

Full Length Research Paper

Evaluation of indexing language used in collective catalogues of university libraries: A socio-cognitive study using verbal protocol

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Accepted 16 March, 2011

The use of indexing language in university libraries' collective catalogs and the socio-cognitive context of indexing and users were evaluated. The methodology consisted of a diagnostic study elaboration of the functioning and treatment procedures of the indexing information from nine libraries of the UNESP network, Brazil, representing the civil engineering, education and dentistry areas from a data collection using the verbal protocol introspective technique in the individual and group forms. The study conducted a reflection upon the statements issued by the seventy-two participating individuals whose the results revealed unsatisfactory results about the use of the subject headings list of the BIBLIODATA network, indexing language utilizing by the UNESP Libraries Network, Brazil, in the representation and in the information retrieval process in the ATHENA catalog, about the sequent aspects of the language: lack of specialized vocabulary as well as updated; lack of remissives and of specific headings, and others. We have concluded that the adequate use of indexing languages of specialized scientific areas becomes by means of evaluation as to updating, specificity and compatibility in order to meet the needs of indexing and information retrieval.

Key words: Indexing language, assessment, qualitative socio-cognitive methodology, knowledge organization and representation, online public access catalog, technologies of representation and information retrieval. university libraries, verbal protocol.

INTRODUCTION

It is a fact that the interactivity between thematic representation, indexing language and information retrieval is conducive to continuous evaluations of language performance during search strategies, guiding their refinement and use in the indexing of documents.

The studies of Henzler (1978), Betts and Marrable (1991), Fidel (1992) and Gil Urdiciain (1998) demonstrated this relevance when they evaluated the performance of indexing language and of natural language in automated systems such as online catalogs

and specialized databases. The results obtained revealed that the combination in the use of terms of indexing language and natural language proves to be ideal when devising strategies, affording quality in the retrieval by subject carried out and expected by the user. In addition, Gil Urdiciain (1998) observes an increase in relevance in information retrieval with the use of indexing language, inserted in a context of high subject specialization, placing the precision of database systems before recall.

The indexing languages, characterized as knowledge organization systems that correspond to the lists of subject headings and thesauruses, are controlled languages built from the principles and meanings stemming from terms that are part of specialized language and natural language (common speech

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language), representing the set of terms to recover the indexing information. They should be structured in a multidimensional plan, crossing cultural and geographical boundaries of access and representation, without disregarding the main functions which include eliminating ambiguity, controlling synonyms and establishing semantic relationships (Zeng, 2008).

The primary function of indexing languages is to represent the content of documents in an information retrieval system, according to content, and its second function is to mediate information retrieval by representing the users' questions, according to use (Boccatto, 2008), hence playing a key role in the indexing and information retrieval processes and enabling the representation of documented contents, thus facilitating user-search by topic whenever information needs to be accessed quickly and accurately.

The considerations of Zeng (2008) and Boccatto (2008) lay out the need for constantly updating the indexing languages used by online catalogs of university libraries, in line with the innate characteristic of scientific progress and the plethora of dynamic and progressive knowledge generated by universities.

The views and comments of librarians and users are collaborative to consolidate these processes, in light of the fact that they should be seen as individuals who interact, understand and interpret their environment and at the same time, share their knowledge with a community of interpreters (Pinto, 2005).

On this matter, Hjørland (2002) reports that the socio-cognitive views are interested in individual cognition, however, approaching it from a social context. Accordingly, the process of individual knowledge is associated with the historical, social and cultural context of units and information systems responsible for organizing and retrieving information.

Thus, the objective of this study is to evaluate the use of alphabetical indexing language of online collective catalogs, focusing on technologies of representation and information retrieval from the standpoint of university libraries and within the socio-cognitive context of librarians and users.

THE ALPHABETICAL INDEXING LANGUAGES OF UNIVERSITY LIBRARIES' ONLINE CATALOGS

Indexing languages are support tools for indexing and information retrieval, which are a fundamental component of automated information systems for organizing and disseminating information in specialized scientific areas that require a greater control of terminology.

Fernández Molina and Moya Anegón (1998) consider online catalogs as automated retrieval systems of information that are more generally available and which are the first to be used by any user when there is a need

for information. In the First Meeting of Experts on an International Cataloguing Code, held in 2003, also known as "Principles of Frankfurt", the functions of the catalog were organized, corresponding to the environment of online catalogs, hence the Paris principles were expanded to the field of bibliographic description by subject and to the conceptual models established by IFLA - International Federation of Library Associations (IFLA, 2009).

The evolution of representation and information retrieval, made possible by technological advances, can also be evidenced by the agility of the description activity, through cooperative cataloging that enables importing standard records in other retrieval information systems from various libraries, in accordance with international standards, aiming to interchange them, hence contributing to the formation of online Bibliographic Database (CRUESP/Libraries, 2006).

This process offers advantages in terms of time, as the cataloging of a specific work will be much faster and easier, resulting in a lower cost.

Cooperative cataloging must be carried out carefully and specifically, regarding the thematic processing of the information and considering the guiding principles to conduct quality indexing. This is a result of developing the indexation during cataloguing, according to a defined indexing policy adopted by the system and with the proper use of alphabetical indexing languages as knowledge organization systems.

It can be concluded that the proper use of indexing language is necessary to ensure the implementation of quality indexing and information retrieval processes used by indexers and by users. The shifts in paradigms within the scope of indexing as a representation process of information for constructing online catalogs, from the proposed use of *FRBRs*¹, are collaborative in these processes.

The construction of online catalogs focused on users and on social context that involves the processing of information must be performed by multidisciplinary and integrated teams: Librarians, users, authors, catalog designers, systems analysts, among others, valorized by the presence of librarians as promoters in the design of access points, exemplified also by the analytical access of subjects, authors and titles and other resources applicable to the representation and information retrieval. From this perspective, it is important to use relevant indexing language that portrays not only the profile of the catalog, but also its user communities and, therefore, the evaluation studies of indexing languages to assist in choosing the more suitable knowledge organization system to meet such purposes.

¹ Functional Requirements of Bibliographic Records (FRBR), Functional Requirements of Authority Data (FRAD) (under revision) and Functional Requirements for Subject Authority Records (FRSAR) (under development).

EVALUATION STUDIES OF INDEXING LANGUAGES IN INFORMATION RETRIEVAL SYSTEMS: METHODOLOGICAL APPROACHES

When discussing the research work and evaluation methods of indexing languages in information retrieval systems, we verify a correlation between these themes and the epistemology of science information that includes independent outlooks to consolidate this scientific field.

Several aspects influenced the development of this area, defining different epistemological paradigms, yet interrelated and complementary. They are characterized by the existence of physical views (physical paradigm, focused on the system), cognitive views (cognitive paradigm, user-centered) and socio-cognitive views (social paradigm, individual user interaction and social/organizational environment) in the process of information retrieval (Capurro, 2003).

The physical paradigm values the information retrieval system and the message transmitting process, and inserted in this context, we consider the online collective catalog as "physical" and the bibliographic record as the transmitter, which transmits the information to the user (receiver) that receives the message. This information will be encoded to be transmitted as a message by the indexing language (communication channel), which is then decoded by the user (receiver), sharing the same code of the bibliographic record (sender). The communication design enables the feedback of the process, which may cause noise (indexing irrelevant to the recovered document) or silence (improper indexing, therefore the document is not recovered) in the recovery process of the information recorded on index supports.

In contrast, the evaluation studies with a quantitative approach, from the 1970s, illustrate a shift from the physical view to the cognitive view, signaling the development of evaluation studies focused on the user.

In the cognitive paradigm, the user is placed in an active position to elaborate ideas, concepts, etc. within an individual context. This scenario is viewed through the human dimension outlook, that is, the perspective focused on the user, because the information retrieval systems should be modeled according to the user, in the framework of their information needs and their behavior patterns in the search and use of information.

However, since the 1990s, the cognitive approaches have been analyzed and criticized by many researchers which, in addition to divulging the cognitive processes of individuals to carry out indexing processes and designing building systems for information retrieval, aggregate "context" as an important element, emphasizing a social-cognitive view, hence rendering this process effective. Our view, supported by Capurro (2003), leads us to presume that the construction of a retrieval information system holds users and their information needs as its focal point. The users, in turn, playing an active role in

the socio-cultural context, enable the storage and perform the recovery and interpretation of the available bibliographic records. Consequently, the individual is seen as a part of a society and thus, the studies developed from the socio-cognitive approach regard the phenomena as embedded in a social context.

In the research development of information science, especially in the evaluation of indexing language thematic, we see that the theories about the quantitative and qualitative methods are part of this important scientific-theoretical scenario depicted by the physical and cognitive paradigms. This demonstrates the applicability of these approaches in the evaluation studies focused on the system and on the user and not considering evaluation studies of indexing languages by the socio-cognitive approach based on epistemological ideas resulting from the social paradigm.

The quantitative methodology², representative of the physical paradigm, enables gathering information from a larger number of respondents, statistical analyses and, usually, the comparison and generalization of results.

From this perspective, we emphasize the classical indexing language evaluation studies; the Cranfield I and Cranfield II Projects, which were developed in 1957 and 1963, respectively, (Foskett, 1996); the Lancaster study (1968, 2003), which established the parameters and quantitative indices of precision and recall, which are applicable to assessing information retrieval systems exemplified by the MEDLARS system and the Aberystwyth Test. These were developed in 1970 inscribing the issue of specificity as a substantially important matter in the development of alphabetical indexing languages, in addition to the research of Torres (1992) and of Oliveira et al. (1997), the object of whose empirical study was the Subject Headings List of the BIBLIODATA network (LCARB), the particular interest of our study.

The qualitative methodology³ works with a plethora of interpretations, meanings, beliefs, values and attitudes, establishing close relationships with the theoretical and conceptual foundations arising from the cognitive paradigm in the Information Science area, showing the change from physical view to the cognitive view, and characterizing the elaboration of evaluation studies guided by the user.

Qualitative evaluation studies on indexing languages developed by Owens and Cochrane (2004) and Toews (2007) are examples of this methodology scenario, depicting the importance of using international guidelines and standards in the construction of knowledge organization systems that are compatible with the users' search needs. Qualitative methodology provides direct

² Also called quantitative approach, realistic quantitative approach and quantitative research.

³ Also called qualitative approach or qualitative research.

involvement with individuals, places and interactive processes; starting a descriptive collection guided the accuracy that must exist during the analysis of data interpretation.

It should be noted that in the context of qualitative methodology, the cognitive approach is present in the area of information science when conducting searches on thematic processing and information retrieval, showing the actions undertaken by librarians and users during the development of these processes.

Thus, studies using the qualitative-cognitive methodology show the subjectivity of the librarians and users' mental activity during their professional activity. This is seen from actions that intend to reveal the implicit aspects in the knowledge structures of these professionals and users (Dal'avedore and Fujita, 2008). The studies of Dervin (1983, 2003) on the sense-making approach, initially applied to the communication sciences area, contributed to developing cognitive approaches.

The data collection technique called Focus group⁴ was also used in qualitative-cognitive research work, initially in the marketing area and then in social sciences, ergonomics, health sciences, information science, and others.

In the field of information science, the research work of Connaway et al. (1997) applied the focus group technique to analyze the performance of the online catalog of the University of Wisconsin-Madison, with emphasis on the evaluation of indexing language adopted by the system from the user's perspective.

The introspective technique of the Verbal Protocol or "Think Aloud" is applied to qualitative evaluation studies where the individuals express, aloud, what they think and what goes on in their minds while performing a task. These statements are recorded, and the individuals' behavior, such as facial expressions are also recorded (gestures and eye movements). Thus, the language of thought performs many cognitive processes such as perception and reasoning.

In Brazil, the pioneer research work using the technique, developed by Fujita et al. (2003) and Fujita (2003), in observing indexed reading, shows excellent results in the use of the verbal protocol, illustrating new aspects of indexed reading, among other contributions.

By using the verbal protocol technique, users can "think aloud" by producing opinions and comments about the object being evaluated, hence carrying out a cooperative and participatory evaluation: The users participate by identifying and understanding problems of information retrieval and by using the system in their own work environment.

Thus, Boccatto and Fujita (2006) developed a research work to evaluate, from the user's perspective, indexing language DeCS - Descriptors in Health Sciences, used

for information retrieval in the LILACS (Latin American Health Sciences Literature) system produced by BIREME, (Latin-American and Caribbean Center on Health Sciences Information), in order to obtain indicators to outline language improvement strategies in the area of speech and language therapy. The study led to the consideration of the statements issued by the four participants and the results of the analysis revealed that the DeCS language in speech therapy demonstrated the search had unsatisfactory results on information retrieval.

In summary, regarding research development in the information science area, especially the thematic evaluation of indexing languages, we saw that the quantitative and qualitative methods are part of this important scientific-theoretical scenario portrayed by the physical and cognitive paradigms. This demonstrated the applicability of these approaches in evaluation studies focused on the system and the user, not considering evaluation studies of indexing languages by the socio-cognitive approach based on the epistemological ideas resulting from the social paradigm that regards users inserted into their social environment.

THE SOCIO-COGNITIVE CONTEXT OF INDEXERS AND USERS IN UNIVERSITY LIBRARIES

The socio-cognitive context concerns representation and information retrieval from the perspective of individuals in their socio-cultural-historical context, on the assumption that the users' information needs are constructed from outside to inside, that is, the users' environment influence and contribute to constructing this need, which will be represented by their mental models associated with their conception of the world, reflected on their real information interest. Boccatto and Fujita (2010)

The context performs the mediation between the real situation in the library, guided by the analysis concepts used by the indexers, and the linguistic system, the indexed language adopted by the system, characterized by the representation of the indexed documents.

According to Gonçalves (2008: 28-29), the socio-cognitive context of indexers refers to "[...] a prior knowledge that such professionals have their working tools (the indexing policy, rules and procedures of the indexing manual, indexing language) and the real needs of users".

The activity of indexing leads to the indexer adopting a conception of the matter which should be intimately related to their established institutional objectives and to the information retrieval system itself, detailed in the indexing policy. These conceptions of subject analysis, which we believe affect the performance of the indexer, are classified according to Albrechtsen (1993: 220-222) in simplist conception, content-oriented conception and requirements-oriented conception. According to

⁴ Also called focus group or focus group interviews.

Gonçalves (2008), the users' previous knowledge is characterized by the university, by the research groups and by the online collective catalog, elements that guide and influence the expression of their need for information, concomitant with the cognitive processes to meet this need.

Thus, the socio-cognitive context is a factor to be considered in the indexing process development, from indexing reading, aimed at the analysis and representation of information consistent with the users' search needs. Associated with the socio-cognitive aspect, the physical aspects, to which the institution and/or the information system are linked through the mission, objectives, the strategic plans and philosophy, and the psychological aspects are fundamental to form the indexers' context, as very significant variables in the construction of this process.

The indexing language seen as the indexers' expertise and prior knowledge, should enable highly accurate content matching of the documents and the users' information needs expressed by their repertoire, resulting from prior knowledge constituted by the university, the research groups, the curriculum classification of scientific and academic disciplines and by the information retrieval system itself.

In this case, the holistic and collective views of indexers and users are favored, as they contribute to the definition of a thematic processing of information and to the modeling and construction of information retrieval systems. Based on this concept, the information science area turns to a theoretical dimension brought into focus by interpretive approaches, focused on the semantic factors and the information social context of indexers and users.

In this sense, our research work is contextualized between the shift of cognitive paradigm to the social paradigm, which puts the context of indexers and users in the center of the informational processes, characterized by the representation and information retrieval and knowledge. Therefore, this research focuses on the socio-cognitive context of indexers and users, based on the theoretical perspectives of Hjørland (1997: 118), which approves a "methodological collectivistic approach" for the proposal of conducting an assessment study on the use of indexing language in online catalogs of specialized scientific areas of university libraries, focusing on technologies of representation and information retrieval, using the verbal protocol as a data collection technique. The verbal protocol technique, viewed by the socio-cognitive approach, focuses on the individual when performing a particular activity and its cognition related to its production context. With regards to the indexers, the interest is the thematic processing of information, specifically the indexing and the use it will make of indexing language when representing the information. From the users' perspective, the focus is on information

retrieval by subject, by using language to search for information and interacting with their environment.

MATERIALS AND METHODS

The data collections were performed on a sample of nine libraries of the UNESP in the three knowledge areas, exact sciences, humanities and biological sciences, of the civil engineering, education, and dentistry courses. The empirical study objective was the Subject Headings List of the BIBLIODATA Network used in the processes of indexing and information retrieval in the online collective catalog ATHENA is demonstrated in Table 1.

The methodology consisted of a three-part diagnostic study: (1) Operation and procedures in the processing of indexed information in the UNESP Libraries Network based on the perspective of the General Coordinator of Libraries (CGB, Coordenadoria Geral de Bibliotecas); (2) Operation and procedures in the processing of information in the UNESP Network of Libraries from the cataloguers' outlook⁵; (3) The users' evaluation on access and retrieval of online information.

To perform the first part, organizational diagnostic questionnaires were administered to the directors of university libraries. According to Almeida (2005: 53-55), the preparation of the questionnaire was essential for the organizational diagnosis, consisting of a total of twenty-six open, closed and mixed questions (Appendix 1).

In the second part, for the operation and procedures for the processing of information in the UNESP Network of Libraries from the cataloguers' outlook, we used the cognitive approach with the verbal protocol introspection technique, as follows:

1. Group Verbal Protocol (GVP) with the heads of libraries, cataloguers, reference librarians, faculty staff users, head researchers and research group staff, and student body users for accessing the participants' knowledge on the processing of indexing content of university libraries as a source of qualified data collection in the diagnosis;
2. Individual Verbal Protocol was conducted with by Cataloguers (IVP-C) to identify the procedures of subject analysis and representation in cataloguing books, as well as to identify the difficulties and restrictions.

In the third part, regarding the evaluation of user access and retrieval of online information, Individual Verbal Protocols were performed with undergraduate freshmen and senior Users (IVP-U)⁶, of the aforementioned courses. In the introspective technique of verbal protocol "[...] the individuals, talk aloud, and express what occurs in their minds during the execution of a task" (Boccatto and Fujita, 2006). These statements are recorded and transcribed verbatim to be analyzed later through the establishment of categories.

In the context of this study, the verbal protocol, seen from the socio-cognitive approach, focuses on the individual at the moment of undertaking a specific activity and his cognition in relation to his context of production (Boccatto, 2009b: 133).

In addition to this, it should be pointed out that the participation of the cataloguer (professional user) is evidenced in the development of the indexing in the cataloguing via the use he makes of indexing language during this activity. With respect to the user, the focus is

⁵ Within the context of UNESP Library Network, the indexers correspond to the cataloguers who develop the activities of cataloging and indexing

⁶ In the education and dentistry Courses, the application of the individual verbal protocol to last year users corresponded to of 4th year students; in the Civil Engineering course, the last year students correspond to 5th year students.

Table 1. Selection of UNESP university libraries and their respective identifications (Bocato, 2009a: 137).

Course	Area	Libraries/Brazilian city	Identification
Civil engineering	Exact sciences	Bauru	E1
		Guaratinguetá	E2
		Ilha Solteira	E3
Education	Humanities	Presidente Prudente	H1
		Rio Claro	H2
		São José do Rio Preto	H3
Dentistry	Biological sciences	Araçatuba	B1
		Araraquara	B2
		São José dos Campos	B3

centered on the search and retrieval by subject, by means of the use of language in the satisfaction of his research needs integrated with his environment consisting of the university, research group, syllabus and catalog. (Bocato, 2009b: 133).

Individual verbal protocol consists of the recording of the “think aloud” of a single individual during the undertaking of a task, and group verbal protocol itemizes the discussion of a copy-text on the subject that involves the task to be observed and, consequently, collected from the utterances of the individuals and from their cognitions of the theme being dealt with and evaluated. The different modalities of verbal protocols follow similar procedures in their application:

Procedures that anticipated application of verbal protocol

Definition of the universe of the research

GVP and **IVP**: University libraries of the UNESP Library Network Brazil.

Selection of copy-text

GVP: Passage between pages 205 and 208 of the following article: Dias, EW, Naves, MML, Moura, MA (2001). The information-seeking behavior of researchers and subject analysis. *Perspect. ciênc. inf.*, 6: 205-221. Available from: <http://portaldeperiodicos.eci.ufmg.br/index.php/pci/article/view/429/237>.

IVP-C: The bibliographical record itself to be catalogued for inclusion in the ATHENA catalog of the UNESP Library Network;

IVP-U: The bibliographical record itself retrieved from the ATHENA catalog of the UNESP Library Network.

Definition of the task

GVP: Discussion of the copy-text previously referenced.

IVP-C: Undertaking of the by cataloguers of the indexing for the cataloguing of books on dentistry, civil engineering and education, highlighting the use of the LCARB in the process of the

representation of information;

IVP-U: Undertaking by the users of information retrieval on topics determined by them in dentistry, civil engineering and education, in the collective Athena catalog, by subject field, using the LCARB indexing language.

Selection of the individuals

GVP: Three librarians (head of library, cataloguer and reference), one teacher and one student.

IVP-C: Population of by cataloguers from the three knowledge areas, biological, exact and human sciences, respectively, dentistry, civil engineering and education, amounting to nine individuals from UNESP libraries;

IVP-U: Population of undergraduate users from the first and last year of the dentistry, civil engineering and education courses in nine libraries of UNESP, totaling eighteen participants.

Informal conversation with the individuals

In this conversation, the researchers contacted the individuals through the General Coordination of Libraries explaining the objectives of the research, the methodology used and agreeing a date for the collection of data. The anonymity of all the participants was protected.

Procedures adopted during the application of verbal protocol

GVP: After the reading of the copy-text, a discussion was initiated, in which the researcher made the necessary interventions so as to prompt the participants. The entire discussion was recorded and transcribed verbatim.

IVP-C: Every expression of thought uttered by the cataloguer during the execution of indexing in the cataloguing task and recorded with the aid of an MP3 device;

IVP-U: Every expression of thought uttered by the user during the development of indexing in the bibliographic search and recorded with the aid of an MP3 device;

Procedures following the application of the verbal protocol

Transcription of the recordings

GVP: After the recording of the discussion of the text by the individuals, a literal transcription was made with the identification of the sources of the individual statements. This identification was made in the following way: Head of Library, reference librarian, cataloguer, Faculty Staff Users/teachers, Student Body Users.

IVP-C: After the recording of the “think aloud” during the indexing in the cataloguing, a literal transcription was made of the recordings of the individuals’ statements;

IVP-U: After the recording of the “think aloud” during the information retrieval, a literal transcription was made of the recordings of the individuals’ statements.

Analysis of the transcriptions

With the transcriptions ready, a detailed reading of the data was undertaken in search of significant and recurring phenomena for the construction of the categories. Following the construction of the categories, we returned again to the data to extract passages from the transcription that exemplified each category.

Thus, the procedures adopted for the organization diagnosis applications in university libraries, and the individual and group verbal protocols were conducted in order to characterize the organizational/academic context in the UNESP Library Network and to observe the views of cataloguers and users to analyze the actions and opinions of the participating individuals regarding indexing during cataloguing and information retrieval.

Thirty-six data collections were held for nine groups of verbal protocols, nine individual verbal protocols with catalogers and eighteen individual verbal protocols with student body users. The total number of individuals participating in this research was seventy-two persons, with forty five in the group of verbal protocol (heads by libraries, cataloguers, reference librarians, faculty staff users/teachers and student body users); nine cataloguers and eighteen students. The collections began in May 2006 and concluded in September 2007; they were conducted in the individuals’ work or study environments, namely the premises of the nine UNESP Library Networks that were previously scheduled to participate in our study. In addition, we should highlight the difficulty of bringing all the participants together in the same place on the same day and at the same time, since the execution of the data collection was possible only when all of them were in the same field of observation.

The transcripts of the data collection generated a substantial amount of data. Considering the socio-cognitive approach to the interaction of the organizational environment (library) and the different perspectives arising from the different participants involved in the data collection (heads of libraries, reference librarians, cataloguers and faculty staff users/teachers and student body users) indicated the complexity in analyzing these transcripts, thus, the reading in full of the verbal protocols were performed, since the language used by the individuals is not always the same used in the literature.

For the collected data analysis procedures and to meet our study proposals, twelve categories were elaborated based on the theoretical frameworks, the research objectives and the statements made by the participants who contributed to exemplifying each phenomenon; each category was systematized into three themes:

1. Indexing language by content: indexing procedures (1); procedures for indexing representation (2); language selection (3); choosing terms (4); performance of language in the indexing representation process (5);
2. Indexing language by usage: knowledge/importance of language (6); search strategy (7); performance of language in the information retrieval process (8); system precision and recall ability (9); evaluation of the information retrieval system (10);
3. Indexing language by form: procedures for construction, upgrading and maintenance of language (11); the role of the librarian in the construction, upgrading and maintenance of language (12).

RESULTS AND DISCUSSION

The results presented aim to demonstrate the vision of the context in which the by catalogers and the users are inserted and, consequently, of the use that is made of indexing language in the indexing in the cataloguing and in the information retrieval. To this effect, we analyzed the organizational diagnostics questionnaires completed by the heads of libraries and the individual and group verbal protocols.

The analysis of the organizational diagnostics questionnaires revealed a picture of administratively consolidated university libraries, promoting a participative management, many involving the users in the process of the planning of products and services. With regard to the activity of indexing in cataloguing, it was confirmed that the libraries are aware that the LCARB is an instrument of terminological control adopted for the representation and information retrieval in the ATHENA catalog. In addition, when asked whether the referred indexing language meets the needs of representation, the replies varied between “does not meet” or “partially meets”.

In the information retrieval process, almost all the libraries concurred in responding that the language does not meet the needs of users’ searches by subject, although all of them provide formal and informal training of users which includes the use of the ATHENA catalog in the information retrieval process by subject field.

The qualitative analyses of the data collected with the application of the verbal protocol technique, in the individual and group modalities, were undertaken on the basis of the selection of the statements uttered by the individuals in this study in the choice of twelve categories, systematized in three thematic axes regarding the use of the Subject Headings List of the BIBLIODATA Network (Appendix 2 to 4).

The indexing language has been widely discussed by catalogers and users, teachers and students, in group and individual verbal protocols in the three knowledge areas and has given rise to many questions and concerns about the performance and importance of this mediation and communication instrument between indexing and information retrieval in online collective catalogs of the specialized scientific areas of

university libraries.

The socio-cognitive context of UNESP Library Network cataloguers', comprised by the university, library, UNESP quality standard for bibliographic records, Subject Headings List of the BIBLIODATA Network, parallel indexing languages, ATHENA catalog and the teachers and undergraduate students of specialized scientific areas influenced the indexing, which provided us important results on the use of LCARB for the information representation in the online collective catalog ATHENA. Such results arrived from the declarations uttered by the participating individuals in the Group (PVG) and Individual (PVI) Verbal Protocols may also be verified, in their entirety, by consulting Appendix 2 to 4, identified in the following way: Heads of Libraries (HL), by Cataloguer participant in the group verbal protocol (C), by Cataloguer participant in the Individual verbal protocol (C-I), Reference Librarians (RL), Faculty Staff Users/teachers (FS-U) and Student Body Users (SB-U) and accompanied also by the identification of the respective libraries (Table 1).

In a synthetic analysis, the use of LCARB proved to be a "required" instrument in the UNESP Network, which was used for confirmation and validation of subject headings to be described in field 650⁷. This important finding is associated with some aspects, also explicit by the obtained results. As a first aspect, due to the fact that LCARB does not have a specialized and updated vocabulary and as it does not provide a consistent syntactic and semantic structure, it was observed that the use of parallel knowledge organization systems was a frequent practice in the search for specificity that is required by the thematic processing of information in scientific areas, through the description in field 690⁸, reflecting the plethora of knowledge in which the university library is inserted.

Examples:

IVP-C B2 [*LCARB does not satisfactorily represent the documents' subjects*] [...] *So as for subject cataloguing when you don't have the subject in the book, you can't find it in the BIBLIODATA you put it in field 690 which covers the local topics. Is that right? ((S))Yes. [...] when it doesn't work for you, you use other resources in the event you search in the DeCS of the BIREME and you enter it under our 690 field.*

GVP H3 [*inconsistencies in the syntactic-semantic relationships of the LCARB*] 13 C [...] *I am going to put it in 650 (a controlled field in the MARC 21 holdings format of the ALEPH software) "Children I do not know what",*

⁷ Field 650: "Subject Added Entry - Topical Term" of the MARC 21 Format for Bibliographic Data.

⁸ Field 690: "Local Subject Access Field" of the MARC 21 Format for Bibliographic Data.

and then you look for "Child" which she does not know if it is in the plural, which it is. She does not know, so what am I supposed to do? Should I create another 650 and put Child in the singular? The standardization of these issues was a concern expressed by the librarians of the three knowledge areas, hence demonstrating the need to adopt a single instrument of terminology control for the Network of Libraries for the description of local issues, aiming to

standardize the subject access points in the online collective catalog ATHENA. In this regard, the dentistry area was also in favor of this, despite their use of a controlled specialized vocabulary to describe indexed content, given that LCARB does not fulfill this function.

This aspect resulted in the librarians acknowledging the need to improve LCARB and construct a specific controlled vocabulary in the UNESP Network, including the significance of the users' participation in this process.

We understand, however, that the users operating in a context of specialized scientific areas of university libraries need documents represented thematically in a greater breadth of specificity and with the use of terms capable of '[...] representing the subject of the document in the same degree of breadth in which it is treated by the author of the document' (Torres, 1992: 45). This attitude is immediately reflected in the information retrieval process and in the more precise results produced by searches by subject, representative of documentary content.

According to the research by Torres (1992) and Oliveira et al. (1997), we observe that the indexing language should offer conditions so that this need may be met, given that it possesses a specialized vocabulary that satisfies the representation of subjects of scientific areas, of an expressive syntactic-semantic chain, with hierarchical relationships, of equivalence and non-hierarchical relationships, and which offers its compatibility with the retrieval language used by the user.

With regards to the second part of librarians' "performance" in the context of indexing, we did not see proper indexing as the activity that includes the identification and selection steps of concepts for representation by means of alphabetical indexing language. We noted the lack of systematic indexed reading and the practice of surveying issues. This was perceived mainly from library cards of catalog publications, in detriment to a subject analysis focused on the document's content. This scenario, in turn, leads to a representation of subjects that do not correspond to the approach level addressed by the authors, with a tendency that chooses the generic subject heading to represent the document's content.

Examples:

IVP-C E2 [*Original Cataloguing*] [*catalog record and parts*

of the document as source for subject analysis]

[...] Now I go to the subject field. [...] I'm going to look for the term. You take a look at the record and I always scan the abstract, if there is an abstract, something I always look for, give a quick read here in the preface, look here over the topics, the bibliographies, to get the information on the subject [...].

GVP H1 *[concern with the procedures adopted for the reading of the documents; concern of the teacher about how the documentary reading is handled; catalog record considered as a source for the determination of the subjects]*

65 FS-U

And something else I am thinking, of course the role of the librarian, he is trained to have the eyes and the perception of the themes and subjects the books deals with, true? Also I do not know what it is like exactly how it is defined when it comes to cataloguing, I mean, what do you read? What do you do? You read the cover...

67 FS-U

How do you extract that information? Why was there a failure at that moment... [...].

69 FS-U

And, it is not from an area you know much about, how are you going to tackle it? [...].

70 HL

From the catalog record.

The literature shows us the conception of indexing as a process of documentary analysis for the purposes of information retrieval formed by the following basic steps:

(a) Analysis: Reading and segmentation of the text for the identification and selection of concepts; (b) Synthesis: Construction of the documentary text with the concepts selected, this especially has to do with the elaboration of abstracts; and (c) representation by means of indexing languages (Lancaster, 2003).

Fujita (2003) stated that the processes of analysis and synthesis suggest that the texts undergo a kind of de-structuring for the construction of another text, the documentary one. Thus, for analysis, the text is segmented, the concepts are identified and selected; and for synthesis, a process is undertaken of condensing the text and the elaboration of a documentary text which is an abstract.

Concerning the subject analysis, Fujita (2003: 41) reports that this “[...] is one of the most important stages of the indexer’s work, since it has the objective of identifying and selecting the concepts that represent the essence of a document”.

Within this context, we believe that the conceptions of analysis “content-oriented and requirements-oriented” professed by Albrechtsen (1993) are totally applicable

during the practice of the indexing for cataloguing of documents from specialized scientific areas of collective online university library catalogs.

The users’ socio-cognitive context shaped by prior knowledge about the university, research work developed at scientific research level, curriculum of scientific-academic disciplines and by the ATHENA catalog, showed us relevant results on the use of LCARB for the information retrieval process.

LCARB as a mediator instrument between the user and the system received a poor performance evaluation, demonstrating the incompatibility of the indexing language adopted by the system and user search.

The all-inclusive results presented by the system represented one of the most important issues for users as a factor of search by topics not compatible with their investigative needs, resulting in a high recall of information retrieval. Examples:

IVP-U H1- *last year [choose by the generic term; lack of specificity in the language]*

[...] ((ASD)) READING or just ((ASD)) WRITING...but you saw the specific even if I can not. That is the point they are very...very general [...].

IVP-U B2 *–1st year [incompatibility between the user’s language and that of the system]*

((S))[...] I am going to try with ((ASD)) INCISIVE TEETH. Look, it got this by ((LR)) Celso Eduardo de Moraes Barbosa, in 1973 with the subject topic ((ASR)) INCISIVE TEETH. The way you type it is different from what they have on the computer [...].((ASD)) CENTRAL INCISIVES. Nothing, again. It only has under ((ASR)) INCISIVE TEETH. Nobody is going to search for that. Nobody talks about incisive teeth. It is incisive. The computer subjects should be more like what people are looking for [...].

With regard to this, Foskett (1996) tells us that the specificity normally is used for the indexing of periodical articles made available in databases of specialized scientific areas and by means of a greater number of terms. In relation to books, these are, in accordance with their content, catalogued in their entirety and the subjects are represented by means of a classification notation for the organization on the shelves and in one or two subject headings for access and catalog search.

We believe, however, that a balance between exhaustively and specificity in the process of documentary indexing is recommendable, mainly for the thematic treatment of books. Exemplifying this affirmation, we resort to the area of dentistry demonstrating that if a book deals specifically with amalgam, resin compounds and dental porcelain and the thematic treatment recognizes the use of exhaustively, it will also contemplate the generic term, dental materials. In this case, if the user’s information need referred to the subject dental materials in a general way, the document would be retrieved. If he requires specifically one of the

three dental materials, the document will also be retrieved.

The lack of knowledge about the language provided by the system and about its use to develop search strategies, also contributed to configuring the list of elements that demonstrate the inadequate performance of language in the retrieval process. As a solution to these problems, users suggest using more specific headings to represent the indexed contents and the construction of a controlled vocabulary based on the specialist's and student's language. Example:

IVPI-U H2 – 1st year [unfamiliarity of the user with the language used by the system]

[...] I go to look for something to do with ((ASD)) CHILD DEVELOPMENT. No document was found. I am going to try ((ASD)) INFANT DEVELOPMENT [...].

Turning to the literature, we confirm that if the information retrieval system were to make indexing language available at the search interface, these confusions could be minimized. The research of Connaway et al. (1997) and Oliveira et al. (1997) support our affirmation, since the user knowing the system's language could use the terms adequately, speeding up the search process and increasing his motivation in the execution of this task. Furthermore, with the indexing language being available to the user, he will be able to undertake the search by means of the language itself, since after the consultation, he would be able to select his terms of interest and these terms would automatically be entered in the search form. Users also perceive the need to reconcile LCARB and the users' search language, hence presenting suggestions about accessibility in the search interface of See and See Also links as guiding links between the searched headings and retrievals by the language. Examples:

GVP B2 [incompatibility between the user search language and that of the system; construction of a vocabulary derived from the language of the specialist and of the user; unsatisfactory performance in the activity of searches by subject: result too wide-ranging]

10 FS-U

[...] because the first thing I do is I log on and enter the subject, only what you get is a whole range sort of enormous sort of things and you end up having a subject there which does not interest you. If you put in a word, and sometimes you type a word, for example, Inflammation, which is what we study quite a lot, only you want a specific area and suddenly you have Inflammation of everything, of all sorts of the human body [...] 70 SB-U But sometimes the vocabulary it uses is not the vocabulary we are used to.

Moreover, they also highlight the availability of a user

manual and language accessibility for local and remote users as guidelines for the needs of precise information retrieval.

With regards to the ATHENA catalog, user outlooks showed us that it should work similarly to a database, allowing retrieval by subject of analytical documents such as book chapters and journal articles and the ordering of records retrieved in descending order, by date of publication, including other aspects. Example:

IVPI-U B2 – last year [catalog functioning like a database]

[...] I do not know if it is a cataloguing mistake or if it is a subject error that does not work, because [...] what you're searching for [...] should appear the same in the ATHENA. The best thing would be for the ATHENA also to provide the function, for example, of a database like LILACS and PubMed and for it to be more specific when you search for a subject, with texts as well or an abstract of the material [...] do not what you think? [...].

With respect to this, our point of view finds support in the theoretical tenets of Hjørland (1997, 2002) on the construction of online collective catalogs seen from the perspective of an integrated information system, aiming at access, retrieval, the location and rapid and easy sourcing of the information and printed and electronic documents representative of the user's real information need and of his social context.

We would point out that the work developed by the IFLA (2009) contributes to this scenario with the establishment of directives for the implementation of bibliographical representation focused on the user and on his environment, with the objectives of indexing for cataloguing and the control of vocabulary, by means of alphabetical indexing languages as the principal actors in this process. From this perspective and based on the results obtained in our research work, we deem necessary, within the reality of UNESP university libraries, proposing recommendations on the proper use of indexing language in the online collective catalog ATHENA for the specific scientific areas, as for instance indexing and information retrieval, based on the construction of a controlled specific vocabulary for the UNESP Network.

CONCLUSIONS

Based on the first three aspects addressed in our research work and our proposal and objective, we were able to verify that the proper use of indexing languages in specialized scientific areas occurs through evaluating the upgrades, specificity and compatibility in order to meet the needs of indexing and information retrieval. The design of this scenario is based on an interactionistic view between the environment and the perceptions of

individuals involved in this process.

The socio-cognitive qualitative approach with the verbal protocol an evaluation method, enabled us to observe the use of indexing languages in online collective catalogs of specialized scientific areas within the contexts of librarians' work, checking their daily "work" using language to represent indexing, their understanding about the indexing language adopted by the system, views on their performance and what is considered in the knowledge organization system as appropriate to the needs of representation and search by subject.

With regards to the users' information retrieval, it allowed us to evaluate the use of language in developing search strategies, the perception on their search by subject performance and understanding what is considered a satisfactory performance and an adequate construction.

Therefore, we believe that the tendency of catalogs is to act like database and the cataloger also acting as an indexer, hence perceiving the importance of this role in building collective retrieval catalogs through subject access points based on the analysis and effective representation of the subject of the document, for the retrieval of personalized information that portrays the users' information needs as well as their social context.

Therefore, university libraries inserted in a plethora of knowledge requires products and tools that portray this reality, since the indexing language is a component of the catalog, it should represent such highly specialized scientific content, promoting mediation and communication between the indexing and information retrieval to its local and remote user communities. This language should be based on a multidimensional concept that considers the syntactic-semantic relationships stemming from the specialized scientific areas and from the language of the user.

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APPENDIX

Appendix 1. Organizational diagnosis questionnaire for the UNESP network of university libraries (Boccatto, 2009a: 265-270).

- (1) Official name of the Library:
- (2) Physical space: Specify the physical area in m²
- (3) What are the Library's areas of activity/specialization?
- (4) Organizational structure of the library:
 - (a) Does it have an organogram? Yes () No ()
 - (b) Is the library close to the senior administration (to the decision-making power of the institution to which it belongs)? Yes () No (). Which?
- (5) Administration of the Library:
 - (a) Centralized ()
 - (b) Participatory ()
- (6) Does the library undertake annual planning of its activities? Yes () No (). If yes, give an example of an activity described in the annual plan.
- (7) Do users participate in the planning of the library's activities? Yes () No ()
- (8) Do users participate in the library commission? Yes () No ()
- (9) What is the work flow of the reference and technical processing services?
- (10) Projects:
 - (a) what kind of projects does the library develop?
 - (b) This process involves:
 - (i) The library team ()
 - (ii) Other institutions/information units ()
 - (iii) The library team and also other institutions/information units ()
- (11) Technical documentation:
 - (a) Does it have service manuals? Yes () No ()
 - (b) which?
- (12) Administrative documentation: Does it have?
 - (a) Library rules: Yes () No ()
 - (b) Regulation of services: Yes () NO (). If yes, which?
 - (c) Library commission: Yes () No ()
 - (d) Regulation of the library commission: Yes () No ()
- (13) Human resources:
 - (a) Quantify:
 - (i) Librarians (Total):
 - (ii) Number of librarians involved in reference activity (assisting users):
 - (iii) Number of librarians involved in activity of cataloguing catalog ATHENA:
 - library assistants:
 - general services auxiliaries
 - Computer science technicians:
 - (b) Does the library have a training program for its human resources? Yes () () No. If yes, which?
- (14) What competencies are important for your function in the library?
- (15) What are the principal needs perceived by you with regard to your in-service training?
- (16) Do you consider it to be important to reflect on your professional performance as you do your work? () Yes () No. Why not?
- (17) Collection: Types of material (Quantify them):
OBS: In the case of periodicals, quantify the number of titles and volumes.
- (18) Technical processing:
 - (a) Is it standardized: Yes () No (). If yes, which cataloguing codes and manuals does it use?
- (19) Technical processing: Cataloguing in indexing:
 - (a) What is the indexing language (name) used for the undertaking of the cataloguing activities in indexing and for bibliographical searches in the ATHENA catalog?
 - (b) Does the indexing language used by the catalog satisfactorily meet the needs of carrying out the cataloguing activity

Appendix 1. Contd.

of indexing?

(20) Computerization: Does it have computerized products; services?

Yes No. If yes, specify:

(21) Information retrieval: Is the ATHENA catalog much used by the users?

Yes No . If yes, which are the most commonly used fields of information retrieval?

All fields

Author

Title

Subject

(22) Users

(a) Quantify the number of users: Actual: Potential

(b) What category/categories of user does the library have? Undergraduate postgraduate specialization master doctorate teacher all the categories aforementioned

(c) Quantify and characterize the research groups active in the Unit:

(i) is there any library service that gives priority to the research groups in your Unit? Yes No. If yes, which?

(ii) How does the library give priority to the Unit's research groups in the development of its services?

(23) Training of users:

(a) Is offered regularly: Yes No

(b) Is aimed specifically at a particular category: Yes No . If yes, which?

(c) Is specific training given for using the ATHENA catalog? Yes No

(d) Search by Subject Field is taught to the users? Yes No

(e) Information retrieval by subject field undertaken by the user of the ATHENA catalog satisfactorily meets the search needs? Yes No . If no, why not?

(24) Communication

(a) How does the library promote the services and products it offers to its users?

(b) The library has:

electronic newsletters

printed newsletters

both

other promotional materials. Which ones?

(c) How is communication between library employees handled:

by email

telephone

memos

in person

other means. Which ones?

(25) Relationship with like institutions

(a) What relationship does the library have with member libraries of the UNESP Network of Libraries operating in the same areas of activity? Very frequent frequent temporary does no exist. Specify which libraries these are

(b) Are internal and/or joint meetings held with these libraries? Yes No

(26) Evaluation:

(a) Is undertaken regularly? Yes No . If yes, answer item (b).

(b) Does it cover all the services and products carried out/available at the library?

Yes No . If yes, which?

Appendix 2. Results of the analyses of the statements of the individuals obtained from the application of group and individual verbal protocols, systematized by thematic axes and categories of analysis.

Indexing language seen from perspective of content	
Analysis category	Result
1. Procedures relating to indexing	<p>Use of UNESP norms for indexing in the cataloguing, although there is nothing specific in this respect (C B2);</p> <p>Analysis of the subject understood as survey of the subject (C-I E2);</p> <p>Subject analysis is not properly conducted (C-I E2; C-I H1; C-I H2);</p> <p>In the practice of cooperative cataloguing, the subject analysis is not undertaken when the elements of the records correspond totally or partially with the catalogued item (C-I H2, C-I B2);</p> <p>Lack of systematization in carrying out the documentary reading by the librarians in the three areas of knowledge (C-IE2; C-IH2; C-IB3);</p> <p>The catalog record, the indexing languages and the classification systems are sources of information to identify and select the subjects (FS-U H1; C-I E2; C-I H1; C-I H2);</p> <p>LCARB as the indexing librarian's prior specialized knowledge for subject analysis (C-I E3; C-I B3);</p> <p>Librarians in the area of dentistry receive training in BIREME for subject analysis (RL B1);</p> <p>Procedures carried out by the librarians are aimed at meeting user demand (C-I H1);</p> <p>Need to undertake analytical indexing of documents: Book chapters (C B3).</p>
2. Procedures relating to representation for indexing	<p>The inadequate execution of subject analysis compromises the representation and the use of the language with subject headings not corresponding to the level at which the subject is effectively handled by the author (C E1; C-I E1);</p> <p>Use of the LCARB for confirmation and validation of the headings (C E1; C-I E1; C-I E3);</p> <p>Use of parallel indexing language for headings not available in the LCARB (C B1; C-I E1; C-I E2; C-I H2);</p> <p>Need for standardization of subjects described in field 690 (C E1; C E3; C H1);</p> <p>Representation of concepts understood as "fitting it into the right" subject heading (C E1);</p> <p>Option for representing concepts by generic terms (C E1);</p> <p>Use of LCARB seen as a "obligatory" instrument of the UNESP Network for the representation of information (C B1; C B2);</p> <p>Absence of the use of the hierarchical list of the LCARB (C-I E1; C-I E2);</p> <p>Use of headings not authorized by the LCARB in field 650 undertaken by some libraries participating in the BIBLIODATA network (C-I E2);</p> <p>Recognition on the part of librarians of the importance of knowledge about the scientific area to be represented by the language (C H3);</p> <p>Representation carried out with the objective of meeting user demand (C E1; C E3; C H1).</p>
3. Choice of language	<p>LCARB does not satisfactorily represent the subjects of the documents (C E1, C B1, C H2, C B2)</p> <p>Use of specialized parallel indexing languages, exemplified by the use of the DeCS (C B1);</p> <p>Need for the standardization of the subjects in field 650 (C H3);</p> <p>Need for the construction of a controlled language for the UNESP network (C H3).</p>
4. Choice of term	<p>The choice of the term is undertaken according to the context of the library where the user is inserted (C H1; C-I E2);</p> <p>Option for the generic term in the libraries that provide thematic cover in the three knowledge areas (C E1);</p> <p>Tendency towards option for the generic term for the representation of the indexing content: lack of specificities of the language (C B2, SB-U last year);</p> <p>Option for the specific term (BCI-E2).</p>
5. Performance of the language in the process of representation for indexing	<p>Unsatisfactory performance of the LCARB caused by the presence of ambiguous terms, lack of cross-references, of specialized, updated vocabulary, of specificity and of normalization of the headings, problems of the headings regarding the use of singular and plural, among others (C H2, C H3, RL B1, SB-U E2-1st year, SB-U E3-1st year);</p> <p>Translation of the subject headings not consonant with the use that is made in the terminology of the specialized scientific area (C H3);</p>

Appendix 2. Contd.

Use of parallel indexing language for the headings not available in the LCARB:
Engineering Index, CDU, VocaUSP, DeCS, among other lists of subject headings (C-I E2; C- I B1; C-I B2; C-I B3);
 Concern as to how the user searches by subject for information retrieval(C H1);
 Availability of the interface language for data entry (cataloguing) of the ATHENA catalog for the representation of the information based on the language itself in connection with the MARC 21 bibliographic format (C H1);
 Creation of a catalog of terms for the representation of the subjects in field 690 (C H3);
 Need for the construction of a controlled vocabulary for the UNESP network (C H3);
 Undertaking of a classificatory indexing (C-I E2).

Appendix 3. Results of the analyses of the statements of the individuals obtained from the application of group and individual verbal protocols, systematized by thematic axes and categories of analysis.

Indexing language seen from perspective of use	
Analysis category	Result
6. Knowledge/ importance of language	<p>Need for the LCARB to be made available for consultation and use by the user in the search by subject of the system (C H3);</p> <p>Unfamiliarity on the part of the user with the indexing language used by the system for information retrieval (FS-U B3; SB-U E2-1st year; SB-U H1-last year; SB-U H2-last year; SB-U B3-last year).</p>
7. Search strategy	<p>Difficulties manifested by the user regarding the procedures for elaborating search strategies and the use of Boolean operators (FS-U B1; SB-U H3-last year; SB-U B3-last year);</p> <p>Elaboration on the part of the user of the search strategies in the manner that he considers the most correct (SB-U H3-last year);</p> <p>The delegated search is considered by the librarian and the users as the best option for effecting the search strategy (SB-U B2-1st year);</p> <p>Training and practice are actions recognized by the user as important in the development of search strategies (SB-U B3);</p> <p>The social context as a factor of influence on the manifestation of the user's information needs (SB-U B2).</p>
8. Performance of language in the information retrieval process	<p>Unsatisfactory performance of the LCARB in the search by subject not corresponding to the user's information retrieval needs (SB-U B2-last year);</p> <p>Lack of specificity of the language causing high recall and low precision in the retrieval: Very wide-ranging results (SB-U B2; SB-U H1-1st year; SB-U H1-last year);</p> <p>Librarian points to the user option of searching by title and by author in the catalog, as well as the searches by subject in the databases and by free words in Internet searches (Google) (HL E1);</p> <p>Incompatibility between the language of the system and that of the user's search evidenced in the three knowledge areas (C E1; FS-U B2; SB-U B2; SB-U B2-1st year);</p> <p>Lack of cross-references 'See' and 'See also' as attributes of the inefficiency of the language in information retrieval(C H3);</p> <p>Construction of a vocabulary derived from the language of the specialist and the user (SB-U B2);</p> <p>Availability of language at the search interface (SB-U B3).</p>
9. The system's capacity for recall and precision	<p>Option for exhaustively in the indexing (C E2);</p> <p>Need for specificity in the indexing (FS-U E2);</p> <p>High recall in the retrieval of search by subject (FS-U H2; SB-U B2).</p>

Appendix 3. Contd.

10. Evaluation of the information retrieval system	<p>Users suggest that the catalog enables the establishment of a link with Internet search engines such as Google (FS-U E1; SB_U B3-1st year);</p> <p>Librarians and users consider, in general, that the system interface is not friendly (FS-UB3; C B3);</p> <p>Librarian considers that the search form is complicated (C H3);</p> <p>Need for the system to offer the possibility of combining search fields (FS-U H3);</p> <p>The search by subject interface is considered by the user as satisfactory, although it could be improved, as for example, with the implantation of search fields (by type of material, indication of the depository library, etc (SB-U E3-1st year, FS-U B3- 1st year);</p>
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Appendix 4. Results of the analyses of the statements of the individuals obtained from the application of group and individual verbal protocols, systematized by thematic axes and categories of analysis.

Indexing language from perspective of the form	
Analysis category	Result
11. Procedures of construction, updating and maintenance of the language	<p>Need to create a controlled UNESP vocabulary (C H3; C B3);</p> <p>Construction of a vocabulary derived from the language of the specialist and the user (SB-U B2);</p> <p>Need to update LCARB (C E2, C H3; FS-U B1);</p> <p>Constitution of a group of librarians to construct a controlled UNESP vocabulary (RL H3);</p> <p>Librarians consider the procedures of the BIBLIODATA Network for updating the LCARB to be bureaucratic, given that some are not very knowledgeable about how that process works (C H1; CH3).</p>
12. The role of the librarian in the construction, updating and maintenance of the language	<p>Interaction between the reference services and the technical processing and these two with the user is recognized by the librarians as important when it comes to updating the LCARB (C E1; C H1; C H2; C H3; C B1).</p>