Mastering Information and teaching controversies : an exploratory study

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Abstract. Our contribution aims at presenting an exploratory study of an experimental course focused on teaching controversies for mastering various dimensions of Information literacy. We will begin presenting the theoretical framework of the Actor-Network Theory approach. Then we will introduce our work-in-progress methodology for controversies analysis. Then, two case studies of teaching controversies will be presented aiming at supporting the acquisition of skills in mastering Information. We will conclude with the first results of our exploratory study based on participant observation, and on a qualitative survey on the knowledge acquisition by the students.

Keywords: Information literacy, controversy analysis, exploratory study, critical thinking, evaluation criteria.

1. Introduction

Even if this concept emerged in the 70s, the field of Information Literacy still produces an extensive scientific literature on an international scale, especially since the emergence of the web. Indeed, this period is characterized by a new profusion of available information. Some literature reviews such as [1], [2] mention numerous approaches and projects on this subject. Even UNESCO and OECD (Organisation for Economic Cooperation and Development) take part in this field.

Since the French universities adopted the LMD reform (Licence-Master-Doctorat) in 2004, education for mastering information gradually became a central issue. Information literacy is widespread in France at different levels of education. For example, in primary or secondary school, a standard evaluation grid is applied to deliver a certificate called B2I (Computer and Internet Certificate)[1]. In this article, we will focus on high school students.

Teaching about information sources and classical information management skills are not sufficient to reach the required evolutive objectives in the actual digital context, especially for Y generation students. In fact, this digital context implies a

[1] [1] Brevet Informatique et Internet

[2] https://gephi.org/

[3] http://freemind.sourceforge.net/wiki/index.php/Main_Page

hyper-connected and fragmented world, where trust and authority are questioned. We claim that the ability to carry out a critical reflection and to achieve reflexivity with self-sufficiency should become the aim of these educational programs, particularly for the master's degree.

Among the extensive literature about Information Literacy, we found three main axis of reflection. The first one consists in defining the concept of information literacy, and the extent covered by this field e.g. [3], [4], [5], [6]. This literature raises issues about the convergence of various literacies: information literacy, computer literacy, critical literacy, library literacy, media literacy, digital literacy, visual literacy, and transliteracy [6]. The second axis focuses on the development of tools, standards and methods for evaluation of skills in Information literacy, such as [7], [8]. The third axis concentrates on a critical vision of both of the previous approaches, including reflections about didactics for information literacy [9], [10], [11], [12]. Inspired by this third axis, our contribution aims at presenting an exploratory study of an experimental course on teaching controversies for mastering various dimensions of information literacy.

In this paper, we will begin by presenting the theoretical framework of the Actor-Network Theory approach. Then we will introduce our work-in-progress methodology for controversies analysis. Then, two case studies of teaching controversies will be presented aiming at supporting the acquisition of skills in mastering information. We will conclude with the first results of our exploratory study based on participant observation, and on a qualitative survey on the knowledge acquisition by the students.

2. Teaching Controversies and Actor-Network Theory

Among the most innovative projects on this subject, teaching controversies is probably one of the most promising ways to pursue this aim of critical reading and use of information. Based on theoretical research work from Latour and Callon (Actor-Network Theory), each grande école in France such as SciencePo, some engineering schools as ESIEE Paris and Telecom ParisTech, and some universities as in the Social Science department of Paris 8 University, have developed this kind of class. We also consider this type of class as additional to more classic teaching.

To define the notion of controversies, we refer to the Medialab researchers (SciencePo): "The cartography of controversies is the exercise of crafting devices to observe and describe social debate especially, but not exclusively, around techno-scientific issues" [13].

Among the controversy subjects, one can find examples such as: Do robots need to resemble human beings? ; Will digital books replace traditional books?; and Does the society gain modernity in authorizing euthanasia? In this context, a variety of digital tools are available and used, for example, Murraly, Freemind, Pearltrees, and GraphCommons.

The Actor-Network Theory (ANT) is a branch of the movement of the "Sociologie des épreuves". This theory arises from studies about the connection between the

scientific fields and innovation process. In this context, the focus is on interactions and mediations between human actors and non-human actors, which form a group: a network where human and non-human actors are considered as equal and qualified as agents or as mediators. They form a complex socio-technical organisation, where they are inter-dependent [11]. In terms of scientific paradigm, rather than pretending to consider subjects objectively, it consists, on the contrary, of considering agents subjectively [14].

In the application of ANT to analysis of controversies, as described by Venturini [13], [15] and Martin and Lezon-Rivière [16] the process begins by the construction of the corpus of texts. Then it continues by applying programs for creating bibliometric and scientometric measures. Finally, maps or cartographies are generated to reveal facts based on these measures, with a visualisation tool, like Gephi[2].

The skills targeted in this type of course are focused on improving the understanding of epistemology and of the methodologies for the production of scientific knowledge, and not specifically on information literacy. From our point of view, applying a standard grid of evaluation cannot assess the skills the students acquire throughout this process.

3. Work-in-Progress Methodology of Analysis of Controversies

3.1. Overview of the Original Methodology

Our methodology of analysis of controversies is inspired by ANT to the extent that we also consider human and non-human actors as agents, but we develop different views which can be described as follow: this course aims at improving the understanding of the complexity of analysis of controversies, considered as a sui generis phenomenon, that reveals characteristics of the ability of a society to carry out a public debate, including all possible sorts of actors. This conception raises questions about the organisation of social roles and the distribution of powers and authority in the society. This definition is also inspired by the sociology of Thevenot [17] and Chateauraynaud [18].

The students are thus playing the role of mediators of the knowledge, required to be capable of taking part in the debate, for the public area. This mediator role implies questions about the position to adopt, the necessary distance with their potential opinions, the vigilance about the potential distortion of different actors' points of view, and how to avoid these problems.

As mentioned in our introduction, we are influenced by the third axis emerging from the literature, which focuses on providing a critical vision about information literacy.

[2] https://gephi.org/

Among this literature we agree with the sociotechnical vision of the field proposed by Tuominen et al. [9], as we consider that the nature of a controversy can have effects on its analysis and representation. We will detail these aspects further on. Thus, like these authors, we disagree with "The predominant view of information literacy [that] tends to conceive of IL as a set of attributes … that can be taught, evaluated, and measured independently of the practical tasks and contexts in which they are used" [9]. Moreover, in the French field of literature Le Deuff [10] proposed a vision of information literacy in relation to citizenship and to mastering technical knowledge. According to him, the technical knowledge composes a culture, which is understood as Simondon's [19] approaches as related to power struggles. Le Deuff's vision is also inspired by Stiegler's approaches [20]: the citizenship dimension of information literacy is based on awareness of the dual dimension of technical objects that are described as "pharmaka". Therefore, technical objects can be considered potentially as solutions as much as obstacles. Finally, we are also following Simonnot [11] who introduced the notion of "digital culture", that implies the awareness of cultural codes at hand in the digital world. These cultural codes format the access to information and its interpretation. It is very important to notice that we agree with these conceptions, and that we thus consider irrelevant to assess information literacy by means of a very precisely defined and strictly applied set of skills. This conception has an effect on the present exploratory study especially on the methodology, which is presented in part 4.1.

3.2. Presentation of the Course's Sequence

Our proposal supplements models and reflections about information literacy, which emphasize the importance of teaching evaluation of sources, but we consider providing methodological tools for critical dimensions important as well.

The global educational objectives of this class can be described as follows:

- Seek for information, detect a controversial subject, and inquire about it;
- Gradually grasp the questions in this controversy;
- List the arguments and their authors, and analyse them;
- Make cartographies about actors, questions, arguments, and design a model of this content;
- Present the results of this process for a specific public: the students have to remove their opinions, and to arrange graphical materials in a consistent way and to clarify this arrangement of chronology, geographical aspects (if relevant), heuristic maps of actors, concept maps or semantic maps about questions, arguments, and viewpoints about specific elements in the controversy, for example: viewpoint by actors' types, viewpoint by quantified involvement of actors in the debate, or by type of arguments. Another possible way is to qualify some specific objects taking place in a specific debate, for example, risks or differing interests.

The following table presents the course's sequence, divided in distinct sessions, which correspond with the different stage of the methodology that we are designing.

Table 1. Presentation of the course's sequence.

Steps	Subject and content	Educational objectives
Session 1	İntroduction : Theoretical course about stakes of controversies	Undestanding of the complexity of the process of analysis in controversies
Session 2	İnformation seeking and training on sorting out information sources with Pearltrees	Defining information need, queries, finding and defining a controversy issue, create information search strategies, quick reading, sorting out of sources
Session3	Theoretical course about the methodology based on models and properties	Undestanding of the complexity of the process of analysis in controversies, appropriating the methodology presented
Session 4	Training on heuristic maps, and concept maps with Freemind and CmapTool	Designing heuristic maps of actors in the controversy at hand, and designing concept maps to represent the main questions
Session 5	Training on designing a chronologic view of the controversy with Timeline JS	Choosing and ordering in time the main events of the controversy for producing a chronologic view
Session 6	Theoretical course about object-oriented modeling and training on semantic mapping with GraphCommons	Designing maps of arguments and viewpoints in the controversy at hand, modeling agents, relations, and arguments
Session 7	Pursuit of the work-in-progress with self-sufficiency, and preparation of the final presentation	Structuring the different maps and others supports, communication skills
Session 8	Final presentation	Contextual evaluation

In Table 1, four specific tools are recommended:

- Freemind[3] : this tool is used specifically to produce heuristic maps to represent the actors that take part in a controversy, as for example industrialists, scientists, and politicians;
- CmapTool[4] : this tool allows to design concept maps, in order to represent the main questions of a controversy. The main difference between heuristic and concept maps is that concept mapping enables to specify wordings for the relations between nodes;
- Timeline JS[5] is an online tool for generating online chronology based on a file

[3] http://freemind.sourceforge.net/wiki/index.php/Main_Page

[4] http://cmap.ihmc.us/

[5] https://timeline.knightlab.com/

template avalaible on GoogleDocument;

- Graphcommons[6] is an online tool, enabling the creation of semantic maps, that is to say, cartographies with a model including entities (agents), relations, and their properties, as presented in part 3.1. of this paper.

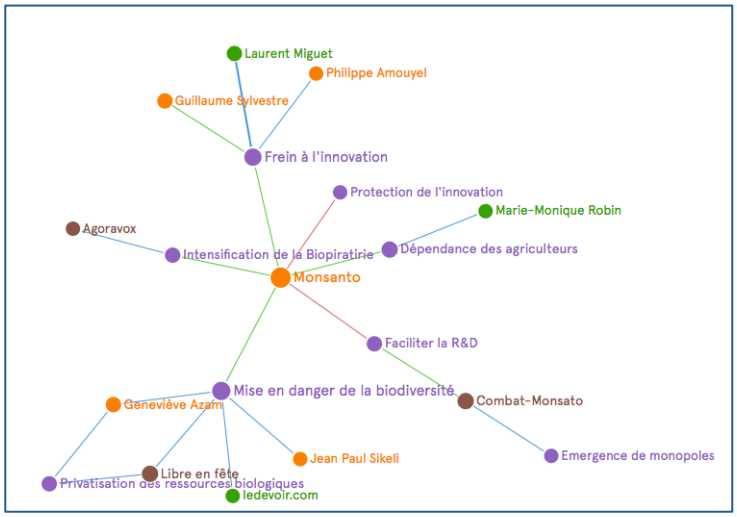


Fig. 1. Example of a semantic map made by a student with GraphCommons

The Figure 1 presents an example of a semantic map made by students with the tool GraphCommons. The different colors correspond to the different types of agents in the model of entities for this controversy about "patent and living things".

4. The Exploratory Study

This section aims to present the exploratory study, its methodology, its conditions, and the preliminary results obtained.

4.1. Methodology of Study

This study is structured in two steps and composes mainly a qualitative study. The first step consists of participant observation during the course's sessions, with note-taking about elements arising during the class, how students manage to fulfill the different tasks described in Table 1, their specific questions, difficulties or ideas, the

[6] https://graphcommons.com/

ways they manage to appropriate the different guidelines, methods and tools. It is completed with our analysis of the final presentations and its graphical materials. The second step is based on a qualitative survey by means of an online questionnaire sent to the student few weeks after the end of the course.

The participant group is composed of two different sub-groups of students. The content of the course is the same for both groups but the teaching conditions are different.

The first group can be characterized as follows: it is composed of 11 students all studying design in two different schools (ENS Cachan and ENSCI-Les ateliers). This course takes place in the frame of an experimental project for testing new forms of teaching[7], the SPOC Controverse. This course is a Small Private Online Course, which means that a part of the course was taught online. This experimental project was organized over ten days of teaching from October 2014 to January 2015, and supported by a digital workspace for the supervision of the different deliverables commanded to the students. The scope of the full project was larger than for the second group, but concerning the similar content presented in this study, for both groups, the duration was equivalent. Nevertheless it can be interesting to notice that the first group students were not familiar with the educational objective of the Session 2 mentioned in Table 1, and formulated as: "Defining information need, queries, finding and defining a controversy issue, create information search strategies, quick reading, sorting out of sources". On the other hand this group benefited from more time to choose their controversy subject. This group founded 4 sub-groups of students, their controversy subjects were the followings:

- Medical auto-diagnosis
- The development of digital technologies and employment
- Do robots need to resemble human beings?
- The customer responsibility, the mobile phone case

The second group is organized in a more traditional way. They were 12 students in Master's degree in the Information and Communication Science Department at University Paris 8. They all benefit from a pre-existing knowledge previously mentioned corresponding to the Session 2 in Table 1. The course was dispensed during a week in January 2015. They formed four sub-groups of students and their subjects were the followings:

- Assisted reproduction and surrogate motherhood.
- Will digital books replace traditional books?
- Patent and living things
- Euthanasia

[7] SPOC controverses gets the financial support from the program "Investissement d'Avenir" IDEFI (ANR-11-IDFI-0031) - Initiatives d'Excellence en Formations Innovantes

4.2. Preliminary Results

From the participant observation process, some interesting elements emerge that can be confirmed by the questionnaire sent to the students. Some of the preliminary results of the questionnaire have been extracted and are presented in Table 2, Table 3 and Table 4.

The first significant aspect emerging from the observation is about the teacher's position in this kind of course. Actually, we think he has to moderate the constraints about applying the methodology, and also on the use of the different types of maps. Indeed, even if the teacher can adopt an incentive attitude towards students to appropriate the methodology, we suggest considering that the students gradually become experts of the subject of the controversy at hand. Moreover, we suggest considering that the proposed experimental methodology can be improved by the practice of the students. Thus, some aspects of the methodology are left vague to provoke the involvement of them in a creative process, especially concerning the analysis and representation of arguments. What follows from the previous statements is that the role of the teacher is less oriented towards a vertical transmission of knowledge than towards an educational support with fluctuating goals because the different groups have various paces of progression.

The second significant aspect of this experimental session is focused on the use of the maps produced by students. In the Medialab course about controversies, it seems that the maps (network graphs) are the expected results requested to the students. As shown in Table 2, even if a majority of students responding to the questionnaire discovered the concept mapping, the semantic mapping, and the related tools during the class, they are interested in re-using them in other contexts. This is consistent with the results presented in Table 3, which show that this kind of course can benefit the students on other dimensions of IL, for example, in production of synthesis or in knowledge acquisition.

Concerning the use of mapping, Table 2 reveals various uses of mapping, for example, for ranking and summarizing information, or for comparing viewpoints. These various uses of maps reveal that the maps are not only used for presenting results, but also serve as analysis tools.

In Table 4, the results consist of an extraction of terms from the responses of students to an open question formulated as follows: "what are the characteristics of a controversy?"

It can be interesting to notice that the analysis of the responses shows a large diversity of understandings about the characteristics of a controversy. This is consistent with an observation realized during the courses, which can be summarized as follows: depending on its subject, a controversy presents various characteristics, as for example, a high degree of technical nature or of opacity, a focus on problems of definition, a low degree of maturity, a characterization by binary oppositions, or by the temporality or geographical aspects. Consequently, we consider that evaluation criteria of the analysis provided by students should take into account this diversity in characterization of each controversy.

Table 2. Extract of results from the questionnaire about maps

Which of these tools did you discover during the class ?	% of the responses
Boolean queries	15.4%
Heuristic maps	30.8%
Concept maps	76.9%
Semantic maps	76.9%
Which of these tools do you think you will use again in the futur ?	
Freemind	61.5%
CmapTool	92.3%
GraphCommons	76.9%
For which of these tasks did you use the maps ?	
Rank Informations	100%
Summarize	76.9%
Compare viewpoints	69.2%
Read and discover the subject	61.5%
Analysis of Information	53.8%
Detect Information needs	38.5%
Take notes	30.8%

Table 3. Extract of results from the questionnaire about mastered domains

Did the class provided you a better mastery in these domains ?	% of positive responses
Production of synthesis	92,3%
Methods for knowledge acquisition	69,2%
Peers confrontation	46,2%
Oral presentation	23,1%

Table 4. Extract of results from an open question from the questionnaire about the characteristics of controversy

Extracted elements from the responses	Number of mentions
Multiplicity of viewpoints	5
Question concerning the whole society	5
Public debate, public arena	5
Multiplicity of actors	4
Argumentative dimension	4
Different opinions	3
Complexity of the problem at hand	2
Critical vision	2
Different ideologies	2
İncertainty	1
Polemic	1
Divergent values or interests	1

5. Conclusion

Information literacy has become an important field of study and gains gradually in independence. We consider that classical courses for information literacy remain insufficient for new generations. The previously presented observations are still a

work in progress, and we will pursue this study with an increasing number of students. Nevertheless, it seems that teaching analysis of controversies proves to be relevant for including critical thinking in information literacy. This course benefits students on different dimensions of information literacy that have to be evaluated with appropriate approaches.

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