

Impact of the TOP-FORUM Hypermedia System in a Pediatric Oncology Care Unit

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Abstract

This paper describes our approach in analyzing the impact of the TOP-FORUM hypermedia in a pediatric oncology care unit. The impact of this technology is realized through the study of accommodation and assimilation adoption. Accommodation refers to the technological adoption and Assimilation refers to the professional adoption. Results show that accommodation depends on information and formation of the users. Assimilation is more difficult to evaluate because it depends on human, social and organizational problems.

Keywords

Hypermedia; Evaluation; Medical Oncology

Introduction

Analyzing the usability of medical information systems is a great challenge in medical informatics. Many researches have been made in this area by analyzing results of questionnaires, interviews, data collections and video recording [1,2,3,4]. Rogers [5] proposed a communication based theory of innovation diffusion in which the adoption process is modeled in five steps: knowledge, persuasion, decision to use or not, implementation and confirmation to use or not. In all these studies the evaluation of the systems is centered in the adoption of informatic tools rather than in the professional adoption.

Piaget [6] proposed that appropriation is a result of two processes: accommodation and assimilation.

Accommodation refers to the impact of technology in its dimension as a "tool". It is normally measured with the help of indicators of manipulation, length and perception of the tool. The new man machine interfaces lead to richer interactions in which effectiveness and accommodation must be evaluated [7]. Accommodation leads to a change in information diffusion channels.

Assimilation refers to the impact of technologies in its professional dimension. It translates the professional investment of the actors after the accommodation phase. It should clarify the strategic intentions of the actors independently of the systems authors' vision. Assimilation leads to a change in work modes and to a new professional position of the actors.

Our project was to analyze the accommodation and assimilation of the TOP-FORUM hypermedia. TOP-FORUM, available in the pediatric oncology department of the Timone Hospital, is aimed at medical and paramedical personnel responsible for the care of young cancer patients. Its goal is to improve the quality and security of care.

This paper presents the TOP-FORUM project and describes the methods and results in analyzing its impact.

TOP-FORUM

TOP-FORUM hypermedia

TOP-FORUM is a hypermedia application derived from the FORUM project. We recall that the FORUM project [8,9] aims to create conditions for the medical community to access new technologies, going beyond a purely technological approach to focus on cognitive needs, integrate applications in daily practice, evaluate the application's ability to achieve the desired results. Several FORUM medical applications have been developed in different areas such as radiology, dermatology and cardiology. They are dedicated to residents that want to learn specific medical domains. TOP, a French acronym for Treatment in Pediatric Oncology, is an other type of FORUM application because it is aimed at the members of a care unit to help daily practice.

TOP-FORUM, as all FORUM applications, was developed with a specific hypermedia authoring system [10] which has two main characteristics.

First, the authoring system is based on a conceptual model able to handle information and knowledge. This model improves the link management system and facilitates creation and consultation of hypermedia. TOP-FORUM was developed by the department head of the oncology pediatric department during 12 months. To date, TOP-FORUM hypermedia consists of 509 pages, 345 hyperlinks and 183 graphic resources.

The second characteristic is a group of tools which encourage the active participation of the user. Using TOP-FORUM, medical and paramedical users can add Post-its and can upgrade information in the hypermedia system.

Post-its are dialogue boxes available on each page and provide space for the user to include personal notes, comments or ques-

tions to the medical community. For instance, Post-its are used to give comments on extravasation or to ask precisions about protocols.

Each user can also add information to develop a particular theme which is not present in the system and that they deem important to share with the rest of the medical staff. A workspace is open for this use. To maintain the integrity of TOP-FORUM, each user can only modify his workspace but all members of the medical team can access and comment all workspaces.

This type of interaction breaks the traditional boundary between author and reader. It allows all of the members of the care unit to participate in the structuring of information, a more beneficial experience than mere browsing. These tools allow for cooperative working.

TOP-FORUM specific medical goals

The treatment of cancer in children is characterized by:

- importance of strategic chemotherapy dosed at the highest limit of tolerance to toxicity,
- great variety of cancers which results in the need for a large number of different procedures,
- various doses of each medication, for which calculation must be carried out carefully to avoid overdosing.

Documents normally available in care units are original protocols, simplified versions for quick reference, technical files on medications and procedural files. They consolidate the information necessary for current medical practice. The physical format of these references has several drawbacks:

- despite every effort, physical references rarely provide easy and rapid access,
- their format requires a period of introductory study before their efficient use,
- some documents are prepared specifically for physicians or nurses. They do not provide consistent access to information for all the medical team,
- their format is static and difficult to update. New information must be appended to existing documents until new editions are published.

To work in an efficient and secure manner, health care workers must be equally aware of limitations and opportunities that new developments generate.

The goal of TOP-FORUM [11] is to improve the quality and security of care by increasing the knowledge of the medical team, improving access to detailed information and providing a means to input information acquired by the individual for the benefit of all the medical team.

TOP-FORUM is composed of seven main chapters: specific treatments, general treatments, methods of care, care structures, care objectives, family counseling and treatment follow-up. TOP-FORUM includes general information in pharmacokinetics but also specific information derived from the group such as technical short cuts.

Methods

Overview

TOP-FORUM is running on Apple Macintosh microcomputers. They are installed in the resident's office on both levels of the pediatric oncology department. Computers are accessible 24 hours a day. The majority of the subjects were not familiar with hypermedia interactions. Since TOP-FORUM's debut in February of 1996, seminars and group training have been organized. The objectives were to inform the subjects of the aims of the project and to train in technical manipulations and hypermedia concepts. But the most important was to make psychological preparation for medical information that is not stiff but rather upgradable. The fact that Post-its are anonymous was emphasized.

To facilitate the tool's acceptance by the group, a physician skilled in medical informatics provides a weekly opportunity for questions and guidance. Every month, staff meetings allow for discussion of Post-its and thereby permit regulation and collective appropriation of the new tool. Requests to open a new workspace are also discussed on these occasions.

Subjects

TOP-FORUM is available to both medical and paramedical staffs, regardless of function or status. There were 54 individuals in this study: 8 physicians and residents, 30 nurses, 13 trainees and 3 chief nurses.

Accommodation

Accommodation has been evaluated with two information sources: those deriving from interviews done after the utilization of the system, and those from automatic recording during each session. In the beginning of each session, the user indicated his/her professional category and his/her motivation. In addition, the system recorded, for each session, many different parameters reflecting the behavior of the user: length of the session, interactions or type of consulted information.

Assimilation

Assimilation has been realized from 40 interviews, made at the end of the study. The aim of those interviews was to show the recurrent terms that have become the indicators of assimilation.

Seven indicators have appeared:

- actual global impact,
- major utility or present usefulness,
- actual implication of the actors,
- actual public aim,
- positive future consequences for actors,
- negative future consequences for actors,
- future of TOP-FORUM.

The first four indicators reveal the actual practice of TOP-FORUM and the latter three are its future projection. For the actors' implication we have used ETZIONI's model [12] who defines three types:

- Alienation or implication under hierarchic constraint,
- Calculated Participation or implication in response to a retribution,
- Moral Adhesion or political implication in the structure.

To achieve strategic assimilation, i.e., the expected assimilation, the department chief, author of the system, has been submitted to those interviews.

Results

The results [13] were obtained after 127 days using TOP-FORUM.

Accommodation

We had 325 sessions, i.e., 2,6 sessions/day. Day sessions (8am-8pm) represent 79%. Night sessions (21%) corresponded to those used by nurses. 79% of hypermedia pages had been consulted.

Table 1 - Users and access motivation (%)

Users		Access motivation	
physicians	34	specific theme	54
nurses	42	general theme	11
trainees	15	no theme	28
chief nurses	9	no answer	7

Table 1 shows that physicians are those who, in proportion, have consulted TOP-FORUM the most. They represent 13% of the population and made 34% of access. The main motivation is the access to a specific theme, for instance the access to a therapeutic protocol. Table 2 confirms this idea since 83% of sessions were inferior to 10 minutes and less than 10 pages were consulted in 83% of sessions. In 45% of sessions there was no hypermedia link activation to change subjects. These results show that TOP-FORUM is used to solve daily problems and not to learn pediatric oncology.

Table 2 - Use (%)

Interactions			
pages <10	83	length <10 mn	83
pages >10	17	length >10 mn	17
post-it=0	76	hyperlink=0	45
post-it=1	14	1<hyperlink<=5	33
post-its >1	10	hyperlink >5	22

Globally, 38 Post-its have been created in which we found, above all, questions asking for complementary explanation about protocols. They are used to ask questions to the chief physician but not to establish communication between actors. Table 2 shows that Post-its were consulted only in 29% of sessions. Users prefer waiting for the staff to talk it over.

Table 3 shows that the perception of TOP-FORUM matches the author's expectations in almost half of the users. Accommoda-

tion to hypermedia interactions is not fulfilled since 44% of the users think they are difficult or very difficult. 42% of department members have never used TOP-FORUM. On the other hand, 60% of those who have used it think that the access to information is better this way.

It should be remembered that most users have never had access to informatic tools. It represents a deep cultural change in their way of working. We must also precise that TOP-FORUM was in free access. Traditional paper documents that describe protocols have not been suppressed for legal and security reasons.

Table 3 - Technology perception (%)

Difficulty of use		Frequency of use		Access to information	
very easy	10	never	42	lower	15
easy	46	sometimes	48	same	25
difficult	22	often	10	better	60
very diff.	22	always	0		

Assimilation

Results of Table 4 must be considered at a department level by the department chief and the chief nurses but at their professional level by all the other actors.

Globally, assimilation by actors is real but it is far from the department chief's expectations. The actors consider TOP-FORUM as a supplementary tool but it does not question working modes or professional relations. Only the department chief considers that it must substitute paper support and that it must regulate practices.

Among actors, only physicians have clearly realized the repercussion of the system for a better knowledge of protocols and for a strict observance of them.

Chief nurses have assimilated it, above all, as a tool for department cohesion.

The weakest assimilation appears among nurses. Their implication is of the alienation type. There is an incomprehension of the objectives of TOP-FORUM's introduction. Some fear that it could become a way to evaluate their practices.

For trainees, this assimilation must be analyzed in a different way. They are training personnel that have not yet been hired by the department. Those trainees are more familiar to new technologies and they have no professional background. For these reasons, trainees are ready to integrate new technologies in their professional practice.

Although an important information, stereotype fears remain such as decreased responsibilities or diminution of interpersonal communication.

It should be noticed that all actors think TOP-FORUM is more beneficial for other categories than for them, even if they access to it themselves. They have developed an individual protective attitude against new technology.

The creation of workshops is the most important example of assimilation related to professional investment. During this

Table 4 - Assimilation

	department chief	chief nurses	physicians	nurses	trainees
actual global impact	homogenizes care	improves quality	harmonizes communication	raises incomprehension	improves quality
actual major utility	regulates practices	nothing	completes paper information	helps in information research	nothing
public aim	all	trainee	trainee	physicians & trainees	physicians
implication	moral adhesion	moral adhesion	calculated participation	alienation	calculated participation
positive consequence	improves competences	favors knowledge	improves information access	specifies information	levels hierarchy
negative consequence	nothing	decreases responsibility	inhibits	diminishes communication	impact on people's power
future of TOP-FORUM	replaces paper	information & formation	reliability of information	information	too sophisticated

study, two workshops were opened. They were proposed by nurses to add to their know-how about bone marrow transplantation and central venous catheters.

Conclusion

Safran [14] recalls that Covell has shown that "the most efficient, or at least the most popular, method of acquiring information is to ask a colleague". On the other hand, new technologies are presented as very efficient in accessing information. Faced with these extreme situations, there is a need to have analysis methods of information diffusion that take into account not only technological appropriation but also professional appropriation.

We have used this approach in analyzing the appropriation of the TOP-FORUM hypermedia by the study of its accommodation and assimilation.

Results show that accommodation depends on information and formation of the actors. Accommodation is evaluated by quantitative indicators that are reported to practices and to actual experiences.

Assimilation reflects professional investment. It is the necessary complement to accommodation to evaluate appropriation in a complete way. It is also more difficult to achieve because it touches social, organizational and cultural problems [15]. Its evaluation needs the help of various competencies. Methods and tools must be created with the help of information and communication sciences and cognitive psychology.

This study is only one step in the analysis of TOP-FORUM's impact. The method we have used ends as an evaluation of individual appropriation. It does not allow to evidence the technological impact in order to install cooperative behavior in care activities. The main objective of our research is to propose an evaluation model of collective appropriation that could reflect the impact of a new technology in the culture of unit care.

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