verbal SATs have fallen. Paradoxically, omnipresent television may be responsible for the spread of basic vocabulary that drives verbal IQ scores, while simultaneously the decline of recreational reading may have led to the loss of the more abstract vocabulary driving verbal SAT scores.

ISSN 1822-7864

All this will influence the educational system. Changes could go in two directions: school can adapt its goals and teaching strategies on the new way of brain functioning or it can detect/recognize deficits and find ways to create environments to develop missing skills human beings need to remain "homo sapiens".

Homo sapiens → homo zappiens

The first option is based on the extreme position Homo sapiens does not exist anymore – he has already changed in to the *homo zappiens* (Veen, Vraking, 2006). He has become a new species with very developed iconic skills and can excellently function in the multimedia world. Homo zappiens does not know the problem of information overload – in fact he has learned to exercise »the strategy of raising and lowering his attention levels, switching from one to the other information« (Veen, Vraking, 2006:61). Homo zappiens looks for conceptual structures first to get overview. Details (can) come later. In the very rich information environments as www is crucial not to focus on details in order to avoid getting lost in information richness – so homo zappiens developed the pattern of *zapping behavior*. As a part of that behavior he *stopped reading in the linear way*. He developed the *strategy of scanning texts*: he reads only those paragraphs, that seem most appropriate and those he is able to make sense of from the bits and pieces of information.

According to this first option schools with classes, separated subjects, teachers, curricula and textbooks are not suitable for homo zappiens any more. They confront children with assignments a new generation finds boring, irrelevant and impossible to solve – because homo zappiens students do not have the abilities, needed to solve them, any more. The school should definitely adopt: more images and less word language, more e-material and less teachers, more iPads / notebooks and (as soon as possible) no textbooks.

The Proustian principle

The second option is called the Proustian principle. This option does not share the idea about full adaptation of school and its teaching strategies to the multitasking, iconic and skimming brain, students have developed in thousands hours of playing video games and surfing in internet. On the contrary: this option thinks critically about the consequences, if we do so and suggests the model of changes to avoid the anti-utopia scenario. Wolf and Barzirllai (2009) suggest a two track model: encouraging deep reading online and preserving the old fashion linear literature reading.

Encouraging deep reading online

An early immersion in reading that is largely online tends to reward certain cognitive skills, such as multitasking, and habituate the learner to immediate information gathering and quick attention shifts, rather than to deep reflection and original thought. The immediacy and volume of available information may well delude new learners into thinking they have what they need to know. From a pedagogical perspective, when information seems so complete, what motivation is there to go beneath and beyond it? From a cognitive neuroscience perspective, the digital culture's reinforcement of rapid attentional shifts and multiple sources of distraction can short-circuit the development of the slower, more cognitively demanding comprehension processes that go into the formation of deep reading and deep thinking. If such a truncated development occurs, we may be spawning a culture so inured to sound bites and thought bites that it fosters neither critical analysis nor contemplative processes in its members. Here lies the crucial role of education. Most aspects of reading—from basic decoding skills to higher-level

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 46, 2012

comprehension skills—need to be explicitly taught. The expert reading brain rarely emerges without guidance and instruction. Nevertheless, too little attention has been paid to the important task of facilitating successful deep reading online.

The development of tools—such as online reading tutors and programs that embed strategy prompts, models, think-aloud, and feedback into the text or browser— may enhance the kind of strategic thinking that is vital for online reading comprehension.

Linear Literature Reading

Good online reading skill, flexible multitasking and interactive modes of communication can assure the efficient, massive information processing and seemingly endless forms of digitally based entertainment – but these emphases are less suited for the slower, more time-consuming cognitive processes that are vital for contemplative life and that are at the heart of what we call *deep reading*. By *deep reading* is meant the sophisticated processes that propel comprehension and that include inferential and deductive reasoning, analogical skills, critical analysis, reflection, and insight. The expert reader needs milliseconds to execute these processes; the young brain needs years to develop them. Both of these dimensions of time are potentially endangered by the digital culture's pervasive emphases on immediacy, information loading, and a media-driven cognitive set that embraces speed and can discourage deliberation in both our reading and our thinking.

What is needed in current situation is the *Proustian principle*, fluent decoding processes, that enables readers to allocate the time and attention, necessary to process the ideas, information, story, and intellectual arguments and assumptions presented. To be sure, such comprehension is not simple, nor does it develop overnight in terms of clues to aid understanding. Little is given to the reader outside the text. For that reason, readers must engage in an active construction of meaning, in which they grapple with the text and apply their earlier knowledge as they question, analyze, and probe. In the process, they learn to build knowledge and go beyond the wisdom of the author to think their own thoughts.

Reflexive Reading in Future School Curricula

On that point the question, what should be the future of literature reading should be considered. The schools are/will be overloaded with computers and other e-devices. Teachers will be forced to use strategies, students are used to from playing computer games, and didactic strategies, which will primarily be student centered. There are two options: according to first option a reflexive reading will be an unnecessary extravagancy (Grisworld at all., 2005), according to second option a reflexive reading will gain new assignments.

The first and very often loudly defended option is, that the reflexive reading will become a hobby of a very tiny minority, a rear hobby as collecting stamps or interest for restorations of antique furniture. Such an exclusive hobby will be treated by majority, which will skim and zipp texts on screens, as an activity of elite class or as a harmless and wired activity of people, nobody can understand any more. In both cases a public school system will not waste the time for students to teach them to read literature, to encourage them to discover the literature history and the literature heritage of the world and of their national heritage. Reflexive linear reading will get no attention in the future school.

Opposite to such expectations it seems that in the context of latest neuroscience discoveries of human brain changing's under the influence of new media the role is going to grow and prosper. Developing student's receptive ability – ability to construct a reflexive meaning of a literary text (Jauss, 1978) – will gain new assignments. It will not only brighten the cultural horizon, encourage inculturation and multiculturalism and develop the empathic

skills. No, reflexive reading will create excellent circumstances for compensating/avoiding those deficits, which occur after (to) long exposure to computer texts, in which the functioning of human brain is influenced by the rules and patterns of computer programs. The reader in the process of reading fiction, in the process of reflection about his reading experience, activates cognitive activities as: reflection, indicative analyses, critical thinking and imagination.

To avoid the accusation of another try of romantic literature teachers to defense their in school history conquered positions, we shall prove the way, and how mindful reading literature develops imagination, inductive analysis, critical and abstract thinking. Let us have a closer look:

Imagination - is not something, what is given by the nature – as for instance the ability to see and hear. A creative imagination is a potential, which can be developed in the stimulative environment or can stay untouched, sleepy, waiting for the opportunity to develop. The electronic world, overloaded with pictures, is certainly not a stimulative environment for creative use of imagination. There are two reasons:

- There is no need for creative using of imagination and
- There is no time for using it.

A child watching fairy tales in the form of a Disney's cartoon or a movie gets perfect visual information: Cinderella (Cinderella, 1950) at the ball couldn't be more beautiful, her dress couldn't be more glamorous and her glass shoes couldn't be shinier. Cruella De Vil, the evil fur coat lover in 101 Dalmatian (1969), couldn't be more ugly, her hair more which-like and her nails more frightening. There is no opportunity and no need to create a visual image that would fit better to a positive character of Cinderella and the evil character of Cruella De Vil. And of course – even if such need would exist, there would be no time for that. Electronic devices are offering one picture after another in the speed, a child can hardly look at, and in that short time he has even difficulties to use all of them to create a coherent understanding of the fictional world.

On the other hand a receptive situation while reading or listening (=story telling) literature confronts a reader with very few data (textual clues), he could use for creation of eidetic picture of literary persons and setting. "Once upon the time there was a king… "said the fairy tale. "And he had a daughter, which… "Perhaps the text will offer the information, she was very beautiful – but that is almost everything a reader will get. For the creation of visual image (eidetic picture) of the princess, the reader will have to wait carefully for the useful textual clues as: what did she do in literary action, how she spoke, what did she say, how did she react to the actions of the other literary persons, what did other literary persons say about her, what attitude has the author toward her… All this and fare more must consider the reader to decide, weather the princess is a good or bad literary person – and as a consequence of that – whether she is beautiful or ugly (or in the case of bad person the text particularly described as a beauty – as the stepmother in Snow-white does – her beauty would be of the repulsive nature). And that is still not all the reader must do! The described textual clues are only a starter – details and information from previous fairy tales reception experiences must be taken in to account to create the image of the particular princess. An experienced fairy tale reader knows, how princess looks like (what is her dress like, how is she wearing her hair, what does she do when a dragon comes, when she meets a witch or when the prince is rescuing her. At the end (or more precisely: parallel to the process of monitoring the literary world) a reader is combining all this data into the visual image of the princess – his own creation, according to his taste, according to his experience, according to his pre-understanding of the literary world. Or in short: according to his horizon of expectations. No doubt: reading and listening fiction – a proustian reading approach – is the *activity very stimulative to develop creative imaginary capacity of the brain.*

Inductive analysis is a cognitive process used on more levels of reception process. For the

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 46, 2012

purpose of this study we shall lighten a thinking process, needed for a decision whether the literary text is a fantasy or it pretends to be a copy of reality.

The first decision a reader has to do is a decision*: reality or fiction.* With the first step at making this decision he must evaluate the textual clues according to criteria, described by D. Buckingham. According to Buchingham (1993) a reader is using two groups of criteria: in the frame of the first group a reader uses his knowledge about the structure, nature, characteristics of the literature genre and about the procedure the text has been produced. In the frame of second group of criteria he evaluates a fictional world according to his knowledge about the social rules/principles in the real world, he knows, and according to a psychological possibility a described literary action could have happened in the real world.

After this general decision, which is, according to Tzvetan Todorov (1970) a key element of communication between a reader and the text at reading fantastic fiction, a reader must accomplish a process of ontological classification (Lem, 1984). He must choose the zero point of his observation – which is his experience of the reality – and then, from this point of view, he must decide, what is the nature of deviation of the literary world, he is imaginatively participating in while reading a particular book. There are many patters of fantastic literary worlds (many types of mentioned deviations) a reader knows from his previous receptive experiences as: myths, ghost stories, gothic novels, science fiction, fairy tales, fantasies … and each of them has its own system of rules. Ontological classification of the literary world to one or the other system of rules enables the reader to construct a coherent meaning of the literary work, to make his own sense of the textual clues – to build his own meaningful interpretation. There is no doubt: reading and listening fiction – a Proustian reading approach – is the *very stimulative activity to develop the brain capacity* of inductive analysis.

Critical and abstract thinking – The absence of the ability for critical thinking, especially on the abstract cognitive level is one of the deficits, psychologists and educators are almost panically complaining about, when they are pointing out the weaknesses of so called distracted digital readers (Woolf, Bazirlai, 2009). A reception of literature offers the opportunity to develop critical and abstract thinking and so to avoid this kind of deficits of long exposure to computer texts too. We shall illustrate, how it works, by describing a thinking process, needed for adoption different perspectives in the reception process.

For adoption the perspective, different as his own, a person must notice three types of information:

- Informational parameter, data about what a particular literary person knows;
- Emotional parameter, data about what a particular literary person feels;
- Intentional parameter, data about what the literary person is intending to do, what is she intending to accomplish.

A reader must notice all this to adopt the perspective of one literary person. But to understand the literary world, he must simultaneously perform a thinking process of noticing and evaluating the perspectives of other important (or at the first sight, in this moment not yet important) literary persons, he must think about *all of them all the time at once* to construct the pattern of all this perspectives. This requires the thinking about thinking → as a consequence of this mental process a reader can understand the motivation for acting of different literary persons in the literary world.

Mental processing about text internal perspectives is not the only cognitive process, a reader is accomplishing concerning perspectives, relevant to the literary work. There are two other perspectives he must take into the account to construct a reflexive meaning of the text:

- He must take a look to the literary world from an author's perspective – to understand his communicative intention and
- He must (critically) evaluate the literary world from the text external perspective: from

ISSN 1822-7864

the perspective of ideology behind the text, from the social perspective, from the class perspective, from the gender perspective, from the historical perspective of the time and place literary work is talking about …

All these are abstract categories and to construct a reflexive meaning of the literary work, to notice and evaluate the concrete level in the text as a relaxing of brother generic reality, the reader must use the cognitive process of generalization and abstract thinking. There is no doubt: reading and listening fiction – a Proustian reading, approach is the *very stimulative activity to develop the brain capacity* of critical and abstract thinking.

Conclusion

To sum up: receptive linear reading of literary text gives an excellent opportunity for developing the capacity to imagine and provides the opportunity for developing a number of qualities as reflection, inductive analysis, critical thinking, mindful thinking in the area of abstract taught. All this has been pointed out as a deficit of a long exposes to online texts on the World Wide Web. On the other hand the receptive literature reading requires great amounts of attention and time for active imagination. That is the reason, why the aims of curricula in future schools should not exclude the receptive reading competence, because reading and listening fiction is the activity, very stimulative to develop creative imaginary capacity and it is the activity very stimulative to develop the capacity of inductive thinking, the capacity of critical and abstract thinking.

References

Bergen, L., Grimes, T., & Potter, D. (2005). How Attention Partitions Itself During Simultaneous Message Presentations. *Human Communication Research*, *33* (3), 311–336.

Buchingham, D. (1993). *Children talking television. The making of television literacy*. London: The Falmer Press.

Carr, N. (2008). *Is Google Making Us Stupid? What the Internet is doing to our brain*. http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/6868/. Retrieved 14. 4. 2012.

Carr, N. (2011). *Plitvine*. Ljubljana: Cankarjeva založba.

Flynn, R. J. (1994). In: *Encyclopedia of Human Intelligence.* R. J. Sternberg, Ed. New York: Macmilan, 617–623.

Flynn, R. J. (1998). *The Rizing Curve: Long-Term Gains*. In: *IQ and Related Measures*, U. Neisser, Eds. Washington. DC: American Psychological Association, 25-66.

Greenfield, P. (2009): Technology and Informal Education: What Is Taught, What Is Learned. *Science*, *323* (5910), 69–71.

Grisworld, W., McDonnel, T., N. Wright (2005). Reading and the Reading Class in the Twenty-First Century. *Annual Review of sociology, 31* (1), 127–141.

Jauss, H. R. (1978). *Estetika recepcije*. Beograd: Nolit.

Keller, T. A., Carpenter, P. A., & Just, M. A. (2001). The neural bases of sentence comprehension: An fMRI examination of syntactic and lexical processing. *Cerebral Cortex*, *11* (3), 223–237.

Lem, S. (1984). *Phantastik und Futurologie. I, II*. Frankfurt a M.

McClellan, S., & Kerschbaumer, K. (2001). Tickers and Bugs: Has TV Gotten Way Too Graphic? *Broadcasting & Cable, 131* (50), 16.

Nicholas Carr (2008) *Is Google Making Us Stupid? What the Internet is doing to our brains?* http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/6868/, retrieved 7. 5. 2012.

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 46, 2012

Herath, Channa, *How do we Read Online: The effect of the Internet on reading behaviour* Submitted http://researcharchive.vuw.ac.nz/bitstream/handle/10063/1443/thesis.pdf, Retrieved 20. 4. 2012.

Todorov, Tz. (1970). *Introductions la litterature fantastique*. Paris.

Veen, W., & Vraking, B. (2006). *Homo Zappiens. Growing up in a digital age.* London: Network Continuum Education.

Wolf, M., & Barzillai, M. (2009). The Importance of Deep Reading. *Educational Leadership, 66* (6), 32–37.

*Advised by Vincentas Lamanauskas, University of Siauliai, **Lithuania***

Received: *May 15, 2012* Accepted: *August 05, 2012*

Metka Kordigel Aberšek PhD., Professor, University of Maribor, Faculty of Education, Department of Primary Education, Koroška 160, 2000 Maribor, Slovenia.
E-mail: metka.kordigel@uni-mb.si

ISSN 1822-7864