Using a Cognitive Flexibility Hypertext to Develop Reading Comprehension. An Ongoing Case Study with Students of a Media Studies Degree.

Maria Isabel Orega  
University of Algarve, Portugal  
miorega@ualg.pt

António Moreira  
University of Aveiro, Portugal  
moreira@ua.pt

Abstract

This paper presents an ongoing case study on the use of the platform DidaktosOnLine (Moreira et al, 2005). The participants in the study are a class of first year students attending an English language course of the Media Studies degree, at the School of Education of the University of the Algarve. DidaktosOnLine was developed at the University of Aveiro by Moreira and his research team and is based on Cognitive Flexibility Theory (Spiro et al, 1987). This is a constructivist theory of learning and instruction which defends that information should be presented from multiple perspectives through the use of cases that function as examples of knowledge in context. According to Spiro et al (1987), multiple representations of knowledge and the development of cognitive flexibility are facilitated by the use of hypertexts which facilitate navigating through complex knowledge domains. As this theory emphasizes repeated presentations of the same material in reorganized sequences and from different perspectives, cognitive flexibility hypertexts provide non-linear links that help implement multiple dimensions of knowledge representation.

The students worked with a hyperdocument called Images of Britain and the British, to develop reading comprehension competences and their sociocultural knowledge on British society. The aim of the study is to understand the effect of some individual characteristics of the readers as well as the effect of features of the digital learning environment on the comprehension of the texts included in it. The individual characteristics of the learners relevant for the study are, among others, learning styles, epistemic preferences, prior knowledge of the themes of the texts and other documents, language proficiency, and reading experience. The features of the digital learning environment studied are essentially aspects of the design of the platform, which allow multiple representations of the texts and themes and their possible contribution to facilitate reading comprehension.

1 – Introduction

Nowadays, the new digital learning environments have contributed to the changes that Van Oostendorp (2003:xi) says "are occurring in society regarding the delivery of information to individuals and the way individuals process this information". In view of these changes, and in an educational context, it is important to understand how the students react to these digital learning environments. How do they assess these tools that claim so many pedagogical positive effects? How do students interact with a new type of document that requires a more active role of the user?

This paper presents an ongoing study on reading comprehension using a digital learning environment, the platform DidaktosOnLine (Moreira et al, 2005). This platform was developed at the University of Aveiro in Portugal and is based on Cognitive
Flexibility Theory (Spiro et al, 1987). This is a constructivist theory of learning and instruction which defends that information should be presented from multiple perspectives through the use of cases that function as examples of knowledge in context.

The ability to read and understand written texts in English is particularly relevant for students in Higher Education, especially in the context of a language course. However, students frequently find it difficult to read more complex texts, and to do reading tasks that require transfer of knowledge and summarising information from different sources. In a digital learning environment, the design of the document may possibly influence the way learners read and learn. Mishra, Spiro and Feltovich (1996:287-288), referring to Cognitive Flexibility Hypertexts, emphasise that “It is now widely accepted that technology is not neutral with regard to its effect on cognition. (...) different technologies engender different mind-sets or ways of thinking”.

The purpose of this study is to look at how some factors associated to the readers and to the texts may influence the text comprehension in a digital learning environment. Some of the factors associated to the readers that will be analysed are: language proficiency, learning styles, epistemic preferences and background knowledge. Regarding the factors associated to the texts, we will focus on aspects of the design of the hyperdocument that allow a special interaction of the reader with the texts, such as the possibility of thematically criss-crossing the texts of the mini-cases.

2 - Reading and the Reader

There have been several attempts to explain the nature of reading and to account for how we read and understand a text. The interactive models (Carrell, Devine and Eskey, 1988) are so far considered to give an adequate description of the process of reading. According to the interactive perspective, reading is an interactive process between the reader and the information in the text. The reader has a central role because (s)he contributes with his/her knowledge and experience. Schema theory (Rumelhart, 1980, Carrell and Eisterhold, 1988, Lencastre, 2003) emphasises the constructive nature of comprehension and the role of the background knowledge in the way we understand new information. Carrell and Eisterhold (1988:76) point out that “According to schema theory, comprehending a text is an interactive process between the reader’s background knowledge and the text. Efficient comprehension requires the ability to relate the textual material to one’s own knowledge”.

Spiro et al. (1992:64) also emphasise a similar idea when they say that comprehension is a process that goes beyond decoding the information in a text. ‘First, we take it as an accepted cognitive principle that understanding involves going beyond the presented information. For example, what is needed to comprehend a text is not solely contained in the linguistic and logical information coded in that text. Rather, comprehension involves the construction of meaning: the text is a preliminary blueprint for constructing an understanding. The information contained in the text must be combined with information outside of the text, including most prominently the prior knowledge of the learner, to form a complete and adequate representation of the text’s meaning.’

If the reader has such an important role in the process of comprehension, then we should expect differences in the way several readers understand the same text, taking into account variables such as, background knowledge on the topic of the text, readers’ attitudes, interests or reading styles.
Cognitive Flexibility Theory and Cognitive Flexibility Hypertexts

Cognitive Flexibility Theory is a constructivist theory of learning and instruction (Spiro et al., 1987). This theory attempts to overcome the difficulties that students experience at the stage of advanced knowledge acquisition, avoiding oversimplification of complex knowledge domains and helping the application or transference of the knowledge acquired to other contexts.

Spiro & Jehng (1990:165) explain the concept of cognitive flexibility in the following way: “By cognitive flexibility, we mean the ability to spontaneously restructure one’s knowledge, in many ways, in adaptive response to radically changing situational demands.”

According to Spiro et al. (1992: 65), “A central claim of Cognitive Flexibility Theory is that revisiting the same material, at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition”.

To implement this claim Cognitive Flexibility Theory suggests that complex subject matters should be presented from multiple perspectives through the use of cases that function as examples of knowledge in context. Each case is divided into small units, the mini-cases. Then it is necessary to identify the themes or points of view to analyse the mini-cases and write a thematic commentary explaining how a general theme applies to a particular mini-case.

As this theory emphasizes repeated presentations of the same material in reorganized sequences and from different perspectives, cognitive flexibility hypertexts are considered the ideal medium to implement multiple dimensions of knowledge representation.

DidaktosOnLine

The platform DidaktosOnline is a cognitive flexibility collaborative and distributed environment (Moreira et al., 2005). According to Carvalho and Moreira (2005:20) it was developed to achieve the following objectives:

1. to foster the production of hypermedia didactic materials by means of collaboration between teachers from common areas and interests;
2. to make universally available the didactic materials produced on the platform;
3. to foster the collaborative sharing of these materials among learning communities that share the same interests;
4. to develop mechanisms of production of e-portfolios for the collaborative construction of knowledge among communities of teachers and students;
5. to foster the development of teaching and learning communities, through the sharing of materials and to promote contacts among all users of the platform;
6. to establish the necessary conditions for the distributed education of teachers under the principles of CFT, random access instruction and case-based education.
The platform DidaktosOnLine allows the organization of a digital content database, which can be accessed, in a traditional, linear structure of content presentation, that is, reading the cases and mini-cases as if they were presented in a book. The content database can also be accessed in a non-linear way, implementing thematic criss-crossing, which means reading several mini-cases of different cases to which one theme or combination of themes apply.

The URL to access the platform is http://didaktos.ua.pt. You can access the platform as a content manager or as an ordinary user. To become a content manager you need to register in the system and be given a password by the platform administrator. As a content manager you may create projects that are organised in cases and mini-cases. The mini-cases may include texts, graphics, audio and video. A content manager may also create special sequences, suggesting the reading of particular mini-cases in rearranged instructional sequences that highlight a specific theme or themes, which is the way thematic criss-crossing is implemented in this platform.

An ordinary user doesn’t need to register in the system and has only access to the public areas of the platform. Figure 1 shows the first page of the project *Images of Britain and the British* presenting the list of cases and special sequences.

![Figure 1](image_url)

**Figure 1** - First page of the project *Images of Britain and the British*.

### 5 - Learning Styles

The interest for the individual characteristics of the learners is an attempt to understand how the general claims about the effect of methodologies or technologies may vary according to particular learners. Milton (2002:9) points out that “There is general agreement that all learners are not alike. Not only will they vary according to obvious characteristics like age and gender, they will also vary according to learning style and preferences. Presented with the same material in the same class, some learners are likely to find the materials helpful and learn well, while others may find the same tasks uncongenial and fail to make the progress they otherwise could.”
There is relative agreement about the idea that learners are not all alike. What is not so consensual is the identification of the differences among learners and how far they influence learning. The concept of learning styles is one of these variables. Dörnyei (2005:121) quotes Reid (1995) to present a general definition of the concept of learning style, “an individual’s natural, habitual, and preferred way(s) of absorbing, processing and retaining new information and skills”.

Several authors, (Brown, 2007, Dörnyei, 2005, Ehrmann, 1996) agree that the concept of learning style is synonymous of a set of personal preferences regarding the way a learner approaches and processes information. On the other hand, there are several views on the number of dimensions that integrate the notion of learning style, or on the way the dimensions are described.

For the current study we have decided to use the Ehrman & Leaver Cognitive Styles Construct, a construct that has been used and validated with students of a foreign language.

**The Ehrman & Leaver Cognitive Styles Construct (E&L)**

Ehrman & Leaver (2002) developed a profile approach to learning style diagnosis. The E&L model consists of a superordinate construct, synopsis-ectasis, and ten subscales.

**The E&L subscales**

1 – Field Sensitive - Field Insensitive
2 – Field Independent - Field Dependent
3 – Random (non-linear) – Sequential (linear)
4 – Global-Particular
5 – Inductive-Deductive
6 – Synthetic-Analytic
7 – Analogue-Digital
8 – Concrete-Abstract
9 – Levelling-Sharpening
10 – Impulsive-Reflective

To implement their approach, they developed an instrument, the Ehrman & Leaver Learning Styles Questionnaire (2002). This questionnaire consists of three items for each of the ten subscales. It has been validated in the USA at the Foreign Service Institute, as one of the questionnaires given to participants in the Learning Consultation Service of that Institute. Ehrman & Leaver (2003:411) explain that “The E&L construct offers a rich variety of information about language learners and language learning. It is useful alone, but even more so in tandem with other information, especially that which comes from discussions and interviews with students that add value, because they permit the interviewer and the learner to discuss unusual or apparently contradictory profiles and make sense of them in the learner’s current context.”

**6 - The Study**

Using a case study approach, the general purpose of this study is to focus on the comprehension of written texts in English presented in a digital learning environment, the platform DidaktosOnLine (Moreira et al. 2005).

The study aims at achieving the following objectives:
1 - To assess the importance of the characteristics of the design of the hyperdocument in the comprehension of written texts integrated in a hyperdocument developed with the platform DidaktosOnLine;

2 – To assess the importance of the characteristics of the participants in the study in the comprehension of written texts integrated in a hyperdocument developed with the platform DidaktosOnLine;

3 – To analyse the opinion of the participants in the study regarding the use of the platform DidaktosOnLine to access documents and study a topic of the syllabus;

4 – To find out the relationship between the characteristics of the participants and their opinion on the hyperdocument and the relationship between their opinion and the results of the test on the background knowledge and of the final task.

Research Questions

The study aims at answering the following research questions:

1 – What is the influence of the following characteristics of the design of the hyperdocument on the comprehension of the texts of the project *Images of Britain and the British*?

1.1 The resources, pictures, videos, charts, other texts, associated to the text of the mini-case;
1.2 The information presented in the areas “description”, “context” and “activities” of the platform;
1.3 The themes indexed to the texts of the mini-cases;
1.4 The sequences which implement a thematic criss-crossing;
1.5 The theme commentaries.

2 – What is the influence of the following characteristics of the participants in the study?

2.1 English language knowledge;
2.2 Experience of learning English, both at school and in other contexts;
2.3 Learning styles;
2.4 Epistemic preferences;
2.5 Experience as a reader, both in English and in the mother tongue;
2.6 Background knowledge on the topic of the project;
2.7 Age;
2.8 Sex.

3 – What is the opinion of the participants in the study regarding the use of the platform DidaktosOnLine to access documents and study a topic of the syllabus?

4 – What is the relationship between the characteristics of the participants and their opinion on the hyperdocument and the relationship between their opinion and the results of the test on the background knowledge and of the final task?

The Hyperdocument *Images of Britain and the British*

The hyperdocument *Images of Britain and the British* develops topics that are part of the syllabus of the English language course of the first year of the Media Studies
degree at the School of Education of the University of the Algarve. The hyperdocument includes seven cases that integrate between three to eight mini-cases each and includes fourteen themes to analyse the mini-cases.

**Figure 2** shows the first page of the mini-case *British Unity in Diversity*. The section *Description* offers a short description of the text.

![First page of the mini-case British Unity in Diversity](image)

**The Participants**

The participants of the study are the first year students of the Media Studies degree of the School of Education of the University of the Algarve enrolled in the English language course in the academic year of 2007-2008. All students have explored the hyperdocument both in a linear and in a non-linear way. In the first sessions they began to study the first cases, having access to the available resources and to the additional information in the sections *context* and *description*. In the subsequent sessions they gradually had access to more information in each mini-case, namely the section *activities*, and the themes indexed to each mini-case, as well as the thematic commentaries. Finally they had access to the special sequences which implement thematic criss-crossings and present the mini-cases in new arrangements according to specific themes.

**Data Collection and Treatment**

The following data have been collected, in order to answer the research questions defined above:
1 - Answers to several tests and questionnaires in order to build a learner profile of each of the students of the class:
- Identification questionnaire.
- Ehrman and Leaver Learning Style Questionnaire (2002).
- A language test (Quick Check Test).
- Test on the background knowledge of the themes developed in the hyperdocument.
- Reading comprehension test, selected from a collection of First Certificate in English tests.
- Questionnaire on epistemic beliefs (Moreira,1996).

2 – Answers to short reading comprehension tasks on the texts of the mini-cases. These tasks will be available in the field Activities.

3 – Summary of the main themes of the hyperdocument.

4 – Opinion questionnaire on the use of the platform DidaktosOnline.

5 – Interview with the students.

7 - Expected Outcomes

Although we don’t have yet the final results of the study, we can try to anticipate the answer to some aspects of the research questions and refer to some data based on the observation during the sessions and on general information from the interviews. Regarding the first research question on the influence of the characteristics of the design of the hyperdocument on the comprehension of the texts, in the interviews students emphasised the following aspects: The importance of the resources associated to the texts of the mini-cases, as a way to expand the information in the text. The visual resources, particularly the videos, helped to explain some concepts of the texts in a simple way. They also considered helpful the information presented in the areas description, context and activities as it introduced and contextualised the texts of the mini-cases. They all considered that the special sequences helped them very much to understand the themes of the mini-cases and didn’t find it boring to read the same mini-cases again, as some participants in previous studies have reported.

Regarding the second research question on the influence of the characteristics of the participants, the group is quite heterogeneous, which anticipates the possible influence of several learner variables in the way they have interacted with the platform and have performed the reading tasks. We are particularly interested in the results of the learning styles questionnaire and also in the results of the epistemic preferences questionnaire. The level of language proficiency of the students had certainly a great deal of influence in the way they read and understood the texts. As a mixed-ability group, there are obvious differences in the time needed to read the texts and to do the reading tasks and also in their reactions to the difficulty and length of some texts, although most of them are short.

Regarding the students opinion on the use of the platform, it was globally a very positive one. None of them had previously worked with a digital learning environment. There was one student who doesn’t like computers and said that he prefers other media. They agreed that they have learned quite a lot on the themes of the project. Only a few students considered the hyperdocument too long.

We are particularly interested in comparing the global results of the group with the individual characteristics of each student.
8 - References


D.H.(ed.s) *Constructivism and the Technology of Instruction. A conversation*, Hillsdale, Lawrence Erlbaum Associates. 57-75


