



E-Learn 2004

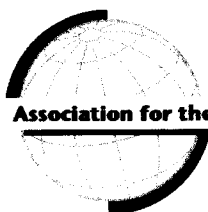
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Government, Healthcare, & Higher Education

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A Web-Based Learning Platform to Promote Cognitive Flexibility through Deconstruction and Reflection

Ana A. A. Carvalho
University of Minho, Portugal
aac@iep.uminho.pt

Virgínia S. Pereira
University of Minho, Portugal
virgínia@ilch.uminho.pt

Abstract: This paper describes and evaluates an approach to learning complex knowledge and to develop cognitive flexibility through a Web platform, FleXml, based on cognitive flexibility theory.

A Latin course, named "Sapere Aude", was implemented to evaluate the FleXml structure and communications facilities. The course structure is described as well as the study carried out. Results point out that the course structure promoted students learning and their involvement in the forum questions. Moreover, students mentioned that the structure of the platform facilitates learning.

Theoretical framework

Most Web-based platforms have several functionalities but are not concerned with a theoretical learning framework. FleXml is a Web-based platform whose main purpose is to structure a subject matter according to cognitive flexibility theory principles (Carvalho et al., 2002).

Cognitive flexibility theory (CFT) was developed by Spiro et al. (1987, 1988, 1990, 1995) and focuses on complex (ill-structured) and advanced knowledge acquisition. "Ill-structuredness means that there cannot be any recourse to homogeneity, to any single course of action across instances, whether it involves a single guiding principle, a single organizational scheme, or a single prototype case" (Spiro et al., 1987: 186).

Spiro et al. (1988) consider three levels of learning: initial or introductory, advanced and expertise. In the advanced level the learner "must attain a deeper understanding of content material, reason with it and apply it flexibly in diverse contents" (1988: 375). One of CFT aims is to develop cognitive flexibility that is a capacity that "involves the selective use of knowledge to adaptively fit the needs of understanding and decision making in a particular situation" (1988: 378). Moreover, as the authors claim, "the potential for maximally adaptive knowledge assembly depends on having available as full a representation of complexity to draw upon as possible" (1988: 378).

CFT is case-based. A case may be a sequence of a movie, a chapter of a book, an event. A case has to be divided into parts, called mini-cases. "The mini-case (a segment drawn from a larger case) is the starting point for all instruction" (Spiro & Jehng, 1990: 181). To analyse each mini-case it is necessary to identify the Themes. These are points of view, approaches, principles or concepts that help to understand the mini-cases.

CFT has two important and complementary learning processes: the deconstruction process and the thematic criss-crossing. The *deconstruction process* is centred on the mini-case, which is deconstructed (analysed) through several thematic commentaries (the applied themes). Each thematic commentary explains how a general theme applies to a particular mini-case. Other information may also be available about the mini-case that helps the learner to understand the mini-case.

The expression thematic criss-crossing is inspired in the work of Ludwig Wittgenstein, *Philosophical Investigations* (Spiro & Jehng, 1990). The understanding of a subject matter arises after criss-crossing it. "The same content material is covered in different ways, at different times" (Spiro et al., 1988: 379). The starting point is a theme (or a combination of themes) and the learner is guided along mini-cases of different cases. "By criss-crossing

topical/conceptual landscapes, highly interconnected, web-like knowledge structures are built that permit greater flexibility in the ways that knowledge can potentially be assembled for use in comprehension of problem solving” (Spiro & Jehng, 1990: 170). Both processes contribute to develop cognitive flexibility (Spiro & Jehng, 1990).

In previous studies (Carvalho & Dias, 1997; Carvalho, 1999; Carvalho, 2000) we concluded that thematic commentaries were responsible for statistical differences in learning. We compared the results achieved by a group (CFT) who had access to thematic commentaries (in the deconstruction process) and to thematic criss-crossing with another group (NTC: no thematic commentaries) that had no access to the thematic commentaries, and the first group had better results (Carvalho & Dias, 1997).

Although students achieved better results, they reported that the thematic criss-crossing was boring, when they knew all the mini-cases. We considered that not only both processes overlap but also that everything is predefined. Therefore students have a passive role as they only have to read the information available (Carvalho, 2002). This idea of a more demanding role in learning is also stressed by Anchored Instruction theory, particularly in the Jasper series (CTGV, 1997). At the end of each video of these series there is a challenge (a question) that students have to solve. We think that analyzing and reflecting is important in knowledge building.

So, we decided to include a challenge to the learners, giving them the chance to be guided in the deconstruction process and to be challenged in the forum, through a problem (stated as a question or a quotation) that will require a reflection about the knowledge learned.

FleXml: a Web-based learning platform

We conceived a Web platform, FleXml, to learn complex knowledge and to develop cognitive flexibility, that was structured to implement the process of deconstruction (Carvalho et al., 2002). We also took advantage of the facilities of the Forum to challenge students to reflect on the knowledge they had studied. We think that with this strategy, students will have more demanding and engaged learning opportunities, than following the thematic criss-crossing only.

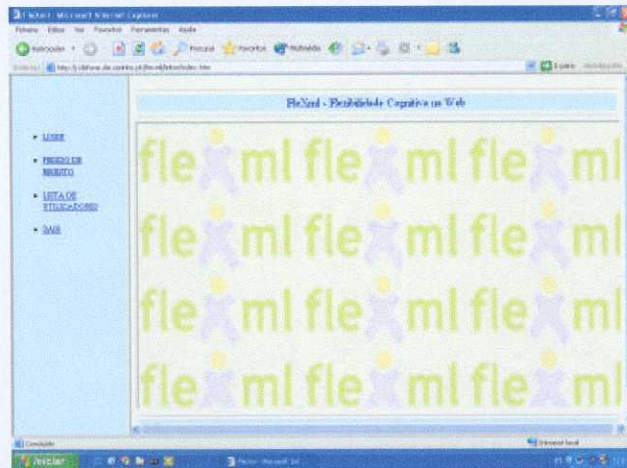


Figure 1 - FleXml homepage

FleXml is available at <http://xilofone.dsi.uminho.pt/flexml/leitor/index.htm> (Figure 1). The platform includes two distinct interaction modes: author mode and reader mode. In the author mode, the Authors build their Subject matters of study, and in the Reader mode students and teacher interact with the content and have access to communication facilities, such as chat, forum and e-mail.

The structure of a Subject matter of study can be represented as a tree that has its root in the identification of the Subject matter and ramifies in Themes and Cases and these, in Mini-cases (Figure 2). The Mini-cases, in turn, are associated to the Themes whose occurrence is explained through Thematic Commentaries. The diagram of figure 2 constitutes a representation of this structure, based on the Cognitive Flexibility Theory principles.

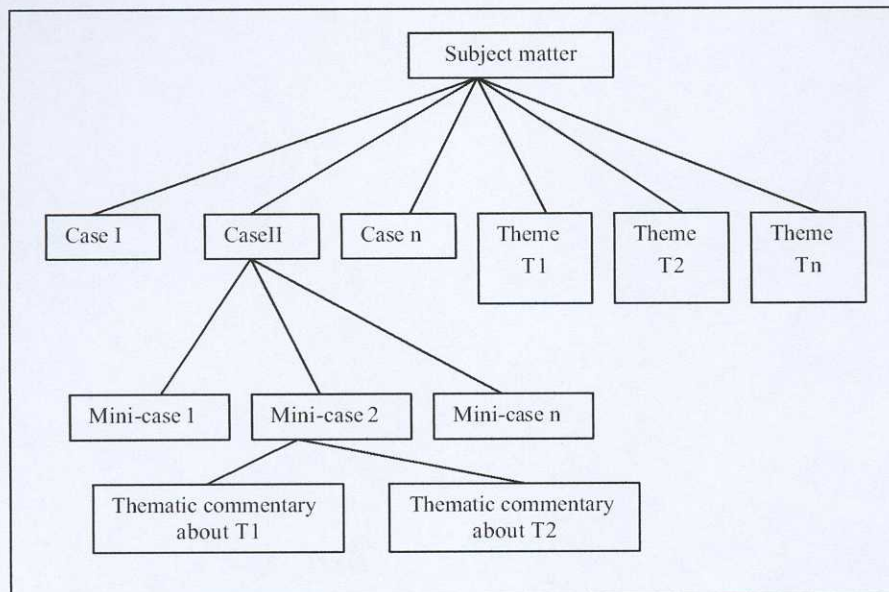


Figure 2 – Hierarchical structure of a Subject matter

Sapere Aude

The first course implemented on the Flexml was a Latin course, called “Sapere Aude”. The learner has access to several functionalities, as we can see in Figure 3: a description of the Themes to learn Latin Language and culture, Cases (and its mini-cases), a Search engine to look for mini-cases and themes, the forum, the Chat, a notepad, user’s path in the hyperdocument and the announcements.

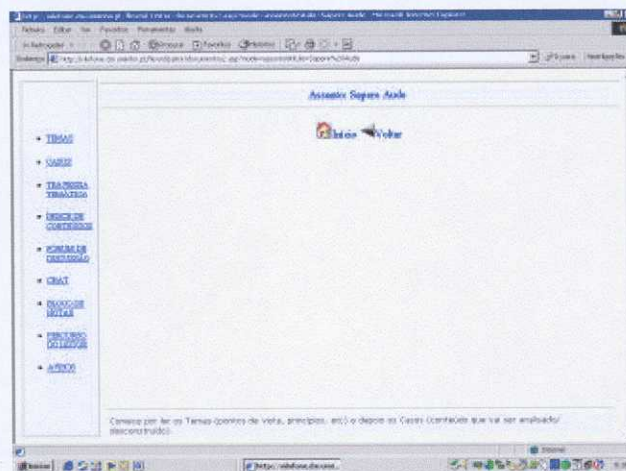


Figure 3 – Main menu of “Sapere Aude”

The “Sapere Aude” includes fourteen Themes, relevant to study the Latin language and culture, and six Cases that integrate nine texts (mini-cases) from different Latin authors (Table 1).

Cases	Mini-cases	Thematic commentaries	Complementary information				
			Author	Context	Similar texts	Complementary readings	Bibliography
1. Rome, <i>caput mundi</i>	9	26	9	8	6	6	9
2. Rome, love and life	9	32	9	7	7	3	9
3. In Rome with Marcial	9	41	1	1	8	5	1
4. Romans and gastronomy	9	34	9	8	6	4	9
5. <i>Panem et circenses</i>	9	36	9	7	5	5	9
6. Writers and books	9	31	9	8	7	7	9

Table 1 – Structure of the deconstruction process of the subject matter “Sapere Aude”

For each mini-case (constituted by a short text in Latin) a translation is available, and students have to read all thematic commentaries, each one explains how a Theme is applied to that particular text (Figure 4). Moreover, students also have access to information about the author, the context (Romans costumes). Other texts of the same author (similar texts) or texts from different authors about the same subject (complementary readings) are also available. Finally, the references (Bibliography) used to write the thematic commentaries.

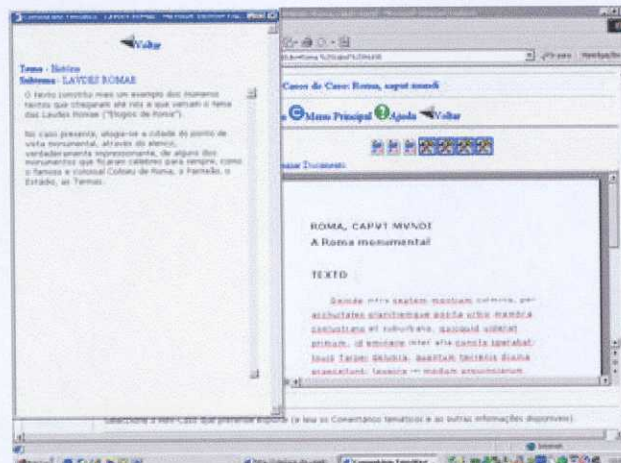


Figure 2 – Mini-case of the case “Rome, Caput mundi” and a Thematic Commentary about the History

Every week a new problem was made available in the forum. Each student had to write his/her answer, which was reviewed and commented by the teacher.

Research design and methods

One group pre-test/post-test design (Schumacher & McMillan, 2000) was used and quantitative and qualitative data were collected, through questionnaires, observation of the discussions taking place during the chat sessions, and analysis of students’ answers to the problem stated in the forum. Three questionnaires were developed and validated: a knowledge test, a questionnaire focusing on user’s identification aiming to characterise users’ Web literacy, and an opinion questionnaire on the structure of their course content and the functionalities of the Web platform Flexml. In the process of data treatment, the answers to the open questions were categorised and the percentages were calculated. In what concerns the knowledge test (scored to 20 points), the level of significance adopted is $\alpha=.05$, and the nonparametric test used was Wilcoxon signed-rank.

The study

This study was organised in three phases: preparatory, exploratory, and concluding phase. During the *preparatory* phase, from 20th to 26th February 2003, students were invited to participate in the study, they filled in the Questionnaire on User's Identification, and the introductory session to "Sapere Aude" as well as the pre-test were scheduled. After doing the pre-test, the introductory session to "Sapere Aude" was conducted. The *exploratory* phase occurred from the 27th February to the 11th April. Each week students were asked to read the Themes and analyse one Case, participate in the chat on Thursday at 6 pm, check the announcements and give their answer to the problem presented at the Forum. The *concluding* phase, took place on the 5th May, and it concentrated on the post-test and the Opinion Questionnaire.

Sample

The sample integrated 17 subjects, 2nd year undergraduate students of a Portuguese Teacher Education Programme at the University of Minho. Fifteen of them were female and two were male. Their ages ranged between 19 and 22 years old.

According to the questionnaire on user's identification and characterization, almost half of the subjects felt comfortable (47.1%) surfing Web sites and the other half felt not very comfortable, only a student indicated not to feel comfortable at all. None of the subjects had previous experience on using a forum, and only 23.5% were used to use chat, and 52.9% to use e-mail. Most of the subjects (82.4%) considered themselves as autonomous learners, and preferred to study alone (88.2%). These two attributes, autonomous learning and preference for studying alone, are important to learn through Flexml.

Results

The knowledge test conducted before and after the study show a great difference in the group mean: 5.1 (pre-test) and 10.8 (pos-test). The standard deviation is higher in the pos-test results (table 2).

	Pre-test	Pos-test
Mean	5.1	10.8
Standard deviation	1.7	3.0
Minimum	3.0	5.6
Maximum	7.8	16.3

Table 2 – Mean comparison between pre-test and pos-test

According to the nonparametric Wilcoxon signed-rank test, there is a statistical difference ($p=.0003$) between these results which indicate that the course and its structure were effective in promoting learning (table 3).

Mean ranking	Z corrected for ties	Statistical significance
9	-3.622	$p=.0003$

Table 3 – Analysis of differences between pre-test and pos-test (Wilcoxon signed-rank test)

The opinion questionnaire addressed issues such as orientation in the "Sapere Aude", the structure of the subject matter, the communication through the chat, the problems stated weekly and their ability to promote a reflection about the subject matter, and finally, students' interest in taking more courses on the Flexml.

In what concerns *user's orientation* in the "Sapere Aude", almost half of the subjects (47.1%) mentioned that during the 1st session they felt lost or a little bit confused, but 52.9% stated that they did not. Almost all users (94.1%) considered themselves comfortable in exploring the document "Sapere Aude" at the end of the sessions.

Most students (70.6%) considered that the *structure of the document* (themes, cases, and mini-cases analysed according to several thematic commentaries) helped them in learning the Latin language and culture, but 29.4% disagreed with the number of mini-cases (nine) per case. These students would prefer less mini-cases per case.

Synchronous communication through chat was something new to most students (76.5%). From the twelve students that were in the first chat session, 66.7% of them mentioned that they liked it, while four subjects disliked it because some of their colleagues “didn’t stick to the theme under discussion”. During the six chat sessions the number of students ranged between 5 and 15 (table 4). On the fifth session it was easy to identify the participants that did not finish the case of that week. It was very difficult for them to collaborate, because they didn’t know enough about the cases and themes to give a reasonable contribute. During the last session (6th), fifteen participants collaborated enthusiastically and their comments gave evidence on their knowledge about the cases analysed.

Chat sessions	Subjects on-line	
	f	%
Session 1 - 6 th April	13	72.2
Session 2 - 13 th March	6	33.3
Session 3 - 20 th March	7	38.9
Session 4 - 27 th March	5	27.8
Session 5 - 3 rd April	8	44.4
Session 6 - 10 th April	15	83.3

Table 4 – Number of participants in the Chat (n=18)

The chat session took place at the end of the afternoon, when more computers were available, but students complained about that time table because they had taken 8 hours of classes before. They were inquired about which aspects they considered more as strengths and weaknesses in the chat sessions. They considered the chat advantageous to exchange views (82.4% of the 17 subjects) and to clarify concepts (64.6% of the 17 subjects). Surprisingly, they didn’t give importance to the fact that a student could have the initiative to introduce a new topic in the chat. They considered negative the fact that the chat occurred at a specific time (64.7% of 17). Besides, students easily deviated from the issue under discussion (52.9% of 17).

In the *Forum* every week a new challenge or problem was available, which was related in part with the case under deconstruction. The teacher gave feedback to each answer given by the students. Most of the students (83.4%) agreed that the problem helped them to reflect on the content of the document. We think that the Forum is an important feature in this Web platform. We replaced the thematic criss-crossing process of cognitive flexibility theory for the Forum. Remember that the thematic criss-crossing process is more like “follow the arrow”, this means, the user only has to read the information available. With our weekly challenge in the Forum, we intend to engage students in thinking about the content deconstructed and reason to give an answer. Though they were novices in using a Forum, they didn’t have any difficulty in using it (table 5).

Difficulties in using the Forum	f	%
No, I hadn’t	16	94.1
Yes, I had	0	0.0
Didn’t answered	1	5.9

Table 5 – Difficulties in using the Forum (n=17)

Inquired if they would like to have other courses on the FleXml, most of the students (76.5%) expressed their agreement, because they felt that they can learn better the content under study, they learn at their own pace and they have access to their course from any place where there is a computer connected to the internet. However, four students showed no interest in taking other courses because they said it implies to spend some hours in a computer, and they do not like it.

Conclusion

The evaluation of the course "Sapere Aude" described in this paper led us to conclude that the Web platform FleXml structure and functionalities help students to learn and to become engaged in learning. Particularly, the deconstruction process and students reply to the question available in the forum weekly.

The replacement of the thematic criss-crossing process available in the cognitive flexibility theory by the thematic challenge in the forum seems to lead to a more engaging activity. At least students didn't complain about seeing the same mini-cases in different contexts as they did in other studies reported by Carvalho (1999; 2000).

References

- Carvalho, A. A. A. (1999). *Os Hipermedia em Contexto Educativo. Aplicação e validação da Teoria da Flexibilidade Cognitiva*. Braga: CEEP, Universidade do Minho (PhD dissertation).
- Carvalho, A. A. A. (2000). Complex Knowledge Representation in a Web Course. In Gordon Davies e Charles Owen (eds) *Proceedings of Webnet 2000 - World Conference on the WWW and Internet*. Charlottesville: AACE, 81-87.
- Carvalho, A. A. A. (2002). Promover a Flexibilidade Cognitiva em Níveis Avançados do Conhecimento. *Revista da FACED*, nº 6, 25-46.
- Carvalho, A. A. A. & Dias, P. (1997). Hypermedia Environment Using a Case-based Approach to Foster the Acquisition of Complex Knowledge. In T. Muldner and T. C. Reeves (eds.), *ED-Media/ED-Telecom 97, Proceedings of the Conferences on Educational Multimedia/ Hypermedia and Telecommunications*. Charlottesville: AACE, vol. I, 142-149.
- Carvalho, A. A. A.; Pinto, C. S. & Monteiro, P. (2002). FleXml: an integrated distance learning tool to improve cognitive flexibility. In J. A. Carvalho, A. Hubler and A. A. Baptista (eds), *Proceedings of the 6th International ICC/IFIP Conference on Electronic Publishing*, Berlin: VWF, 115-124.
- Cognition and Technology Group at Vanderbilt (1997). *The Jasper Project: lessons in Curriculum, Instruction, Assessment, and Professional Development*. Mahwah, New Jersey: LEA.
- Schumacher, S. & McMillan, J. (2000). *Research in Education: a conceptual introduction*. New York: HarperCollins.
- Spiro, R., Vispoel, W.p., Schmitz, J.G., Samarapungavan, A. & Boerger, A.E. (1987). Knowledge Acquisition for Application: Cognitive Flexibility and Transfer in Complex Content Domains. In B. C. Britton & S. M. Glynn (eds.), *Executive Control in Processes in Reading*. New Jersey: Lawrence Erlbaum Associates, 177-199.
- Spiro, R., Coulson, R.L., Feltovich, P.J. & Anderson, D.K. (1988). Cognitive Flexibility Theory: Advanced Knowledge Acquisition in Ill-Structured Domains. In *Tenth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Erlbaum, 375-383.
- Spiro, R. & Jehng, J.-C. (1990). Cognitive Flexibility and Hypertext: theory and technology for the nonlinear and multidimensional traversal of complex subject matter. In Don Nix & R. Spiro (eds.), *Cognition, Education, and Multimedia: Exploring Ideas in High Technology*. Hillsdale, NJ. Lawrence Erlbaum Associates, 163-205.
- Spiro, R., Feltovich, P., Jacobson, M. & Coulson, R. (1995). Cognitive Flexibility, Constructivism, and Hypertext: random access instruction for advanced knowledge acquisition in ill-structured domains. In L. Steffe and J. Gale (eds.), *Constructivism in Education*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

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