Evaluation of Persian thesauri of basic sciences based on ANSI / NISO 39.19-2005 standard

Nadjla Hariri[1], Maryam Kazerani[1,] and Reza Moghaddam-Kiya[2]
[1]Department of Library and Information Science,
Science and Research Branch, Islamic Azad University, Tehran, IRAN.
[2]Faculty of Foreign Languages and Literatures,
University of Tehran, Tehran, IRAN
e-mail: nadjlahariri@hotmail.com; kazerani.m@gmail.com; rzmsk@ut.ac.ir

ABSTRACT
Thesauri have played a significant role as information storage and retrieval aid. However, to ensure effective retrieval of information, thesauri should comply with the standards such as ANSI /NISO Z 39.19 -2005, which provide rules and principles for constructing controlled vocabularies. These rules include four dimensions; form construction, semantic relationships, displaying controlled vocabularies, and management systems. These dimensions served as a basis in this study to evaluate the accuracy of vocabulary construction in four Persian Thesauri of Basic Sciences. The research approach utilised in this study was the analytical survey method and a checklist was developed as the research instrument. The samples of terms established by using Morgan's table were entered into the checklist and were evaluated on the basis of the relevant standards. According to the results, the thesauri under study had observed the standards of form construction and semantic relationships properly but had not given due attention to management and displaying dimensions.

Keywords: Thesauri; Controlled vocabularies; Evaluation; ANSI /NISO Z 39.19 -2005; Basic Sciences.

INTRODUCTION

Thesauri are controlled vocabularies in one or more fields of human knowledge that represent logical relations among various concepts. They aim at integrating terms that represent a field and act as tools for information storage and retrieval, providing cross-references among terms, and preparing a controlled vocabulary in a post-coordinated system (Khosravi 2001). Thesauri help users build up their vocabulary, give them alternative ways of writing and speaking, and provide them the information they need in the shortest time with minimum effort. Today, despite the emergence of more advanced tools for information storage and retrieval, thesauri have maintained their importance and are still being utilized. Furthermore, thesauri now make an indispensible part of the bigger system of information storage and retrieval, such as the Web (Shiri and Revie 2000). However, as Hudon, (2003) has emphasised, even though thesauri have moved into a different environment, their nature and structure, and even their main functions, have remained the same.

About ten years ago Rosenfeld and Merville, (2002) predicted that thesauri would become a key tool for dealing with the growing size of websites and intranets. Today, not

surprisingly, we see that many thesauri developers share their thesauri on the web for potential applications. According to Shiri and Revie (2000, p. 273-274) "the reasons for increasing availability of online thesauri are closely linked to key issues associated with the emergence of the World Wide Web", which include:

- the colossal growth of information resources demanding better subject identification;
- the migration of traditional information resources to the web calls for more consistent subject approaches;
- an urgent need for resource description and discovery through reusing the existing information management tools such as controlled vocabularies;
- problems associated with quality of unstructured information retrieved from the Web; and
- the need to provide users with knowledge structures such as thesauri for rapid and easy access to better organised information.

The implication of all these developments for the publishers and researchers dealing with creating thesauri is that if thesauri are to keep pace with the growth of sciences, they have to be carefully created, regularly updated and repeatedly evaluated to match the recognized standards. McCulloch (2005) suggests a number of steps that, she believes, if they are taken into consideration in the process of creating the thesauri will help to simplify the construction process and, ultimately, lead to a more effective end. Such end will be more adequate, manageable, easily updated, and cost-effective. The stages, recommended by McCulloch, are as follows: ensuring the necessity of the work; selecting relevant terms; using a flexible structure and notation system; adhering to recognised standards; establishing a consultation team; using an accessible and user friendly software; planning for web display and web evaluation; updating regularly and achieving cost-effectiveness. (2005; p.404-407)

In Iran, until recently, construction of thesauri had not been a popular practice. However, there is now a growing tendency in the construction of thesauri in various areas of knowledge, particularly in the area of basic sciences. The construction of four thesauri of basic sciences within three years (2004 to 2006) is an evidence for this observation. The question one might ask here is; why is there a need to construct Persian thesauri? The answer to this question lies in the fact that as Lancaster (1986) suggests if we want to use controlled vocabularies in storage and retrieval systems with a defined language (e.g. Persian) we need to construct some tools like thesauri according to literary and user warrant in that language. Moreover, construction of thesauri in a given language is important because the thesauri serve as fundamental functions within the fields of text mining and information retrieval (Loosie 2007) in the published literature of a selected discipline.

Now, in spite of the need for constructing thesauri and the growing interest in creating thesauri, no attempt has so far been made to conduct a survey to determine whether the recognised standards have been utilised in their construction. The present study is conducted to fill this gap. It aims to examine and evaluate four Persian thesauri of basic sciences based on ANSI/NISO z39.19- 2005 standard. The evaluation will be carried out in accordance to four dimensions: semantic relationships, form construction, displaying controlled vocabularies, and management systems.

OBJECTIVES

The primary purpose of this study is to shed light on the status of Persian thesauri of basic sciences in relation to the four dimensions of semantic relationships, form construction, displaying controlled vocabularies, and management systems and to evaluate these thesauri on the basis of ANSI / NISO Z39.19- 2005 standard (ANSI/NISO 2005). The following objectives have been formulated for this study:

a) To determine the degree to which the semantic relations of terms in Persian thesauri follow the standards provided by ANSI/NISO Z39.19 2005 standard;
b) To determine the degree to which the form structure of terms in Persian thesauri follow the standards provided by ANSI/NISO Z39.19 2005 standard;
c) To determine the degree to which the displaying of controlled vocabularies in Persian thesauri follow the standards provided by ANSI/NISO Z39.19 2005 standard;
d) To determine the degree to which the management system of Persian thesauri follow the standards provided by ANSI/NISO Z39.19 2005 standard;

MATERIALS AND METHODS

The research method utilised in this study is the analytical survey method. Descriptive statistics is used in the analysis of the information obtained. This study sampled the following four Persian thesauri of Basic Sciences created and published in Iran between the years 2004 and 2006:

- Thesaurus of Chemistry (Rajabi 2004)
- Thesaurus of Biological Sciences (Akbari, Hosseini, and Norouzi 2005)
- Thesaurus of Geosciences (Sadighi, Hosseini and Norouzi 2005)
- Thesaurus of Physics (Norouzi, Hosseini and Norouzi 2006)

Due to the great number of entries in every thesaurus, a sampling method was adopted. Morgan's table for determining the random sample size from a determined population (Krejcie and Morgan 1970) was used to determine the number of terms to be sampled for every thesaurus. If the total number of terms in one of the thesauri was not specified by the authors in the preface, the number was estimated via multiplying the approximate average number of terms in each page by the number of pages indexed alphabetically. It is worth mentioning here that according to Morgan's table, the number of acceptable sample was 344 terms for the Thesaurus of Biological Sciences, 374 terms for the Thesaurus of Geosciences, 346 terms for the Thesaurus of Chemistry, and 367 terms for the Thesaurus of Physics.

The next stage was to use systematic sampling method to obtain sampling fractions via dividing the number of pages of the thesaurus by the number of samples. For example, if a thesaurus contained 3000 alphabetically-indexed pages and if it was required to study 300 terms on 300 pages of it, then one page had to be selected from every 10 pages. And this was done with the help of the simple random number table. What had to be done next was to choose one term among the terms in each one of the selected pages, which again was easily done through using a simple random number table. Then the selected terms were entered into a checklist developed in an Microsoft Excel spreadsheet. If a term had followed the standards with regard to semantic relations and form constructions, it gained the value of one (1) ; and if it had not, it obtained a value of zero (0). In cases where a

term lacked the intended feature a value of two (2) was given to it. And finally, the frequency distributions were presented in tables.

Regarding the displaying controlled vocabularies, if a selected entry had followed the required standard, the value of one (1) was given; if not, the value of zero (0); and if it was wrong, the value of 0.5 was assigned to it. And finally, with regard to management system for every thesaurus, observance and non-observance of standards were once again measured through a zero and one evaluating system. The resulting values were rounded off up to one decimal place and were tabulated.

RESULTS

In the following sub-sections, the levels of observance of standards for the dimensions of semantic relationships, form construction, displaying controlled vocabularies, and management system for each of the four Thesauri of Basic Sciences are presented.

Level of Observance of Standards of Semantic Relationships:

A semantic relationship in a thesaurus refers to a relation between terms that is true as a matter of general knowledge, rather than depending on what the terms refer to in some particular document. There are three types of semantic relationships used in a thesaurus (ANSI/NISO 2005):

a) Equivalent relationships: when the same concept can be expressed by two or more terms, one of them is selected as the preferred term which substitutes the other terms expressing equivalent or nearly equivalent concepts.
b) Hierarchical relationship: These relationships are based on degrees or levels of super ordination and subordination, where the super ordinate term represents a class or a whole, and the subordinate term refers to its members or parts.
c) Associative relationships: This relationship covers associations between terms that are neither equivalent nor hierarchical, yet they are semantically or conceptually associated to such an extent that the link between them should be made explicit in the controlled vocabulary

In the Thesaurus of Biological Sciences, the level of observance of standards for hierarchical relationships is 96.5%; for equivalent relationships is 100%; and for associative relationships is 93%. The average level of observance of standards for semantic relationships in this thesaurus is 96.5% (Table 1).

Table 1: Frequency Distribution of Correctness and Incorrectness in Hierarchical, Equivalent and Associative Relationships in the Thesaurus of Biological Sciences

Type of relationship / Outcome		Hierarchical		Equivalent		Associative		Average
		Number of terms	Percentage	Number of terms	Percentage	Number of terms	Percentage	
Observed	correct	326	96.5	120	100	106	93	96.5
	incorrect	12	3.5	0	0	3	7	3.5
Total		338	98	120	35	109	32	---
Not observed		6	2	224	65	235	68	---
Sum total		344	100	344	100	344	100	---

In the Thesaurus of Geosciences, the level of observance of standards for hierarchical relationships is 60%; for equivalent relationships is 100%; and for associative relationships is 94%. The average level of observance of standards for semantic relationships in this thesaurus is 85% (Table 2).

Table 2: Frequency Distribution of Correctness and Incorrectness in Hierarchical, Equivalent and Associative Relationships in the Thesaurus of Geosciences

Type of relationship / Outcome		Hierarchical		Equivalent		Associative		Average
		Number of terms	Percentage	Number of terms	Percentage	Number of terms	Percentage	
Observed	correct	199	60	12	100	263	94	85
	incorrect	130	40	0	0	18	6	15
Total		329	88	12	3	281	75	---
Not observed		45	12	362	97	93	25	---
Sum total		374	100	374	100	374	100	---

In the Thesaurus of Chemistry, the level of observance of standards for hierarchical relationships is 93%; for equivalent relationships is 100%; and for associative relationships is 99%. The average level of observance of standards for semantic relationships in this thesaurus is 97% (Table 3).

Table 3: Frequency Distribution of Correctness and Incorrectness in Hierarchical, Equivalent and Associative Relationships in the Thesaurus of Chemistry

Type of relationship / Outcome		Hierarchical		Equivalent		Associative		Average
		Number of terms	Percentage	Number of terms	Percentage	Number of terms	Percentage	
Observed	correct	249	93	51	100	296	99	97
	incorrect	20	7	0	0	4	1	3
Total		269	78	51	15	300	87	---
Not observed		77	22	295	85	46	13	---
Sum total		346	100	346	100	346	100	---

In the Thesaurus of Physics, the level of observance of standards for hierarchical relationships is 74%; for equivalent relationships is 100%; and for associative relationships is 96%. The average level of observance of standards for semantic relationships in this thesaurus is 90% (Table 4).

Table 4: Frequency Distribution of Correctness and Incorrectness in Hierarchical, Equivalent and Associative Relationships in the Thesaurus of Physics

Type of Relationship / Outcome		Hierarchical		Equivalent		Associative		Average
		Number of terms	Percentage	Number of terms	Percentage	Number of terms	Percentage	
Observed	correct	254	74	62	100	330	96	90
	incorrect	91	26	0	0	13	4	10
Total		345	94	62	17	343	93	---
Not observed		22	6	305	83	24	7	---
Sum total		367	100	344	100	344	100	---

Level of Observance of Standards of Form Construction

Form construction refers to the form of the terms in a thesaurus. This dimension requires the correct presentation and the correct spelling of the terms, including the nouns, adjectives, verbal nouns, modifiers, scope notes, and compound nouns (ANSI/NISO 2005).

The minimum level of observance of standards for this dimension in the Thesaurus of Biological Sciences is 60% for single word versus multi-word feature. The average level of observance of standards in the form construction of this thesaurus is 91% (Table 5).

Table 5: Distribution of Correctness and Incorrectness of Form Construction in the Thesaurus of Biological Sciences

Features / Outcome		Homograph		Scope notes		Single word vs. multiword terms		Nouns & noun phrases		Adjectives		Initial articles		Compound terms		Spelling		Average
		Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	
Observed	correct	12	92	4	100	207	60	344	100	83	99	3	75	105	100	344	100	91
	In-correct	1	8	0	0	137	40	0	0	1	1	1	25	0	0	0	0	9
Total		13	4	4	1	344	100	344	100	84	24	4	1	105	30.5	344	100	---
Not observed		331	96	340	99	----	----	----	----	260	76	340	99	239	69.5	----	----	---
Sum total		344	100	344	100	344	100	344	100	344	100	344	100	344	100	344	100	---

The minimum level of observance of standards of form construction in the Thesaurus of Geosciences is 37.5% for homographs. The average level of observance of correctness of standards in the form construction of this thesaurus is 86% (Table 6).

Table 6: Frequency Distribution of Correctness and Incorrectness of Features related to Form Construction in the Thesaurus of Geosciences

Features / Outcome		Homograph		Scope notes		Single word vs. multiword terms		Nouns & noun phrases		Adjectives		Initial articles		Compound terms		Spelling		Average
		Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	
Observed	correct	3	37.5	209	100	344	92	316	84	72	96	4	100	188	78	374	100	86
	In-correct	5	62.5	-	-	30	8	58	16	3	4	-	-	54	22	0	0	14
Total		8	2	209	56	374	100	374	100	75	20	4	1	242	65	374	100	-
Not observed		366	98	165	44	-	-	-	-	299	80	370	99	132	35	-	-	-
Sum total		374	100	374	100	374	100	374	100	374	100	374	100	374	100	374	100	-

The minimum level of observance of standards in the Thesaurus of Chemistry is 0% which again belongs to the homograph feature. The average level of observance of standards in the form construction of this thesaurus is 79% (Table 7).

Table 7: Frequency Distribution of Correctness and Incorrectness of Form Construction in the Thesaurus of Chemistry

Features / Outcome		Homograph		Scope notes		Single word vs. multiword terms		Nouns & noun phrases		Adjectives		Initial articles		Compound terms		Spelling		Average
		Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	
Observed	correct	0	0	-	-	275	79	338	98	118	98	-	-	260	98	346	100	79
	In-correct	3	100	-	-	71	21	8	2	2	2	-	-	5	2	0	0	21
Total		3	1	-	-	346	100	346	100	120	35	-	-	265	77	346	100	-
Not observed		343	99	346	100	-	-	-	-	226	65	346	100	81	23	-	-	-
Sum total		346	100	346	100	346	100	346	100	346	100	346	100	346	100	346	100	-

The minimum level of observance of standards in the Thesaurus of Physics is 54%, which belongs to the homograph feature. The average level of observance of standards in the form construction of this thesaurus is 80.5% (Table 8).

Table 8: Frequency Distribution of Correctness and Incorrectness of Form Construction in the Thesaurus of Physics

Features / Outcome		Homograph		Scope notes		Single word vs. multiword terms		Nouns & noun phrases		adjectives		Initial articles		Compound terms		Spelling		Average
		Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	Terms	%	
Observed	Correct	7	54	---	-----	235	64	362	99	121	97	----	-----	252	69	367	100	80.5
	In-correct	6	46	---	----	132	36	5	1	4	3	----	----	0	0	0	0	19.5
Total		13	4	-----	-----	367	100	367	100	125	34	----	---	252	69	367	100	---
Not observed		354	96	367	100	-----	-----	-----	-----	242	66	367	100	115	31	----	--	---
Sum total		367	100	367	100	367	100	367	100	367	100	367	100	367	100	367	100	---

Level of Observance of Standards in the Displaying Controlled Vocabularies

This dimension refers to the way in which a controlled vocabulary is presented. The way the terms are displayed in a thesaurus affects the user's willingness and ability to make use of the thesauri (ANSI/NISO 2005).

The score for observing features related to this dimension in the four Thesauri of Basic Sciences is 12 out of 22, and the percentage of the level of observance of these standards in the four thesauri is 54.5% respectively (Table 9).

Level of Observance of Standards in the Management System

This dimension suggests that, because controlled vocabularies are reflections of language, and are, therefore, dynamic instruments (Aithchson and Gilchrist 2000), policies and procedures should be established for periodic review of terminology, establishment of new terms, and replacement of obsolete terms, especially in fields where the terminology changes rapidly. Controlled vocabulary editors should update the controlled vocabulary at intervals that will be determined by the frequency and volume of changes made, and by the method of distribution (ANSI/NISO 2005).

All the four thesauri of basic sciences acquired the same score of one out of seven for following the features related to the management system. This score accounts only for 14% percent of observing the standards of the management system in these thesauri (Table 10).

Table 9: Frequency Distribution of the Features Related to the Displaying Controlled Vocabularies in the Four Thesauri of Basic Science

Features \ Thesauri	Thesaurus of Biological sciences			Thesaurus of Geosciences			Thesaurus of Chemistry			Thesaurus of Physics		
	Observed			Observed			Observed			Observed		
	Correct	Incorrect	Not Observed	Correct	Incorrect	Not Observed	Correct	Incorrect	Not Observed	Correct	Incorrect	Not Observed
Alphabetical displays	1	-	-	1	-	-	1	-	-	1	-	-
Graphic displays	-	-	0	-	-	0	-	-	0	-	-	0
Permuted displays	1	-	-	1	-	-	1	-	-	1	-	-
Term detail displays	1	-	-	1	-	-	1	-	-	1	-	-
Hierarchical displays	1	-	-	1	-	-	1	-	-	1	-	-
Faceted displays	-	-	0	-	-	0	-	-	0	-	-	0
Needs of thesaurus maintenance personnel	-	-	0	-	-	0	-	-	0	-	-	0
Needs of indexers & expert searchers	-	-	0	-	-	0	-	-	0	-	-	0
Needs of end users	-	-	0	-	-	0	-	-	0	-	-	0
Element to address (Presenta-tion , type of displays , format & documentation)	-	-	0	-	-	0	-	-	0	-	-	0
Displaying equivalent relationship	1	-	-	1	-	-	1	-	-	1	-	-
Displaying associative relationship	1	-	-	1	-	-	1	-	-	1	-	-
Displaying hierarchical relationship	1	-	-	1	-	-	1	-	-	1	-	-
Usage (literary, organisational & user warrants)	-	-	0	-	-	0	-	-	0	--	-	0
Indention	1	-	-	1	-	-	1	-	-	1	-	-
Typography	1	-	-	1	-	-	1	-	-	1	-	-
Filling and sorting	-	0.5	-	-	0.5	-		0.5	-	-	0.5	-
Print format	1	-	-	1	-	-	1	-	-	1	-	-
Screen format	-	-	0	-	-	0		-	0		-	0
Web format	1	-		1	-		1	-	-	1	-	-
Documentation	-	-	0	-	-	0		-	0		-	0
Elements to address	-	0.5	-	-	0.5			0.5	-	-	0.5	-
Score	12			12			12			12		
Percentage	54.50			54.50			54.5o			54.50		

Table 10: Frequency Distribution of Factors Related to the Management System of the Thesauri of Basic Sciences

Features	Observation of the standard
Avoid duplicating existing vocabularies	Yes
Determine the structure & display formats	No
Testing and evaluation	No
Updating the vocabulary	No
Error checking	No
Candidate terms	No
Term deletion	No
Score	1 /7 (14%)

CONCLUSIONS

The results of this study show that the greatest problem of the thesauri under study is their failure in observing the standards in their management system. The results are in line with the findings of previous studies and provide further evidence that the problems of constructing standard thesauri in Iran are mostly managerial and executive in nature. Furthermore, lack of interaction among responsible institutions, at national and organisational levels, constitutes yet another serious problem against successful management of this task.

In an evaluation carried out by Kazerani (1999) comparing the Persian language macro-thesauri with ISO 2788, the most serious shortcomings of thesauri in Iran were shown to be the non-observance of the standards in semantic relations and displaying controlled vocabularies. However, in the present study, the lowest level of compliance to the standards was in their management system. This finding however was expected since these thesauri are all developed by the same organisation and the same managerial team. In another qualitative study conducted to identify the problems of thesaurus construction in Iran from the developers' perspective, Hosseinizadeh (2004) found the same results. He reported that most of the interviewees had experienced problems, which were of managerial and executive in nature. Also, almost all the developers referred to the lack of interaction between responsible institutions, at the national and organisational levels, as the main problem of thesauri construction in Iran. The low observance (14%) of the standards in the management system of the thesauri examined in this study could be due to the difficulties experienced by the developers in publishing the new editions of the thesauri (Mohammadi 1997). In fact, they are not sure whether the new edition of the thesaurus will be published, and thus do not take the measures necessary for publishing the next editions of the thesaurus.

Displaying controlled vocabularies is another problematic area in the thesauri examined in this study. The findings of the present study show that the conformity to the standards in terms of the methods of display in the thesauri of basic sciences was about 55%. If a thesaurus lacks order, clarity and the fundamental information, it will not be helpful to users. In the same way, if certain concepts like subject coverage, number of terms, aims, punctuation, abbreviations and symbols, the rule of choosing selective terms and their relations, elaboration of the rules of the page layout, date of updating and updating policy, and instructions on how to use the thesaurus are not clearly stated, observed or described in a thesaurus, it cannot effectively satisfy the needs of their users. As for the dimensions of semantic relations and form construction, according to the results, there were fewer problems compared to the management system and displaying controlled vocabularies, that is, the average level of observing the standards fluctuated between 85% and 97% for semantic relations and between 79% and 91% for form construction.

In general, it can be said that at the time of the emergence of the World Wide Web, expansion of media, and variation in information storage and retrieval tools, not only the need for constructing thesauri is not abolished, but also it is felt more urgent than before, especially for the purpose of information architecture on the Web. However, achieving higher standards in creating thesauri requires commitment to reasonable thoughts and the considerations of cost-effectiveness (Kazerani, Asadi, and Rahadoust 2000). In order to achieve this goal, those involved in thesaurus construction in Iran are recommended to be concerned about the quality of the thesauri, not merely the quantity; adopt standard approaches in the process of creating thesauri; support thesauri constructors who try to

observe recommended standards; deepen one's knowledge of scientific innovations and apply new theoretical developments of the field.

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