Collaborative Multi-professional Narrative Based e-learning. An application to teaching Medical Statistics

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Abstract

The present paper describes e-CNA (e-Collaborative Narrative Analysis), a web based multi-agent environment where different agents contribute to the exploration and social co-construction of the meanings of a set of narratives. The paper also describes an action-research e-learning experiment aimed to involve the students of different courses and a multi-disciplinary team of health professionals in a blended online educational project on qualitative and quantitative research methodologies in health sciences. A taxonomy of illness-related concepts/terms was generated, and the narratives were represented as semantic networks.

Introduction

The present paper describes e-CNA (e-Collaborative Narrative Analysis), a web based application embedded into MEANINGS, an interactive system of web based applications aimed to analyse and co-construe the "meanings" of several concepts by means of words associations, semantic differentials, emotion-cognition relationships, and so on. e-CNA can be considered as a multi-agent environment where different agents contribute to the exploration and co-construction of the meanings of a set of narratives from different points of view.

Even if e-CNA is a general purpose analytic e-learning system, the present paper describes an application to teaching/learning medical statistics and informatics. This field represents an example of the debate about the relative merits of qualitative and quantitative methods in the scientific research (1).

In fact, even if medical statistics can be conceived as the dominant paradigm of the scientific research in health sciences, some authors claim that the statistical approach merely describes mass phenomena and concerns collectives of individuals, so it would be at odds with the intrinsic nature of medicine, i.e. the care/cure of the individuals (2-5). On the other side, the opponents argue that the qualitative approaches merely accept anecdotal evidence, and that without statistically relevant data there is no guarantee that the generalizations are correct (6).

In this framework Illness Narratives can play a crucial role because they represent the way in which the actors of the care/cure process interpret a multifaceted complex dynamical situation, and this interpretation influences both the real decision-making processes and the production of statistical data.

The present paper describes the results of a multiprofessional narrative e-learning experiment based upon an innovative application (e-CNA) which enabled the participants to co-construe the meanings of a purposive sample of Illness Narratives. The narratives were segmented into elementary meaning units which, on one side, triggered the study of statistical concepts and, on the other, led to the co-construction of a shared taxonomy of narrative-related terms/concepts. This could be the basis for the development of an ontology (7) of Illness Narratives.

Methodology

Two multidisciplinary virtual classes of medical and nursing students of the courses of Statistics and Informatics (respectively, 270 and 60 students) were formed by means of Dynamical Virtual Learning Networks (DVLN, http://elearning.medicina.unina.it/dvln). Also, a multi-professional team of teachers was set up.

Before the beginning of the courses two pilot illness narratives (i.e. the narrative of a woman affected by acute leukaemia, and the narrative of the father of a young girl affected by malignant sarcoma) were videotaped and de-structured into different sub-themes. The corresponding video-clips were uploaded onto the website
http://elearning.medicina.unina.it/WebPon/Storie_vere/Storie_vere.htm
Also, the transcripts of the two narratives were uploaded onto DVLN.

Then a vis-à-vis multidisciplinary plenary session introduced the problem of the relationships between the quantitative (i.e. statistics) and the qualitative (i.e. illness narratives) approaches. The role of the interplay between Illness Narratives and statistical knowledge in medical decision making was also discussed according to the model represented in figure 1.
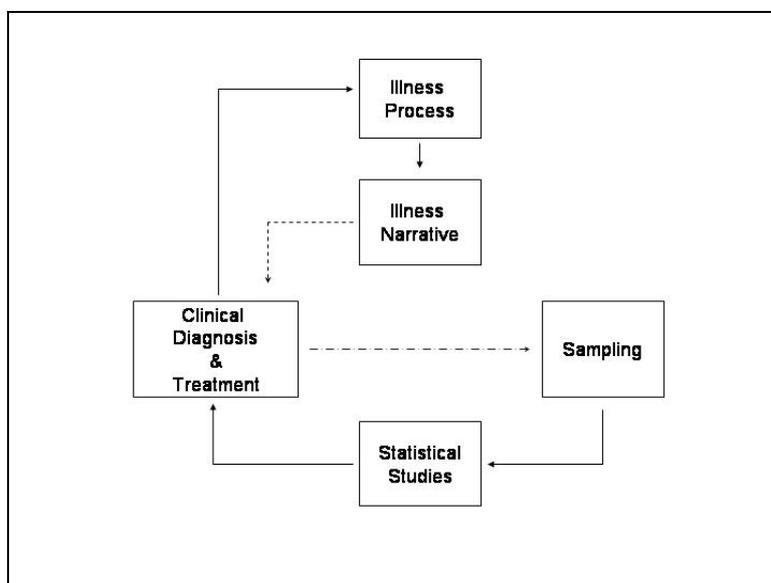

Figure 1 Double Feedback Model

Each student was then invited to conduct a non directive audio-taped interview of a real non hospitalised patient, and to transcribe it according to a set of shared typographical rules. The transcripts were downloaded onto DVLN as textual documents. In this way a repository of 230 illness narratives was created.

The courses were organised as a sequence of jumps from qualitative-narrative to quantitative-statistical learning issues and vice versa. For example, a narrative theme (e.g. the dynamics of the diagnostic process) was drawn from the narratives in order to trigger the students' curiosity in classical statistical issues (e.g. probabilistic reasoning and Bayesian clinical belief revision). This issue was then the object of a set of vis-à-vis lessons and seminars, and web based interactions. Then a new jump to the narratives was made in order to introduce qualitative research issues (e.g. the techniques aimed to segment Illness Narratives into meaning units and to organize them as a set of themes).

The jumping-from and jumping-to the illness narratives was repeated until all the arguments of the course were explored.

Moreover, e_CNA was used for the web based collaborative analysis of the downloaded narratives (http://elearning.medicina.unina.it/associazioni).

In e-CNA the entire process is under the control of a narrative owner (NO), usually a member of the teachers' team. Each NO controls one or more narratives and one or more groups of participants (students and/or teachers).

The process of meaning construction is typically carried out in different phases.

First Phase: De-structuring the narrative and definition of the Meaning Units

The "Narrative de-construction" module (ND) is aimed to disaggregate each narrative into small sequentially numbered meaning units (MU), each MU being a sentence or a sub-sentence of the transcript. ND was carried out several times by different participants until a shared segmentation of the narrative was obtained. At this point, the NO blocked the de-construction and activated the "Segmentation" module which generates automatically a numbered sequence of MUs.

Second phase: Coding

The second phase was aimed to codify the MUs in a web based collaboratively way.
The participants suggested a first tentative codification of each MU. The raw list of codes was then refined by using the module SYNONYMS, which allows correcting typographical errors, and negotiating the synonyms. The final product was a raw basic vocabulary of narrative related terms/concepts.

Third phase: Generation of taxonomy of terms

The use of the module CODIFY allowed to negotiate the categorization of the raw codes. In particular, each raw code was initially allocated into one of a set of first level categories. CODIFY was then recursively applied to the first level categories in order to group them into higher level categories.
So, a taxonomy of terms/concepts was generated. In this way different narratives can be in principle compared and analysed by means of both quantitative and qualitative methods.

Fourth Phase: Generation of a semantic network

The participants defined a set of relations among couples of MUs by means of intra-narrative links. A freely chosen label attached to each link described the logical relation connecting the chosen segments. In this way, each transcript was transformed into a semantic network which was represented as a directed binary NxN graph, where N is the number of the meaning units of the narrative. The module STRUCTURE implements a graph based algorithm aimed to perform a structural analysis of the network in order to find subsets of structurally similar nodes, i.e. the components corresponding to coherent sub-plots of the narrative.

Statistical Analysis

The repository of Illness Narratives can be analysed for gathering insight into the specificity of each narrative and/or into the statistical commonalities among several narratives.

Results

A web based repository of 230 illness narratives was created.
The web based discussions and interactive lessons led to the co-construction of the following tentative model of the role of illness narratives in the care/cure process.
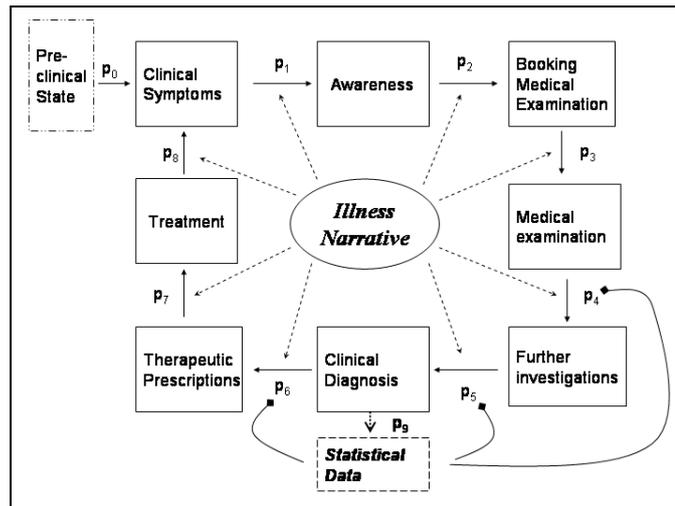
Figure 2 Model of the care/cure process

In other words it was assumed that the patient enters into different states during the illness trajectory. The transfer constants represent the perceived length of the interval between the previous and the successive state:

p_0 is the perceived time to become aware of the symptomatology, and to move from the preclinical state to the clinical "manifest" state

p_1 is the time to become aware that the symptoms are severe enough to require a technical advice by a physician

p_2 is the time to decide to consult a physician

p_3 is waiting list time

p_4 is the time to complete the lab test or instrumental investigations

p_5 is the time to the formulation of the "definite" clinical diagnosis

p_6 is the time to the negotiation of the treatment

p_7 is the time to implement the treatment

p_8 is the time to a clinical control, a recurrence, a relapse, a complication, or a new type of event.

p_9 is the probability to be enrolled in a clinical trial.

It was assumed that the results of clinical trials and statistical knowledge indirectly affect the physicians' diagnostic and therapeutic decisions.

The temporal process depicted in figure 2 is an abstract model of the basic loops (episodes) of the illness narratives: a narrative can be conceived as a sequence (maybe incomplete) of basic loops.

This model provided the rationale for the codification schema.

By means of e-CNA interactions the raw codes attached to the MUs were organized as taxonomy of descriptors related to the possible states and transitions. So, each descriptor was characterised by a set of attributes, and each attribute was characterised by a range of values (table 1).

Entity	Attribute	Range of Values
Event	Medical Name	Medical terms
	Type	Relapse Recurrence Complication New type of problem Physiological event Social event
	Causal Explanation	Explained/Not Explained
	Starting time	Birth-Elderly Critical phase of the life(e.g. adolescence, marriage, pregnancy, retirement, and so on)
	Onset	Abrupt-Smooth
	Expectation	Unexpected-Expected
	Initial reaction	Traumatic-Indifferent
	Effect on the life trajectory	Turning point-Indifferent
	First signs and/or symptoms	Unrecognised-Recognised
	Perceived Severity	Severe-mild
Emotional response	Shame	Strong-absent
	Guilt	Strong-absent
	Negation	Strong-absent
	Alarm	Strong-absent
	Perception of diversity	Strong-absent
	Anger	Strong-absent
	Worry	Strong-absent
	Happiness	Strong-absent
Activation of the diagnostic process	Readiness	Quick Negligent
	Facilitating factors	Social pressure Severity perception Scientific knowledge Cultural level
	Inhibiting factors	Shame Negation Omnipotence Distrust in medicine
Diagnostic process	Interaction with the health system	Hospitals Specialized centres Diagnostic services Family doctors Specialists Complementary medicine
	Dynamics of choice	Many changes-Just one referent doctor
	Duration	Very long-Short
	Diagnostic troubles	Errors Un-useful diagnostic manoeuvres
	Feelings	Calvary-Linear
Treatment	Type	Pharmacological Surgical Psychological Dietological Physiotherapy
	Compliance	Compliant Two-phases Alternate Not compliant
	Perception	Degrading Discomforting Painful Unavoidable
Outcome	Perceived status	Definite recovery Worsened
	Psychological acceptance	Accepted Refused

Social relationships	Degree of involvement of relatives	None/High One referent person Enlarged family
	Size of the social network	Shrinking-Enlarging
	Quality of the social relations	Deteriorated-Unmodified
	Changes in the social position	Relevant-Not relevant
	Communication barriers	Just towards strict relatives None
Naive epidemiology	Beliefs about causes or risk factors	Psychological Social Environmental Pharmacological Professional incompetence Status of the scientific knowledge Knowledge of other similar cases
Ethno-medicine	Beliefs about	Remedies Taboos Personal therapies
Attitudes towards the future	Hope	Hopeful/Hopelessness
	Trust in the advancement of scientific research	Strong-None
	Perceived effects of the prescribed treatment	Effective-Ineffective
Religious and moral aspects	Interpretation of the disease	An expiation of one's sin A proof A miracle A support A vision
Personal Reflections	Considerations	Philosophical Social Economical Artistic Psychological

Table 1 Codification of the episodes of the Illness Narratives

In principle, this conceptualization allows describing each episode (loop) of a narrative as an array of attribute values, and provides a basic language for comparing different narratives.

Main relations

The deep structure of the story the narrator is trying to communicate can be captured by creating a semantic network in which the elements of each episode are linked by means of relations.

The relations were co-construed by analysing the semantic labels attached by the participants to couples of MUs. The following tentative set of relations was defined:

1. Caused by
2. Facilitated by
3. Followed by
4. Complicated by
5. Is_a
6. Despite
7. After a period of (relative) well being

Figure 3 shows an example of the cognitive structure of the narrative of a diabetic woman. The main components, i.e. the structurally equivalent nodes, were

1. the *perception of diversity* due to the diagnosis of diabetes leading to initial infringement of the prescribed therapy that led to an initial episode of hyperglycaemic coma
2. a set of unexplained *"hysterical crises"*
3. the *abortion* attributed to medical incompetence
4. the *onset of hypertension* with progressive renal failure and final dialysis
5. the *hopelessness*

The components of the graph form a sort of building blocks of the patient's logical argumentation leading to the conclusion that her life is unsustainable and hopeless because all the events occurred even if she complied with the physicians' prescription, taking aside a first phase of rebellion.
The graph describes at the same time the patient's description of her suffering trajectory and a causal explanation of her hopelessness.
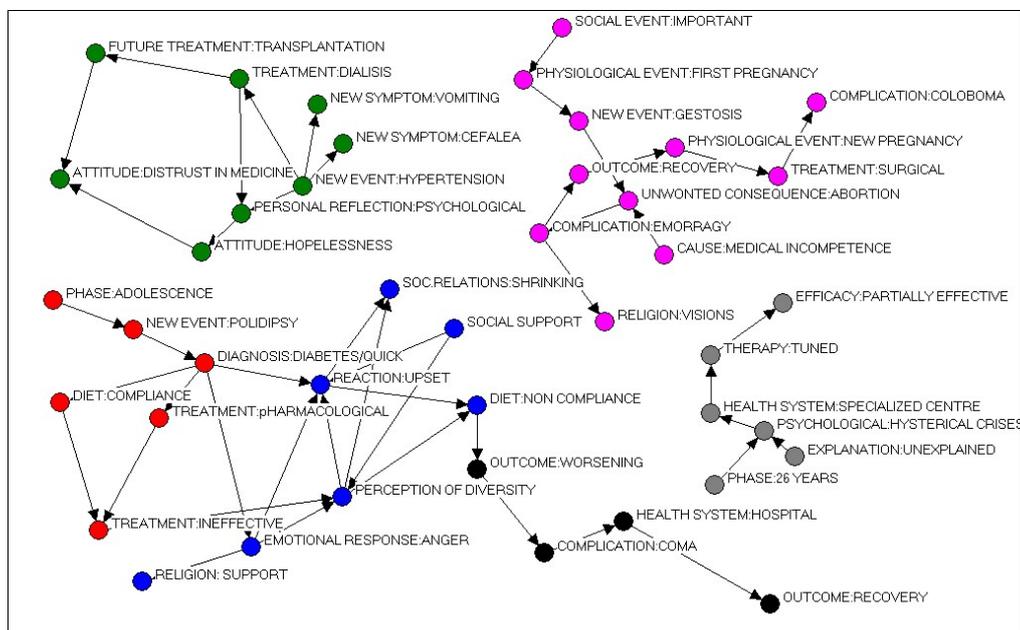

Figure 3 Graph of the narrative of a woman affected by type-1 diabetes

Discussion

The present paper describes an action-research e-learning project aimed to involve the students of different courses and a multi-disciplinary team of health professionals in a blended knowledge co-construction e-learning project. The starting point was the collection of a purposive sample of Illness Narratives. The transcripts were downloaded so that they were accessible to the whole multidisciplinary virtual classroom.

Teaching medicine by using the literature has become a well-recognized practice, whose benefits are increased empathy, a deeper understanding of ethics and the physicians' role, and improved "narrative knowledge". From this point of view, the added value of narrative based e-learning would be merely the education of the doctors' gaze to recognize the idiosyncratic peculiarities of individual stories.

From the point of view of the present research, a given narrative can be considered as a sort of implicit argumentation, i.e. as the product of a *narrative rationality* (8), where the narrator aims to persuade an imagined or real audience that his/her personal interpretation of the sequence of events is sound, and justifies his/her decisions and past or future actions.

So, each theme of a narrative has a twofold meaning: a personal and a scientific meaning that can be considered as the two sides of the same coin. These meanings affect both the behaviour of the actors of the care/cure process and the production of suitable statistical data for research purposes (9).

From the pedagogical point of view, e-CNA provides a radical re-conceptualization of the teaching/learning models in health statistics and informatics. This re-conceptualization is based upon the integration of the concreteness and vividness of the real Illness Narratives with abstract statistical concepts. From another point of view, e-CNA implements a blended web based educational model aimed to reinterpret the evidence (quantitative) based approach within a narrative (qualitative) based approach. This e-learning model could help to overcome the misleading dichotomy between the humanistic and the scientific sides of health care. The model could be extended to other knowledge domains such as sociology, psychology, mathematics, and so on.

The final product is a web based socially co-structured set of interrelated narrative "meaning units". So, e-CNA provides not only a repository of illness narratives, but also a system of scientific tools for acquiring new insights into the world of the diseases. From the pedagogical point of view, e-CNA enables the learners and teachers to co-construct meanings, and this activity is a very powerful motivating factor for understanding abstract mathematical/statistical concepts (10-11). In fact e-CNA is an attempt to embed quantitative and formal reasoning into a narrative environment. The main difference between our model and the classical narrative-centred learning environments is the emphasis upon the involvement of the students in an emotionally intense unstructured interview and upon the interpretation rather than upon the creation of a narrative (12).

Finally, the representation of the narratives as directed graphs allows analysing the structure of the meanings by means of mathematical tools (13, 14). This could be the base for getting more insight into the nature of the interpretation of "reality" by human beings.

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