

IMRAD USAGE IN LATVIAN LANGUAGE RESEARCH PAPERS

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Abstract: Within the scientific discourse it is commonplace to write articles based on the IMRAD structure (Introduction, Methods, Results, and Discussion). This structure is typical for the natural sciences (STEM) but scientists in other disciplines are also often required to use it. This paper looks at scientific texts in Latvian published from 2008 to 2018. The basis for this research project is a corpus of 758 scientific articles from natural sciences, engineering and technology, social sciences, humanities and arts. The aim is to show in which disciplines IMRAD is a dominant structure for texts written in Latvian and what wording authors use. It could be concluded that in the structure of Latvian scientific texts have a significant variation in the use of IMRAD and there are different wording versions used, it aligns to previous research about scientific text structure in other languages and cultures. Not all Latvian scientific texts adhere to the IMRAD structure and there are deviations based on the discipline.

UDC Classification: 811.174, **DOI:** <https://doi.org/10.12955/pss.v1.42>

Keywords: Latvian, scientific article, text macrostructure, intralingual

Introduction

One of the most popular types of scientific texts is a scientific article, which is published in proceedings or most often in a scientific journal. The scientific article informs the scientific community, professionals and students about research results, their significance in science, via a description of the research methodology and encouraging discussion. Research articles have a relatively standard form and structure, and often used and recommended or requested is the IMRAD structure. Traditionally, the IMRAD structure is used by natural sciences and engineering researchers in their articles, while the social sciences and humanities often have a different article structure.

Studies on the Latvian scientific language have relatively little research on scientific texts, their types and structure; including on the specifics of a scientific article. Baltiņš (2003) gives a brief overview of the types of scientific papers and briefly describes the structure of IMRAD in them. In addition, Pipere & Dambrova & Martinsone & Berķis (2018) look at the types of scholarly papers and their structure, based on secondary literature about scientific papers in medicine and psychology.

This paper analyses the macrostructure of scientific texts in Latvian and aims at to show in which disciplines IMRAD is a dominant structure for texts written in Latvian and what wording authors use.

Some remarks about the IMRAD structure

Every scientific article should have a structure to ensure that the research done is easily read and understood not only by the author, but also other readers. Nowadays it can be heard more and more that every work should use the IMRAD structure as it would unify all disciplines at least from a point of view of article organisation.

Sollaci and Perreira (2004) found that the structure was initially used in British Medical Journal, JAMA, The Lancet, and the New England Journal of Medicine from the 1940s and its use increased and by the 1970s it had reached 80% of all paper structures and past the 1980s it became the dominant structure used in medical sciences. It should be noted, however, that these aforementioned journals are all published in English speaking countries and the timeline of its usage in other cultures could possibly be different, but due to the globalisation of science, many scientists have to write in English to be successful so they should be aware of requirements set out by various publishers. Many would say that this structure has several advantages, for example “IMRAD helps the author to organize ideas and remember critical elements; it makes it easier for the editor and the reviewer to evaluate manuscripts; and it improves the efficiency of the scientist to locate specific information without going through the entire paper.” (Wu, 2011)

Papers often follow the general structure of introduction, body and discussion and the so called Hourglass model has been discussed in Swales (1993) and later this model was expanded by Derntl (2004) into a King model that also includes the title of the paper, the abstract and references. No matter the discipline a paper should have at least these elements to follow a logical order. Even if a paper does

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not strictly follow the IMRAD structure, it does not necessarily mean that it is illogical and has no structure, as Ahmed (2012) writes “in the end, scientific discourse is still writing”. Differences in disciplines and cultural background do play a role that might not be initially apparent.

Efficiency is often welcomed, sometimes along with a more pragmatic approach to writing, however, there are also arguments that such structures (like IMRAD) may lead to conformity to match Western standards (Popova, Moisenko, Beavitt 2017) and being “international” is often mentioned when there are discussions about academic writing in Latvia.

Scientific articles in Latvian and methods of macrostructure research

For a study on the macrostructure of scientific articles in Latvian including for analysis of IMRAD structure, a corpus was created. Scherer (2014, 5) emphasizes that a body of texts consists of collections of texts that are ideally selected according to certain linguistic criteria, and that size, content, consistency and representativeness of the text corpus are set for a certain goal. A specialized body of texts has been chosen for research papers because it is “more likely to be reliably representative of a particular register or genre than a general corpora.” (Koester 2010, 69)

Based on the guidelines of the Frascati Manual (2015), scientific articles were selected from natural science, engineering and technology, social sciences, humanities and arts groups. For the selection of the research texts, information was collected from the websites of Latvian universities and research institutions, that is, information on scientific publications, mainly scientific journals and collections of articles, available online open-access and published between 2008 and 2018. For the corpus of the research texts, scientific articles in Latvian were selected from all the previously mentioned groups of sciences.

Since 2013, scientific articles in Latvian are no longer available online in the natural sciences and since 2015 in the engineering and technology sciences, but the corpus of texts in the social sciences group and the humanities and art sciences group can be supplemented significantly still. The categories of social sciences and humanities and arts were not supplemented in the text corpus in order to ensure the balance of texts across scientific groups. For the study the following amount of papers were analysed 114 natural sciences, 182 for engineering and technology, 211 for social sciences and from the humanities and arts – 251 scientific articles.

In order to perform a macrostructure analysis of the body of research texts and to determine the scientific structure of the IMRAD structures in Latvian, a qualitative macrostructure analysis of the texts included in the body was carried out by a random selection from natural sciences, engineering and technology, social sciences and the humanities and arts. Thus, the presence or absence of the IMRAD structure in the scientific articles of the above-mentioned scientific groups was determined. In the absence of an IMRAD structure, the structural elements of the scientific texts were analyzed and the results summarized.

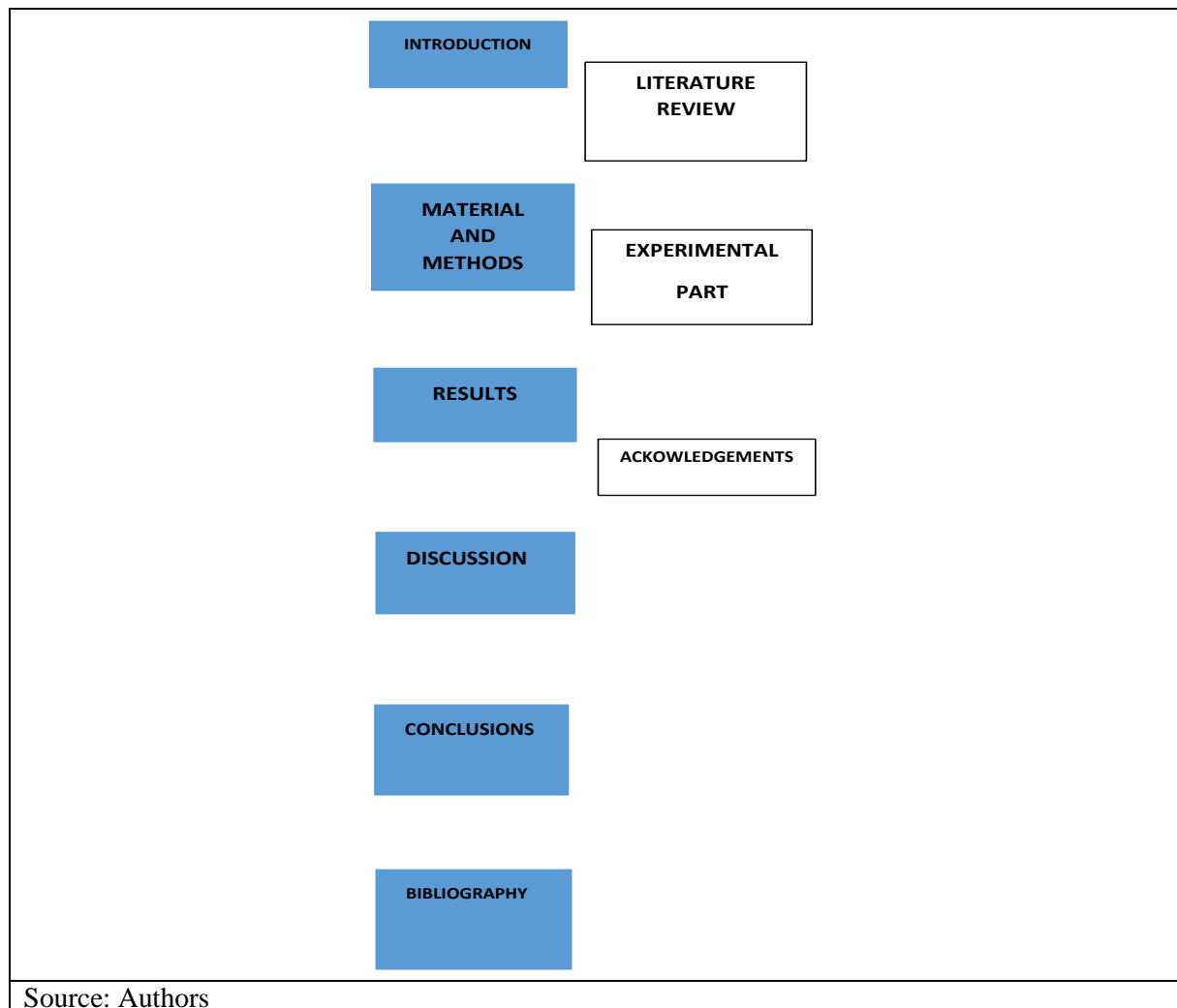
IMRAD structure of Science, Engineering and Technology group articles

Qualitative analysis leads to the conclusion that the structure of IMRAD is dominant in the natural sciences. Contrary to expectations, in the field of engineering and technology, scientific articles in Latvian usually contain an introductory section, methods and results, with a conclusion or summary at the end. On the other hand, a specific part of the discussion in these scientific articles is in most cases not included or distinctly specified.

Looking at the scientific papers in the natural sciences, the results of the analysis show that the authors have usually created them according to the scheme shown in Figure 1. In addition to the four basic elements of the IMRAD structure, conclusions or summaries are usually given at the end of the text. Separate parts of the text may include, but are not always, a review of previous research or literature review, an experimental part, and acknowledgements.

Looking at each component of the IMRAD structure elements separately, it has to be concluded that the authors of scientific articles choose different variants of their titles. In the following, different options for the formulation of the individual parts / chapters of the IMRAD structure are considered, thus also allowing for a different presentation of the study content. The parts where the differences or variants of the wording are found were analysed.

Figure 1 : IMRAD structure in Latvian articles



In describing research materials and methods, in natural sciences the authors tend to choose variants to designate this part of the scientific article *Material and methods* (Materiāli un metodes); *Material and methodology* (Materiāli un metodoloģija); *Methodology and material* (Metodoloģija un materiāls) or *Data and methods* (Dati un metodes). This section can be divided into two separate sections in the scientific papers, distinguishing between *Research Material* (Pētījuma materiāls) and *Research Methods* (Pētījuma metodes). Interestingly, the title of the study material in the natural sciences often uses the title “Characteristics / Description of [x]“ (*Description of the study area* (Izpētes teritorijas raksturojums); *Characteristics of the studied river basins* (Pētāmo upju baseinu raksturojums); *Pollen rain characterization* (Putekšņu lietus raksturojums)). Unlike other natural sciences in computer science and informatics, in many places this part of the material and methodology is replaced by a description denoted by *Problem / task statement* (Problēmas / uzdevuma nostādne).

The analysis shows that the results of the study can be described in a separate section as well as presented in a single chapter along with the discussion. In the first case, the authors of scientific articles use several variations for naming of the article section. Constructions with “[x] results“ (*Research results* (Pētījuma rezultāti); *Results of experiments* (Experimentu rezultāti); *Experimental results* (Eksperimentālie rezultāti)) were used. In the second case, while the results and discussion are dealt with simultaneously in one chapter, the constructions that explicitly show the merging of the two parts into one are mainly used: *Results and analysis* (Rezultāti un analīze); *Results and their evaluation* (Rezultāti un to izvērtējums); *Results and discussion* (Rezultāti un diskusija); *Research results and discussion* (Pētījuma rezultāti un diskusija); *Results and discussion* (Rezultāti un to apspriešana). In a few articles, the results of the research are presented in one chapter together with the conclusions, denoted by *Results and conclusions* (Rezultāti un secinājumi) or *Achieved Results and conclusions* (Iegūtie rezultāti un secinājumi).

Like the findings about the result description, the discussion section can be either divided into a single chapter or merged into a chapter with conclusions or recommendations. In this case, the authors use different wording to designate the chapter in question: *Discussion and conclusions* (Diskusija un secinājumi); *Discussion and suggestions* (Diskusija un priekšlikumi); *Discussion and suggestions: Research opportunities in Latvia* (Diskusija un priekšlikumi: pētījumu iespējas Latvijā). In the wording versions above, it is clear from the chapter title that the parts of the discussion explicitly include the article's concluding insights on future research directions and opportunities. It is in these texts that this chapter forms the very end of the scientific article.

In natural sciences, engineering and technology, authors choose to end the article with a concluding chapter, most often referred to as the word *Conclusions*. However, variations are also found in this chapter, namely that the term “conclusions” (secinājumi) may be supplemented by other components (“Conclusions and [x]”) (Secinājumi un [x]). The most common are the formulations *Conclusions and Proposals* (Secinājumi un priekšlikumi); *Conclusions and subsequent use of the results* (Secinājumi un turpmākie rezultātu lietojumi); *Conclusions and observations* (Secinājumi un novērojumi); *Conclusions and directions for further work* (Secinājumi un turpmākā darba virzieni); *Conclusions and ending* (Secinājumi un nobeigums). In both natural science and engineering, there are also scientific articles that end with the authors' choice to give a brief summary instead of conclusions, which they designate as *Summary* (Kopsavilkums). There are also articles which, instead of conclusions and summaries, include a section at the end describing the necessity for further studies to be done. In such cases, that division is referred to as *Perspective* (Perspektīva) or *Prospects for the future* (Nākotnes perspektīvas).

In the corpus of natural science papers reviewed, there are often articles outlining previous research and theoretical findings between the introduction and the description of the material and methods. This section is denoted by various variations of the wording, the most commonly used of which are: *Literature review and theoretical discussion* (Literatūras apskats un teorētiskā diskusija); *Approaches, research overview* (Pieejas, pētījumu apskats); *Theoretical notions and essence of the problem* (Teorētiskie priekšstati un problēmas būtība); *Earlier studies* (Agrākie pētījumi); *Previous studies* (Iepriekšējie pētījumi). The analysis carried out shows that this part is quite widespread in natural sciences in Latvian, and could therefore be considered as an alternative, additional component to the IMRAD structure.

Summarizing the results of the qualitative analysis of scientific papers in natural sciences and engineering and technology, it was found that the structure of IMRAD in its classical sense is mainly used directly in texts dealing with natural sciences. The results show that today this established structure is likely still experiencing changes. The research material can identify different variations in the structure element naming as well as the merging of the individual parts into one or the addition of new parts of the article structure.

IMRAD in the Social Sciences

Unlike the previously described structures of the natural sciences that tend to follow the IMRAD structure based on traditions and origin, the structure of a social sciences article in Latvian is significantly more unpredictable as authors choose the structure per their research needs. Social sciences are very often based upon qualitative, not quantitative research so the authors need to describe the phenomena observed within their research topic in enough detail to ensure that as many aspects as possible are laid out clearly. It could be reasonable to assume that issues regarding teaching aspects would be written about differently than explorations within a field of law.

As Social sciences deal with various issues regarding people, there is not always a distinct method of research. While in Psychology there may be a distinct description of how participants were questioned, what was the question order and other procedures that then lead to a possible case study, articles about Pedagogy (Education) do not always have a method described. For example, in education there can be a survey or an observation of a student group, but this is shown within the text, described in detail but not with a subheading titled *Methods*. Often an article about Pedagogy might not have a clearly defined goal – that does not imply that there is no goal but most of the time it is the reader's prerogative to find what the goal is. There are results in Pedagogy, but once again there are no subheadings to mark the result section. As Pedagogy has various subdisciplines, there are different results – if there was a survey then there will likely be survey results, often also tables or charts to list these. If a paper is based on

observations of students of a certain school subject or extracurricular, there will be a description of the situation but it might not be described in definitive terms as it is not a laboratorial experiment like in Natural Sciences where one can have a set of assumptions about what could happen if one uses a certain method, as students might respond in different ways to teaching methods and questionnaires. There can be a summary or discussion at the end of the article. These are often marked with a subheading and the content of the article and further research possibilities are discussed.

The most apparent structure can be found within articles regarding Law. While they do not follow IMRAD directly, many papers have a table of contents that is not typical of other Social Sciences. The table of contents lists an introduction, at least three subheadings regarding the topic discussed within the paper and a summary and a list of sources and references and a foreign language summary. It should be noted that references and sources for a Law article are very numerous and can reach over 150 items listed as they are references to laws, precedents, judgement details that are very briefly mentioned within the text. As Law articles often deal with a very specialised matter, there is no distinctly highlighted method as this discipline requires a lot of descriptiveness about situations and reasonings about implications of a certain law or legal norm.

Variation of stylistic structures in Social Sciences is quite vast and this article itself is an attempt to give a brief insight about which disciplines in Latvian are more likely to use the IMRAD structure and the corpus that has been created as part of this research project and the variations between disciplines.

IMRAD in Humanities texts

Research on the structure of the scientific writings of the humanities and arts sciences emphasizes that the structure of scientific writing in this group is less conventionalized than in the so-called “hard sciences” (Bondi 2009, 86). Graefen & Thielmann (2007, 79) also note that the humanities article competes with the monograph and often contains knowledge that can be further developed in the monograph, and the structure of these articles is much less standardized due to the variety of research topics and methodologies (see also Gläser 1998, 483–484).

In order to reflect the macrostructure of scientific writings of the humanities group in Latvian, we first look at the texts by sub-group, i.e. History and Archaeology, Languages and literature and Philosophy, Ethics and religion. This is necessary because the research aspects of the humanities are so wide and varied that they are reflected in the structure of the texts.

The Latvian scholarly articles in the History and Archaeology subgroup mainly present a three-part structure consisting of an introduction, a main body and a conclusion. The introduction includes a short introduction to the article or a brief description of the topic. The goal or objectives of the article are relatively rarely mentioned in the introduction. In the main body of the article, great attention is paid to the description of the analysed source or sources, their significance and/or its interpretation. A review of existing research and literature is also possible in this section. Mostly this section contains the presentation and interpretation of the material of results, or historical facts. The concluding section contains a brief conclusion or multiple conclusions and sometimes highlights the importance of the research conducted in the context of the historical research of the topic.

A similar three-part structure of texts is also found for scientific texts in the sub-group Languages and literature. However, there are differences between linguistic and literature scholarly articles. For scholarly articles written by linguistics, the structure shows a certain resemblance to the structure of IMRAD, as these texts contain an introduction which contains a description of the research topic, often the aims and objectives. However, the introduction may also include an explanation of terms or research keywords. Then follows a description of the study material, often followed by a description of the methods and/or techniques. The body of the article also outlines the previous research and the results of the analysis of the language material. In the final part, there are conclusions, which may also be in the form of an enumeration. The article may also end with a brief summary, recommendations, or further research perspective. On the other hand, the structure of literature articles is rather heterogeneous. The articles usually consist of the three-part structure already mentioned. If the introduction contains a topic description, less common is a description of the purpose and tasks, but also a research object and a hypothesis, then the main body may contain different text structural elements, which depends on the specifics of the research conducted. It may include a description of the period, historical, cultural-historical, political, psychological background, biography and work of the author of the literary work,

characterization of the literary work (s), including past research and interpretation of literary works such as symbols, themes, artistic and stylistic techniques, images, typology of images, etc. Finally, there are conclusions and often an outline of the author's creative work.

In the case of scholarly articles in the sub-sector Philosophy, ethics and religion, the three-part structure already mentioned can also be observed. Like the history and archaeology texts, the introduction has a brief description of the subject and rarely purpose and tasks. The main body is often structured with headings of chapters and sub-chapters that include a person's biography, a chronological representation of events, including past research and factual information. The structural elements of the concluding section coincide with the structure of articles in the field of history and archaeology.

In general, the scientific articles of the Humanities Group in Latvian present a three-part structure: introduction, the main body and the conclusion. However, there is not much heterogeneity in the structure of the scholarly articles of the humanities subdivisions, which is determined by the diverse research directions and topics, the different research traditions of the subdivisions, and the influence of international research and contact languages.

Conclusion

The qualitative analysis of the scientific articles in Latvian suggests that the use of the IMRAD structure is quite variable in different scientific fields. More generally, IMRAD dominates in natural sciences. It is believed that this is related to the internationally established scientific article conventions in English and their impact on the authors' approach to writing in Latvian. Here it is also possible that the authors merge the individual parts of the basic structure together or subdivide it, choosing the most appropriate type of article macrostructure for the presentation of their research. This is also evident in the wording of the titles of these sections.

Latvian engineering-related articles tend to resemble a classical three-part structure with an introduction, discussion, and conclusion, which is also widespread in the social sciences and the humanities. The social sciences and the humanities show considerable differences between the individual subgroups. The corpus material shows that it can often be difficult to determine structure in Literature studies articles, where the specifics of the research also determine the structure of the article.

The analysis carried out may permit to conclude that the authors in Latvian create the structure of scientific articles and hence the macrostructure mainly based on the research and the form most suitable for its presentation. Often the structure of an article depends on the formatting rules set out by publishers of a journal or proceedings, and these can then depend on the traditions of the discipline and country. Therefore, the structure is not always the sole choice of the author but also depends on where an article was intended to be published. In the context of the Latvian language, this has not yet been widely researched but it is a topicality that should be researched to shed more light on academic writing traditions.

Acknowledgements

Research funded by the Latvian Council of Science, project *Intra-lingual Aspects of the Latvian Scientific Language*, project No. lzp-2018/2-0131.

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