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THE COMPONENTS OF ABSTRACTS: THE LOGICAL STRUCTURE OF ABSTRACTS IN THE AREAS OF MATERIALS SCIENCE AND TECHNOLOGY AND OF LIBRARY AND INFORMATION SCIENCE

Abstract

Purpose

Purpose of this study was to examine whether the logical structure of abstracts in the areas of materials science and technology and library and information science comply with the ISO 214 or IMRAD formats, while also suggesting guidelines for components of abstracts.

Design/methodology/approach

In the first part of the research the components of abstracts are analysed. The results showed that not all the proposed structural elements are present in the abstracts. Therefore also the improved prototypes and recommended abstracts are developed to examine the satisfaction of readers with different forms of abstracts. According to the results of satisfaction of readers with different forms of abstracts, uniform guidelines for the components of abstracts in accordance with the IMRAD format are proposed.

Findings

The introduction (I) should include three sentences of background information. The method (M) should include three sentences of method. The results (R) should include three sentences of results. The discussion (D) should include two sentences of conclusions. The conclusions should present the implications of the results on subjects that were not part of the study, suggestions for possible application of the findings, suggestions for further research work and an evaluation of the research.

Originality/value

It is important to emphasize that even if the guidelines for writing abstracts by the individual journal exist, authors do not always take them into account. Therefore, it is important that the abstracts that are actually published in journals were analysed. It is also important that the opinion of researchers was taken into account.

Keywords: scientific journals, Materials and Technology, Materials Science and Technology, Journal of Documentation, Journal of Librarianship and Information Science, materials science and technology, library and information science, abstracts, standards, guidelines

INTRODUCTION

Abstracts are an essential element of scientific information. Every scientific journal requires that the author submits an abstract: as examples of such instructions, see Journal of Documentation: author guidelines, 2013; Materiali in tehnologije: navodila avtorjem, 2013; Materials Science and Technology: instructions for authors, 2013; SAGE, 2013. According to Nicholas *et al.* (2007), abstracts help deal with the situation of information overload. They also save reading time (Borko and Bernier, 1975) because they reduce the reading problem to about 10 percent of that of primary journals (Bernier and Yerkey, 1979 and Lancaster, 2003). Considering the importance of the abstract, it is quite natural that an author would be concerned about what to include in it and how to properly construct it.

ANSI/NIS0 Z39.14:1997 (1997), ERIC (1992), ISO 214:1976 (1976), Mihajlov and Giljarevski (1975), Skolnik (1979), Slovar (2000), Zelenika, (1998) state that abstracts are an abbreviated but accurate representation of a document. In order to ensure the accuracy of abstracts ISO 214:1976 (1976) emphasises that they should not include any added interpretations or criticism. Based on definitions in the above sources a definition of an abstract for the purposes of the research presented here was also developed. Based on the definitions from the above sources, the definition used in the research presented here is "*an abbreviated form of an article without added interpretation*". According to Milas-Bracović (1987), as well as sources which describe the writing process (e.g. Nakayama, 2005; APA, 2010; Rabinowitz and Vogel, cop. 2009), the sections of a traditional scientific paper are: the introduction, methods, results, and discussion (the IMRAD format).

We wanted to see whether the logical structure of abstracts in the area of materials science and technology and library and information science comply with the ISO214 or IMRAD format. We also wanted to suggest guidelines for the components of abstracts to improve both their quality and, consequently, the transfer of new findings from authors to readers.

First, the components of abstracts published in selected scientific journals were analysed. We also investigated whether the components of the abstracts were in accordance with guidelines. This was followed by preparation for the user study, which included the development of improved abstracts (prototypes and recommended abstracts). The user study examined reader satisfaction with different forms of abstracts. First the initial literature review will be presented, followed by details of the empirical research.

PREVIOUS RESEARCH

According to Milas-Bracović (1987) an abstract should contain the following: an introduction, methods, results and a discussion. This logical structure is essential for scientific communication, and is taught to students of all sciences (Bawden and Robinson, 2012; Koltay, 2010; APA, 2010; Tibbo, 1993;

Rabinowitz and Vogel, cop. 2009). However, guidelines for the components of abstracts in the area of technical sciences were already researched in 1963 when Weil *et al.* (1963 b) stated that abstracts should be reader-oriented. In their opinion, abstracts in the area of technical sciences rarely need to mention WHO did the work, WHEN, or WHERE it was done or reported – unless these things were not clear in the bibliographic citation. Abstracts should state WHAT was found and, only when appropriate, WHY and HOW the work was done. An abstract in technical sciences should contain the purpose, findings, conclusions, recommendations, the chief experimental results (from which the conclusions were drawn), and indications of the methods used to obtain the data. It should not contain introductory or background materials, details of the experiment method, or detailed experiment results. Background materials should be included only if they are intended for readers who are not knowledgeable in the area. Details of the experimental methods should be included only if they are new. They should also be included if the full-length document is not readily available, or is in a language that readers are not likely to know.

However, abstracts are not always written in accordance with such guidelines. This was proven by a pilot study (Jamar and Šauperl, 2009) that focused only on abstracts from the area of materials science and technology. The purpose and the aim of the research was to analyse the content and the structure of abstracts published in the journals MIT (*Materiali in tehnologije*[1], a Slovenian journal) and MST (*Materials Science and Technology*, an international journal). The analysis was conducted on a sample of twenty-five abstracts from each journal. The results showed that there were no major differences between the two journals. Most frequently, two structural elements were present: M (method), with 100%, and R (results), with 66%.

[1] The official title of the journal *Materiali in tehnologije* in English is *Materials and Technology*. This translation was found on the website of the journal; Materiali in tehnologije = Materials and Technology: http://mit.imt.si/Revija/.

A similar study, conducted by Šolar (2008), also showed that abstracts were not written in accordance with standards. The structural elements M (method), C (conclusions and discussions), H (hypothesis) and T (theme) were present in only a minority of the abstracts included in the study. The most commonly present structural elements were R (results), B (background) and P (purpose/scope). The analysis was conducted on a sample of one hundred abstracts published in the Slovenian journal *Knjižnica*[2] and one hundred abstracts published in the Croatian journal *Vjesnik bibliotekara Hrvatske*[3].

Hartley and Betts (2009) went even further and, according to the presence or absence of structural elements that were marked with points, calculated an information score for individual abstracts. The structural elements searched for in the abstracts were: background (3 points), the aims of the research (3 points), methods (3 points), number, sex and age of participants (1 point each), where the study was carried out (2 points), the results (3 points) and the conclusions or implications (3 points). The sample was comprised of one hundred abstracts from fifty-three journals in social sciences (health and old age, schooling, higher education, new technology, academic writing) from January 2008 to November 2008 and came from academic papers. Most abstracts included information about the aims (92%), the results (88%), the method (84%), and the conclusions (78%). Information on the background of the studies was provided in just over half of the abstracts (56%). Only 58% of abstracts reported information about the age of the participants involved in the study, 36% about the number of participants, and 12% about their sex.

RESEARCH DESIGN

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[2] The English translation for *Knjižnica* is *Library*. This translation was found on the website of the journal; Knjižnica = Library: http://revija-knjiznica.zbds-zveza.si/.

[3] The English translation for *Vjesnik bibliotekara Hrvatske* is *Journal of Croatian Librarians*. The journal does not have an official translation, so the translation used is a literal one.

As abstracts, as noted above, are extremely important for the transmission of scientific information, we wanted to develop useful guidelines. Also, since leading publishers (e.g. Emerald, Sage) tend to use the same guidelines for all sciences, it is desirable that these guidelines be uniform for different sciences.

We analysed abstracts in two selected scientific areas (original abstracts) to identify their most frequent structure (prototype abstracts). Since we expected that the prototype abstracts would not provide some important information, we planned to enhance them with elements of the missing content (recommended abstracts). A user survey would then test which form of abstracts was preferred – the original, the prototype (the original changed to the most common structure) or the recommended version (the prototype enhanced with all the recommended structural elements).

CONTENT ANALYSIS OF ORIGINAL ABSTRACTS

Content analysis

Content analysis was used in the first part of the research presented here. Neuendorf (cop. 2002) defines content analysis as a quantitative method for summarising and analysing messages. White and Marsh (2006) describe the steps that should be involved in all research using content analysis.

For the research being presented here, two areas – one from natural sciences (materials science and technology) and one from social sciences and humanities (library and information science) – were selected. This was done because the comparison of abstracts from the area of natural sciences (materials science and technology) and social sciences and humanities (sociology) in the pilot study showed that the guidelines for the components of abstracts were more suitable for the natural sciences than for social sciences and humanities. In the case of social sciences and humanities (sociology) there were sentences that did not contain the specifics of any structural element proposed by the guidelines for the components of abstracts. That was not, however, the case in the area of natural sciences (materials science and technology). We wanted to check this result, because of the desirability, noted above, for uniform guidelines for the components of abstracts, which should be appropriate for all sciences. All scientific journals, from natural sciences to social sciences and humanities, should then publish articles that adhere to the standards of scientific writing.

The area of materials science and technology was selected because this has been the main research area of the first author for some time. The area of library and information science was selected because it is the basic discipline of the researchers which are included in the research presented here. It was expected that knowledge of the areas would facilitate the coding of the original abstracts, as well as the development of prototype and recommended abstracts.

The sample for the analysis of abstract components consisted of four hundred abstracts: one hundred abstracts from each of four journals; two journals (or two hundred abstracts) from materials and technology, and two journals (or two hundred abstracts) from library and information science. From the area of materials science and technology the Slovenian journal *Materials and Technology* (MIT) and the international journal *Materials Science and Technology* (MST) were selected. The Slovenian journal was chosen for this research because the first two authors of this text are Slovenian researchers, and it was relevant to compare abstracts from both international and local journals. From the area of library and information science, two international journals were selected: the *Journal of Documentation* (JDoc) and the *Journal of Librarianship and Information Science* (JoLIS). These two journals were selected because they both widely cover library and information topics and one has structured and one has unstructured abstracts. No Slovenian journal was selected from the area of library and information science, because the journal *Knjižnica*, that would be suitable for comparison to international journals, has already been included in the research presented by Šolar (2008). The abstracts were published from 2003 to 2009 in the above mentioned journals. Subsequently, they are referred to as the original abstracts. The research was conducted from August 2010 to October 2010.

For the manual analyses the abstracts were prepared so that the individual sentences were inserted into a table. After that, each sentence was marked with a code denoting the appropriate structural element. A sentence represented a unit of data collection (the element with which each variable is measured) and a unit of analysis (the element with which data are analysed and for which the findings are reported).

The coding scheme that was used in the research being presented here was used in the study of Šauperl *et al.* (2008). It was developed on the basis of ISO 214:1976 (1976) and the coding scheme developed by Tibbo (1993). The structural elements of the coding scheme are presented in the Table 1.

Table 1: Structural elements of the coding scheme that was used in the research

Structural element	***Description of the content of the structural element***
B – background	introduction, sentences that indicate the context of the research at hand, its background, previous research, or underlying theories
P – purpose/scope	sentences describing the reasons for engaging in the study, the goals of the study, or the reasons for writing the paper
H – hypothesis	sentences including claims that can be accepted or rejected on the basis of the results of the research project being presented
M – method	a description of the research process
R – results	theoretical or empirical findings, data, relationships, effects, influences, reliability levels, quantity of data, and events
C – conclusions and discussions	sentences describing the implications of the results on subjects or objects that were not part of the study, usually connected with the goals of the study, recommendations, evaluations, suggestions for use or further research, arguments for accepting or rejecting the hypothesis

Originally, the reliability of the coding was to be ensured by double coding, but this was not done because the coding scheme had already been used and tested during the pilot study. Thus, all uncertainties concerning the content of individual structural elements had already been dealt with.

The structural elements of our coding scheme could also be compared to the structural elements most commonly presented by the sections of scientific articles: introduction (I), method (M), results (R) and discussion (D) (Milas-Bracović, 1987) (Table 2). Our coding scheme can also be compared to the guidelines for the components of abstracts proposed by Weil *et al.* (1963 b) (Table 2). In their opinion, abstracts should provide answers to questions about WHAT was found, WHY the work was done and HOW the work was done.

Table 2: A comparison between our coding scheme, the IMRAD format, and Weil *et al*.

Our coding scheme	***IMRAD format***	***Weil et al.***
Background	Introduction	-
Purpose/Scope		Purpose/Scope
Hypothesis		-
Method	Method	Method
Results	Results	Results
Conclusions and discussions	Discussion	-

Guidelines for the components of abstracts

It is true that all the journals included in the research presented here had their own guidelines for the components of abstracts. Therefore, one might expect that all authors would follow the guidelines, but there can be variations in the way that authors interpret them. This kind of research is important, because the results show the real state (abstracts published in scientific journals) and not the proposed state (guidelines for the components of abstracts).

So, as in the introduction of this text, we have emphasised that in terms of the research being presented here an abstract is "*an abbreviated form of an article without added interpretation*". Salager-Mayer (1990) also states that abstracts should contain all the structural elements of the article, otherwise this has an effect on the readability of the abstract. The results of her study showed that only 52% of the abstracts studied were well structured. This means that during the review process the editors of scientific journals should also pay a large amount of attention to whether abstracts adhere to guidelines concerning their components. This is especially true if we take into account the fact that a meaningful title and well-prepared abstract are sometimes the only parts of the article that will be read (ANSI/NIS0 Z39.14:1997, 1997; Nicholas *et al.*, 2007).

If the abstracts contain all the structural elements of an article, then the guidelines for the components of abstracts from the journals included in the research presented here can be compared to the IMRAD format (Milas-Bracović, 1987). The IMRAD format presents the sections of traditional scientific papers and the guidelines should coincide with the structural elements of the article. But it should be acknowledged that it is less universally used in humanities and social sciences. In the Table 3 the guidelines for components of abstracts (Materiali in tehnologije: navodila avtorjem, 2010; Materials Science and Technology: instructions for authors, 2013; Journal of documentation: author guidelines, 2013) are compared to IMRAD format. As it can be concluded from the Table 3 two from three journals included in the research have their guidelines for the components of abstracts in accordance with IMRD format. The guidelines of JoLIS (SAGE, 2013) are mainly focused on how to search for articles online, and there is no emphasis on the components of abstracts.

Table 3: The comparison between IMRAD format and guidelines for components of abstracts

IMRAD format	***Guidelines for the components of abstracts***		
	MIT	MST	JDoc

I – Introduction	+	+	+
M – Method	+	-	+
R – Results	+	+	+
D - Discussion	+	+	+

It should be noted that the publisher Sage advises authors in JoLIS to write abstracts so that the articles will be easily found by search engines. One might expect that structured abstracts, with an emphasis on the exact structure, would be more appropriate for search engines than traditional ones. Therefore it is interesting, if the emphasis is on search engines, that abstracts published in the journal JoLIS are not structured. Perhaps, because of the digital flood of information, the abstracts should be primarily "search engine friendly". However, that would mean that the abstracts should also continue to be "reader friendly", because that would allow readers to more easily find the desired information. That the abstracts should be reader-oriented, or "reader friendly", and should provide the reader with what is for him key information, was emphasised already quite some time ago by Weil *et al.* (1963 b).

The presence of structural elements in the original abstracts

In Table 4 and Table 5 the number of structural elements and the presence of structural elements in the abstracts from the area of materials science and technology and library and information science are presented.

Table 4: The number of structural elements in the abstracts from the area of materials science and technology

Journal	***% of 1.el.***	***% of 2.el.***	***% of 3.el.***	***% of 4.el.***	***% of 5.el.***	***% of 6.el.***
MIT	10	24	49	17	0	0
MST	6	28	55	10	1	0
Average	8	26	52	13	0	0

Table 5: The presence of structural elements in the abstracts from the area of materials science and technology

Journal	*% of B*	*% of P*	*% of H*	*% of M*	*% of R*	*% of C*
MIT	86	11	0	79	69	28
MST	92	6	0	74	83	17
Average	89	9	0	76	76	22

The statistical, chi-square test showed that the journals MIT and MST differed statistically (5% risk, Yates correlation, df=1) only in terms of the presence of structural element R (p=0.027, N=100, df=1). The most commonly present combination of structural elements from the area of technical sciences was B-M-R. This is in accordance with the number of structural elements present in the abstracts, and also with the most commonly present individual structural elements in the abstracts from the area of materials science and technology.

In Table 6 and Table 7 the number of structural elements and the presence of structural elements in the abstracts from the area of library and information science are presented.

Table 6: The number of structural elements in the abstracts in the area of library and information science

Journal	*% of 1.el.*	*% of 2.el.*	*% of 3.el.*	*% of 4.el.*	*% of 5.el.*	*% of 6.el.*
JDoc	0	0	6	70	24	0
JoLIS	10	17	36	33	4	0
Average	5	8	21	52	14	0

Table 7: The presence of structural elements in the abstracts in the area of library and information science

Journal	*% of B*	*% of P*	*% of H*	*% of M*	*% of R*	*% of C*
JDoc	42	96	0	99	98	83
JoLIS	96	13	2	73	69	51
Average	69	55	1	86	84	67

The statistical, chi-square test showed that the journals JDoc and JoLIS differed statistically (5% risk, Yates correlation, df=1) in terms of the presence of all structural elements except the hypothesis (p=0.490, N=100, sp=1). The most commonly present combination of structural elements from the area of technical sciences was P-M-R-C. This is in accordance with the number of structural elements present in the abstracts, but it is not in accordance with the most commonly present individual structural elements in the abstracts from the area of library and information science. The combination of structural elements in accordance with most commonly present individual structural elements was B-M-R-C, and was in second place.

The chi-square test showed a significant statistical difference between the journals JDoc and MIT, and JDoc and MST (p=0.001 or p=0.000, 5% risk, Yates correction, df=1) in terms of the presence of all structural elements included in our coding scheme. There was also a significant statistical difference between the journals JoLIS and MIT (p=0.001 or p=0.000, 5% risk, Yates correction, df=1) in terms of the presence of structural elements B (p=0.022, N=100, df=100) and C (p=0.003, N=100, df=100). There was a significant statistical difference between the journals JoLIS and MST in terms of the presence of structural elements R (p=0.260, N=100, df=1) and C (p=0.001, N=100, df=1).

Statistically, the journal JDoc - which is the only journal studied here which uses structured abstracts - differs significantly in terms of almost all structural elements (the exception being just hypothesis in comparison to the journal JoLIS) from all the other journals included in the research presented here. Other statistical comparisons show statistically important differences between the journals only in one or two structural elements out of the six. Based on this, it is obvious that the journal JDoc stands out with its results. The presence of structural element B is, in the case of the journal JDoc, lower than other journals, and the presence of structural elements P, M, R, and C is higher than other journals. The original abstracts published in the journal JDoc obviously contain more information about the research described in the article that is abstracted (P, M, R, and C) than original abstracts published in other journals. And, from the reader's point of view, that is very important. ~~It should be also mentioned that JDoc is the only journal with structured abstracts.~~

In our case, the presence of structural elements in the original abstracts was checked, because we wanted to determine which structural elements were most commonly present in the original abstracts from the area of materials science and technology and library and information science.

USER STUDY OF ORIGINAL, PROTOTYPE, AND RECOMMENDED ABSTRACTS

At this point the results concerning the presence of structural elements in the original abstracts were known. But, we also wanted to examine the satisfaction of readers with different forms of abstracts. So, on top of the original abstracts, we developed two more types: prototype and recommended.

Prototypes and recommended abstracts

The development of prototypes was based on the results of studying the structure of the original abstracts. Namely, they present the most commonly published abstract structure from the individual scientific areas. Since three of the four journals from the two areas included in the first part of the research published original abstracts in non-structured form, prototypes in non-structured form were also developed.

Hartley and Betts (2009) provided some proposals to deal with deficient traditional abstracts in terms of their content. The first proposal was that authors could write structured rather than traditional abstracts, as structured abstracts prevent authors from omitting key details. The next proposal was that if the editors/journals would not accept structured abstracts, then it would be easier for authors to write structured abstracts first, and then remove the headings to present the information in a conventional single-block format.

That is precisely the procedure we used for the preparation of prototypes and, later, also for the preparation of recommended abstracts. We made a table with structural elements that should be present in the abstracts which was then completed using the contents for the specific structural element. In that way we were positive that we did not forget any structural element which should be present in the specific abstract. The abstracts were then evaluated in the traditional, single-block format.

There are reasons for and against the use of structured abstracts. Borko and Bernier (1975) state that the labelling of each part of an abstract has been found to be unnecessary, because readers understand what part of the abstract they are reading (conclusions, results, procedures). On the other hand, Hartley (2004) stated that structured abstracts, in comparison to traditional abstracts, contain more information, are easier to read and search, facilitate peer review for conferences, and are generally welcomed by readers and authors. However, it should be emphasised that Borko's statement is from 1975, and Hartley's is from 2004, and that the abstracting process had gone through many changes over those years. The reason for the differences is most likely connected to the costs associated with the publication of the abstracts, and with the development of the standards and guidelines for the components of abstracts. Namely, abstracts were sometimes published in secondary scientific journals, and now they are published in data bases of abstracting services.

In the sample for the development of prototypes and recommended abstracts, twelve abstracts from each journal selected for the research presented here were included: twenty-four abstracts for each individual area (materials science and technology, library and information science), or forty-four abstracts in total. These abstracts were selected from the sample included in the first part of the study (the first twelve abstracts coded in the first part of the research from each of the four journals in our sample), and were published in 2009. The original abstracts were rewritten according to the most common structure and length. The original abstracts commonly contained one hundred and eighty-two words in eight sentences.

Table 8: Structure of prototype abstract (182 words in 8 sentences)

Structural element	***Number of sentences***	
	Materials science and technology	*Library and information science*
Background	3	2
Method	3	2
Results	2	2
Conclusions	0	2

The study of the presence of structural elements in the original abstracts showed that original abstracts from the area of materials science and technology most commonly contained structural elements B (89%), M (77%), and R (76%). This means that the prototypes for materials science and technology contained (Table 8) three sentences for structural elements B and M and two sentences for the structural element R . The study of the presence of structural elements in the original abstracts showed that the original abstracts from the area of library and information science most commonly contained the structural elements M (86%), R (83%), B (69%), and C (67%). This means that the prototypes for library and information science contained (Table 8) two sentences for each structural element. If there are eight sentences, and based on the fact that the prototypes should contain one hundred and eighty-two words, this means that each sentence contained on average twenty-three words. That is in accordance with the average number of words in the original abstracts.

The prototypes do not include all the structural elements that are commonly proposed if the aim is the best possible informative value. Compared to our coding scheme, only four of the six structural elements were present. The purpose and hypothesis elements were not included in the prototypes, because in the original abstracts they were present at a lower percentage than other structural elements. Therefore, it was decided to improve the structure with missing information in order to develop recommended abstracts.

Some improvements for writing abstracts were already proposed in the pilot study (Jamar and Šauperl, 2009) and in some previous studies (Erman, 2008; Kajba, 2005; Klasinc, 2005; Kralj, 2006; Lužar, 2005; Šolar, 2008; Vidmar, 2006). This was also taken into account for the development of a sample for recommended abstracts. It was proposed that some structural elements should be divided into more parts. This applies to the method (method description, method appointment, sample) and the results (direct results, indicated results, previous results). So, we wanted to test if the division of structural elements would have any effect on the evaluation of the abstracts.

The structural elements for recommended abstracts were therefore determined according to experience from the pilot study and from the research being presented here. But, they were also determined in accordance with the IMRAD format for a scientific article (Milas-Bracović, 1987). In this way, the recommended abstracts in abbreviated form reflected the content and the structure of the article. That is also in accordance with the definition of an abstract which was developed for the purposes of the research presented here. The number of words in the abstract is in accordance with the proposal of international standard ISO 214 (ISO 214:1976, 1976), which states that an abstract should contain fewer than two hundred and fifty words. Therefore, our recommended abstracts include two hundred and fifty words in eleven sentences (Table 9). This means that there were, on average, twenty-three words per sentence, which was in accordance with the average number of words in the original abstracts.

Table 9: The structure of the recommended abstract (250 words in 11 sentences)

IMRAD format		***Number of sentences***	***The content of structural elements***
I	Background	2 sentences	the framework of the research, the background of the research, any previous research work,

			and any underlying theories
	Purpose	1 sentence	the reasons for engaging in the study, the goals of the study, or the reasons for writing the paper.
M	Method description	2 sentences	an exact description of the method used
	Sample	1 sentence	the number of individuals included in the study, where the sample was taken from and so on
R	Direct results	3 sentences	results obtained from the study presented in the article
D		2 sentences	the implications of the results on the subjects or objects that were not part of the study, as well as recommendations, evaluations, and suggestions for use or further research

If we compare the recommended abstract structure to our coding scheme, it is clear that no new structural elements were added. The structural elements “methods” and “results” are more precisely defined and the structural element “sample” is emphasised. The structural element “hypothesis” is not included in the recommended abstract. Hypotheses are important at the beginning of the work and provide some kind of guideline or guidelines for the research. So, after the results are known, the hypotheses are no longer important for the readers of the abstracts. However, it should also be emphasised that the presence of structural element H (hypothesis) was present in 2% of abstracts in the pilot study. In the current study the presence of the structural element H (hypothesis) was 0%. A low percentage for this structural element was also noticed in some other research studies related to abstracts (Erman, 2008; Kajba, 2005; Klasinc, 2005; Kralj, 2006; Lužar, 2005; Šolar, 2008; Vidmar, 2006). It appears that the authors of the abstracts think that the hypothesis is not one of the structural elements which should be included in the abstract. This applies to the cases where the hypothesis or hypotheses are stated in the article.

The evaluation of original, prototype and recommended abstracts

After all the forms of abstracts were prepared (original, prototype, recommended), a user survey was conducted to check the satisfaction of researchers with different forms of abstracts. This survey was conducted from August 2011 to October 2012.

The abstracts from each area included in the research presented here (materials science and technology and library and information science) were evaluated by forty-eight researchers (coming to ninety-six researchers in total). The aim was to choose researchers from institutions where a great deal of attention is given to research work, meaning that their employees were in constant contact with scientific publications and abstracts from their respective areas. From the area of library and information science the researchers that participated in the evaluation of the abstracts were obtained mainly with the help of the Association of Librarians Ljubljana. The answers to our questionnaires were also kindly returned from the employees of large public and academic libraries and a school of library science. From the area of materials science and technology the researchers that participated in the evaluation of the abstracts were mainly authors that publish in one of the journals from the area of materials science and technology included in the content analysis of the original abstracts. The researchers also came from various industries, institutes and a faculty of materials sciences. Because the first two authors of this text are researchers in the area of library and information science in Slovenia the help of Association of Librarians Ljubljana was possible. For the area of materials science and technology some other way needed to be chosen. For the most part, the researchers were from Slovenia, but nine researchers from materials science and technology came from other countries. It should be emphasised that a total of forty-eight researchers from one scientific area is a relatively large number for a small nation such as Slovenia. The first researcher knew the identity of the respondents, but their anonymity was assured in all reports. The aim of the research was never focused on the evaluation given by individuals, but to present the overall results.

Our goal was to obtain four marks for each original, prototype and recommended abstract in order to ensure objectivity. Therefore, the same abstract was evaluated by four different researchers. In accordance with that, it was also decided that every researcher would evaluate two originals, two prototypes and two recommended abstracts. That seemed to be a reasonable number of abstracts for evaluation from one researcher.

The abstracts were evaluated with marks from one to five, with one being the lowest and five being the highest mark. Different forms of abstracts were listed in a mixed sequence and the researchers did not know what form of abstract they were evaluating. Also, bibliographic data about the article were not available. However, it should be emphasised that in the study of Hartley and Betts (2007), in which traditional and structured abstracts were compared, the presence or absence of titles (one part of bibliographic information) had no effect on the evaluation of the abstracts. According to Koltay (2010) bibliographic data usually include the title of the periodical (journal), the year, volume and issue numbers, and the page numbers. None of the researchers were involved in an evaluation of the original abstract followed by the prototype or the recommended abstract of the same article. If the researchers asked how to evaluate the abstracts, we suggested that they question themselves: "Is the abstract sufficiently informative that I could, without reading the whole article, decide if the article could or could not be useful to my further research work?" Their marks gave an answer about the most useful form of the abstract (original, prototype, recommended abstract) and, according to that, the proposal for new guidelines for the components of abstracts was developed.

Table 10: The structure of the recommended abstract (250 words in 11 sentences)

Area of science	**Original abstracts**	**Prototype abstracts**	**Recommended abstracts**
Materials science	3.79	3.61	3.75
Library and information science	3.76	3.43	3.58

As can be seen in the Table 10 the highest marks in both areas were given to the original abstracts. However, it should be mentioned that the differences were very small.

DISCUSSION

Based on the pilot study, in the abstracts from the area of materials science and technology it was expected that two of the most common structural elements would be present: method and results. However, the results of the research did not confirm these expectations. The results of this research showed that most often three structural elements from our coding scheme were present in the abstracts, and these three structural elements were background, method and results. Differences were noticed in the number of structural elements that were most often present and in the actual structural elements which occurred most often in the abstracts. The reason for differences could lie in the different sample sizes.

Based on the results of Šolar (2008), in the abstracts from the area of library and information science it was expected that three of the most common structural elements would be present: background, purpose/scope and results. However, the results of the research presented here did not confirm these expectations. Most often, four structural elements from our coding scheme were present in the abstracts and these four structural elements were method, results, background and conclusions. Differences were noticed in the number of structural elements that were most often present and in the actual structural elements which occurred most often in the abstracts. The reason for the differences could lie in the selection of the journals for the research. The journals JDoc and JoLIS publish articles in English language and have impact factor. The journals included in the research of Šolar (2008) publish articles in Slovene and Croatian language and do not have impact factor. That would require broader discussion about the role and importance of local journals and the influence of publishing in today's global, English language. That topic was for the area of materials and science already discussed in the article of Južnič and Jamar (2002).

Statistically, the journal JDoc differs significantly from the journals in terms of all structural elements, with the exception of hypothesis. However, the hypothesis was present in only 2% of the abstracts in the journal JoLIS. The journal JDoc also had a significantly higher impact factor for 2009 (1.405) among the journals included in the research presented here (JoLIS: 0.581, MST: 0.794, MIT: 0.143). The impact factor is calculated every year by Thomson Reuters and is a measure of the frequency with which the average article in a journal has been cited in a particular year or period (Thomson, 2011) in journals which are indexed in Thomson Reuters Journal Citation Reports (Impact, 2013). It is still a measure of quality for scientific journals and the funding of Slovenian journals depends on it. Since researchers are also evaluated on the basis of their publications in journals with impact factors, authors are interested in publishing in journals with higher impact factors. Of course, this means an even larger number of articles are submitted to journals with a high impact factor, and so there is a greater possibility of selection. The possibility of selection means a higher quality of articles and abstracts in the journal, and this could then be reflected in significant differences between the journals as in the case of JDoc and other journals included in the research presented here. The other difference between the abstracts published in the journal JDoc and in other journals in our study is the structured form of the abstracts. Perhaps in some way the structured form of the abstract forces the authors to take into account the guidelines set by the editors of the journal, and that could also be seen in statistically significant differences between abstracts published in different journals.

Based on the results of the pilot study, it was also expected that the guidelines for the components of abstracts would be more appropriate for natural sciences than social sciences and humanities. If we compare the data that show the presence of structural elements in the abstracts from library and information science and materials science and technology noticeable differences were only found in the presence of the structural elements purpose/scope (54% and 8%) and conclusions (67% and 22%). There were also no sentences that did not contain properties of at least one structural element. So, these expectations were not confirmed. The guidelines for the components of abstracts can be appropriate for abstracts from the area of natural sciences and also for abstracts from the area of social sciences and humanities. This, however, confirmed our expectation that uniform guidelines appropriate for all of the sciences can be created.

According to the coding scheme, the recommended abstracts should have contained the following structural elements: background, purpose/scope, hypothesis, method, results and conclusions. These expectations were, however, not confirmed. In the recommended abstracts the structural elements I (background, purpose), M (method description, sample), R (direct results) and D (conclusions) were included. The structural elements were coordinated with the IMRAD format (Milas-Bracović, 1987).

For the evaluation of original, prototype and recommended abstracts it was expected that the recommended abstracts would receive the highest mark for evaluation. The intention was that more detailed definitions (a description of the method, direct results) and a division (sample from method) of the structural elements proposed for the recommended abstracts would improve the informative value of the abstracts and would represent a step forward, in terms of the needs of the users. But, according to the fact that the researchers from both areas included in the research presented here (materials science and technology and library and information science) gave the highest mark when evaluating original abstracts, that was not the case. The reason for this is probably the fact that within the slightly broader description of the structural element, the authors of the abstracts are able to more easily adapt the content of the abstract to the characteristics of each article and the area of science. However, to confirm this statement, further research work would be needed. In both cases the recommended abstracts and the prototypes were in second and third place respectively.

Regarding all these results, we propose that the guidelines for the components of abstracts follow the IMRAD format. For structural element we propose that the content present the background and purpose/scope of our coding scheme; for structural element M we propose that the content present the method of our coding scheme; for structural element R we propose that the content present the results of our coding scheme; and, for structural element D we propose that the content present the conclusions and discussion of our coding scheme. The content can also be adjusted to the needs of the area covered by the article. Abstracts should contain no more than two hundred and fifty words and should be published in non-structured form. In the continuation of the article is an explanation for these decisions.

We propose that the abstracts follow the IMRAD format. If we present the results of the user study in another way, then they show that in one case the B-M-R (the most common combination of structural elements of the original abstracts from the area of materials science and technology) and in one case the B-M-R-C (the most common combination of structural elements of original abstracts from the area of library and information science) combination of structural elements was evaluated with the highest mark. According to the terminology of Milas-Bracović (1987) the combinations of structural elements should be I-M-R or I-M-R-D. However, it should be emphasised that the difference between the average mark for the original abstracts (structure B-M-R) and the recommended abstracts (structure B-M-R-C) in the area of materials science and technology was very small (3.79 and 3.75). Besides that, two out of three (66%) guidelines for the components of the abstracts from the journals included in the research presented here were in accordance with the IMRAD format.

Abstracts should contain no more than 250 words. That length is also proposed by ISO 214:1976 (1976) and ANSI/NIS0 Z39.14-1997 (1997). However, it is interesting to note that in 1963 (Borko and Chatman, 1963 and Weil *et al.*, 1963 a) the proposed length for abstracts was from 100 to 150 words. That is between 150 and 100 words less than proposed by ISO 214:1976 (1976) and ANSI/NIS0 Z39.14-1997 (1997). The reason probably lies in the costs associated with publication of the abstracts and in the development of standards and guidelines for the components of abstracts.

Finally, we also propose the non-structured form of abstracts. We think that the structured form of abstracts should be replaced by good guidelines for the components of abstracts, and with a good review process from the editors of the journals, not only in the case of articles, but also in the case of abstracts. That would ensure that all the structural elements proposed in the guidelines for the components of abstracts would be present in the abstract. Perhaps a checklist for abstracts appropriate for the reviewers would also be useful. However, we would like to emphasise, as was proposed by Koltay (2010), that structured abstracts, even if they are not required by a given journal, may be helpful in writing (traditional) author abstracts because they allow easier identification of important content.

It is interesting to note that in the study of Nakayama *et al*. (2005) a comparison between the introduction, methods, results and discussion (IMRAD) format, and the eight-heading format of the structured abstracts was also presented. The only difference between the eight-heading and IMRAD format is the structural element "method", which is divided into five parts for the eight-heading format (design, setting, patients or participants, interventions and main outcome measurement). Based on that, in the case of structured abstracts the IMRAD format also is used. It is also surprising that Nakayama *et al*. (2005) state that even in the area of medicine, where the history of structured abstracts began, a low percentage of the use of structured abstracts has been noticed. According to impact factors, in January 2001 the top thirty journals noted in the "Medicine, General and Internal" category of the ISI Journal Citation Reports (2000) used structured abstracts in 61.8% of cases. 66.5% of the structured abstracts adopted the IMRAD format, and the eight-heading format proposed by Haynes *et al.* (1990) was used only 33.5% of the time. The data is surprising, especially when considering the fact that as far as structured abstracts are concerned there has been a lot of research work done in the area of medicine, and several positive sides of structured abstracts were presented. According to that data, the structured abstracts also adopted the IMRAD format, which is the most common format for writing articles. That means that also in the case of structured abstracts the abstract is just an abbreviated version of the article.

All these facts speak in favour of our decisions. The use of a structured format is obviously not as high as could be expected. Also, in the case of structured abstracts, the IMRAD format is used more commonly than the eight-heading format. And, if we return to the definition of an abstract from the beginning of this article, abstract should be an abbreviated form of an article without added interpretation. If IMRAD is the most commonly used format for writing scientific articles, than an abstract written in accordance with the IMRAD format truly presents an abbreviated version of the abstracted article.

Further research regarding the guidelines for the components of abstracts should focus on how the content within the structural elements could be adjusted to different areas of the sciences, and not on the structural elements that should or should not be included in abstracts.

CONCLUSION

The main aim of the research presented here was to present uniform guidelines for the components of abstracts that are appropriate for all sciences. The proposed guidelines should appear as follows. The number of sentences ~~was proposed~~ for each section is suggested, so as to be in accordance with the importance of individual structural elements and in accordance with the average number of words in the original abstracts.

The introduction (I) should include three sentences of background information. The background should present the context of the research, the background of the research, previous research and any underlying theories. The method (M) should include three sentences of method and that means an exact description of the method used. The results (R) should include three sentences of direct results and that means results obtained from the study presented in the article. The discussion (D) should include two sentences of conclusions. The conclusions should present the implications of the results on subjects or objects that were not part of the study, suggestions for possible application of the findings, suggestions for further research work and an evaluation of the research.

~~For the end of this article also~~ To conclude, an example of the abstract written according to the proposed guidelines is presented.

The paper presents the case study research of a job rotation pilot involving six library assistants in the Cardiff University Library Service (ULS). This is the result of a merger in 2004 between the Cardiff University and the University of Wales College of Medicine (UWCM). Aim of the pilot study at Cardiff ULS was to find out how effective job rotation was at motivating staff and increasing skills. Case studies involved semi-structured interviews and each of six rotatees was interviewed immediately before and after six-week job rotation. Change and development in six rotatees were investigated in terms of their perceived motivation levels as well as any acquisition of skills, both technical and soft. Six library assistants/senior library assistants formed the case studies for this research and they were all paired with *another rotatee for the pilot. Job rotation demonstrably improved the skills and motivation of the majority of the rotatees. Further benefits that arose from the rotations included improvements in communications between different areas of the library service. An unexpected benefit was the fact that some of the rotatees were able to identify the types of work that suited them the best and to pursue this further, and this is not highlighted in the literature. Many benefits concerning job rotation suggested in literature have been reflected in this case study. Job rotation at Cardiff University Library Service was of real value and it would be worth the not insubstantial time and investment required to implement it as a formal scheme.*

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