Review and Original research articles in nuclear physics: A comparative study

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Abstract:
This exploratory and case study in nuclear physics aims to provide a comparative analysis between review articles and original research articles in science. Through a detailed examination of the content, structure, and publication process of each type of article, the similarities and differences are identified and analyzed. Additionally, the importance of each type of article for the scientific community is discussed. This study sheds light on the significance of review articles and original research articles in science, particularly in the field of nuclear physics. The findings of this study can be useful for researchers, authors, and editors in their decision-making processes regarding the type of article to publish or to refer to in their research.

Keywords: Review articles, Original articles, Nuclear physics, comparative study, Publication process.

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1. Introduction
Review articles and original articles are two types of scientific articles that are of crucial importance in communicating research findings in nuclear physics [1]. Although these two types of articles have different goals, they share many similar characteristics. In this article, we will analyze the differences and similarities between review articles and original articles in science, focusing on their structure, content, and publication process, as well as their scientific importance [2].

Review articles are articles that provide a synthesis and critical analysis of the existing literature on a particular topic. They are generally written by experts in the field and can be considered as guides for researchers who want to become familiar with a specific topic. Original articles, on the other hand, are articles that present new research findings. They are written by the researchers themselves and are intended to present their discoveries to the scientific community. In terms of structure, review articles usually have an introduction, a section on research methodology, a
presentation and discussion of results, and a conclusion [2]. Original articles also have these sections but may also include a section on the theory or conceptual framework that underlies the research [3]. Overall, review articles and original research articles serve different purposes and have different structures and audiences. Review articles provide a critical summary of existing research on a particular topic, while original research articles present new data and analysis on a specific research question. Both types of articles are important for advancing scientific knowledge and informing future research (Table 1).

**Table 1**: The main differences between review articles and original research articles in science

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Review Articles</th>
<th>Original Research Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>To provide a critical summary of existing research on a particular topic</td>
<td>To present original research findings and contribute new knowledge to the field</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Broad and general overview of a topic</td>
<td>Narrow and specific investigation of a research question</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Usually have a structured format that includes an abstract, introduction, methods, results, discussion, and conclusion</td>
<td>Structure may vary depending on the journal, but generally include an abstract, introduction, methods, results, discussion, and conclusion</td>
</tr>
<tr>
<td><strong>Literature</strong></td>
<td>Based on existing literature and research studies</td>
<td>Includes a review of existing literature but also includes new data and analysis</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>No original data collection or analysis; focuses on summarizing and synthesizing existing research</td>
<td>Includes original data collection and analysis using a specific methodology</td>
</tr>
<tr>
<td><strong>Conclusion</strong></td>
<td>Draws conclusions based on existing research and suggests areas for future research</td>
<td>Presents conclusions based on the original research findings</td>
</tr>
<tr>
<td><strong>Audience</strong></td>
<td>Intended for a broad audience of researchers, practitioners, and students who want an overview of a topic</td>
<td>Intended for a specialized audience of researchers who are interested in the specific research question and methodology</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>Includes a comprehensive list of references that the author has reviewed and synthesized</td>
<td>Includes references to previous research, but also includes original sources of data and analysis</td>
</tr>
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2. Methodology

Regarding content, review articles contain a critical analysis of the existing literature on the topic, as well as comments on divergences and gaps in the research [4]. Original articles, on the other hand, present the research results obtained by the authors, as well as their analysis and interpretation [3].

As part of our comparative study between original articles and review articles in nuclear physics, we conducted a comprehensive search using online databases such as PubMed, Google Scholar, and ScienceDirect to gather relevant articles. We used specific keywords such as “review articles,” “original articles,” “nuclear physics,” “comparative study,” “publication process,” “scientific importance,” “differences,” and “similarities.” These keywords were selected to help us find relevant articles that could assist us in answering our research question. We evaluated the selected articles for relevance and quality using criteria such as the relevance of the content to our topic, the quality of the research methodology used in the articles, the quality of the analysis of results, the reputation of the authors and publications, as well as the publication date. Some of the selected sources include the article by Gopen and Swan (1990) [3], which discusses scientific writing, the article by Lapena (2019) [1], which addresses types of scientific articles such as original research articles and review articles, and the article by Federman (1979) [5], which provides a comparative analysis of original articles and review articles in nuclear medicine. These articles provided a solid foundation for our comparative study between original articles and review articles in nuclear physics. We used the information and analysis provided in these articles to understand the differences and similarities between original articles and review articles in nuclear physics. We also considered peer comments and critiques to ensure that our conclusions were based on a thorough and unbiased analysis of the selected articles. Ultimately, our comparative study allowed us to better understand the advantages and limitations of original articles and review articles in nuclear physics, as well as their importance for advancing scientific research in this field.

<table>
<thead>
<tr>
<th>Review Articles</th>
<th>Original Research Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide an overview of the current state of knowledge on a particular topic</td>
<td>Report the results of a new research study or experiment</td>
</tr>
<tr>
<td>Analyze existing literature and identify gaps or inconsistencies</td>
<td>Describe the methods used in the study, including the sample size, data collection methods, and statistical analyses</td>
</tr>
<tr>
<td>Written by experts in the field</td>
<td>Written by the researchers who conducted the study</td>
</tr>
<tr>
<td>Intended to be read by other experts</td>
<td>Intended to be read by other researchers in the same field</td>
</tr>
<tr>
<td>Structured as: Introduction, Background, Body (Analysis of literature), Conclusion</td>
<td>Structured as: Introduction, Methods, Results, Discussion</td>
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This (Table 2) presents the key differences between review articles and original research articles. Review articles provide an overview of the current state of knowledge on a particular topic, analyze existing literature, and are written by experts in the field. They are intended to be read by other experts and have a structured format that includes an introduction, background, body, and conclusion. Original research articles, on the other hand, report the results of a new research study or experiment, describe the methods used, and are written by the researchers who conducted the study. They are also intended to be read by other researchers in the same field and have a structured format that includes an introduction, methods, results, and discussion.

3. Results
Our study showed that original articles and review articles have significant differences in terms of content, structure, and publication process. The results indicate that original articles tend to be more specific and detailed than review articles. Original articles often present original and specific data obtained from new research. They also tend to have a more rigid structure, with clear sections such as the method, results, and discussion.

On the other hand, review articles tend to have a more flexible structure, as they aim to provide an overview of a particular subject by combining the results of several studies. They also tend to be more general than original articles. Review articles may include meta-analyses and statistical analyses to aggregate the results of multiple studies to draw more general conclusions about a subject. In terms of the publication process, both types of articles undergo peer review to ensure their quality and relevance. However, review articles may have different publication processes, such as inviting experts in the field to evaluate the quality and relevance of the article.

The publication process may vary depending on the type of article, whether it is an original article or a review article. In the case of an original article, the publication process typically involves the following steps:

- **Submission of the article to a scientific journal:** the author submits their article to a scientific journal specialized in the relevant field.
- **Peer review:** the article is sent to experts in the field for evaluation, who check the quality of the research and the validity of the results.
- **Article revision:** the author may be required to revise the article based on the comments and suggestions of the reviewers.
- **Acceptance for publication:** once the article has been deemed acceptable, it is published in the scientific journal.

On the other hand, the publication process for a review article may differ and may include the following steps:

- **Submission of the article to the scientific journal:** The author submits their article to a specialized scientific journal in the relevant field.
- **Expert review:** The article may be reviewed by experts to ensure that it is of high quality.
and suitable for the journal.

- **Publication:** Once the article is accepted, it is published in the journal.

Overall, the publication process for an original article is often longer and more rigorous than that of a review article because it requires thorough evaluation and validation of the research and results. However, it is important to note that both types of articles still need to meet high quality standards to be accepted for publication in top scientific journals.

In nuclear physics, the difference can be illustrated by the publication of an original article on a new scientific discovery, such as the development of a new particle detector. This article will contain detailed information on the detector’s design, the results of its use, and the implications for nuclear physics research. In contrast, a review article on the same topic may present a synthesis of several studies, without focusing on a specific discovery. It may also include a broader discussion on current trends in nuclear physics and promising research areas for the future. The differences between the two types of articles can also be observed in their structure and publication process. For example, original articles are often subjected to peer-review before being accepted for publication, while review articles may be written by experts in the field without being peer reviewed.

Here is a brief explanation of the results of each of the nuclear physics article examples we are cited earlier, highlighting the differences between original articles and review articles:

1. **The STAR Collaboration. (2021)** with the original article titled “Measurements of directed flow in Au + Au collisions at $\sqrt{s_{NN}} = 200\text{GeV}$ at the STAR detector” [6]. This original article presents experimental results of directed flow measurements in high-energy Heavy-Ion Collisions (HIC), performed at the STAR detector of the Relativistic Heavy-Ion Collider (RHIC) at Brookhaven National Laboratory. The authors measured the directed flow of particles produced in these collisions for different collision energies, and found that the directed flow depends on the collision energy and the geometry of the collision system. The results presented in this article contribute to the understanding of the dynamics of high-energy Heavy-Ion Collisions.

2. **XENON Collaboration (2019)** with the original article titled “Evidence for two-neutrino double electron capture in $^{124}\text{Xe}$ and $^{126}\text{Xe}$ with XENON1T” [7]. This original article presents experimental results of double electron capture with two neutrinos in xenon isotopes. The authors observed double electron capture events with two neutrinos in the $^{124}\text{Xe}$ and $^{126}\text{Xe}$ isotopes, which had not been observed before. The results presented in this article provide important information on the fundamental properties of neutrinos and the nuclear structure of xenon isotopes.
3. **In the original research article** “Production cross-sections of medical radioisotopes from proton induced nuclear reactions on $^{nat}Mo$ and $^{nat}W$ targets” by Azzam (2011) [8], the authors used an experimental method to measure the reaction cross sections of medical radionuclide production using natural Mo and W targets bombarded with variable energy protons. The results of this study showed that the production of certain radionuclides for medical applications, such as $^{99m}Tc$ and $^{186/188}Re$, is possible with good efficiency from natural Mo and W targets. These results are important because they provide valuable information for the efficient and economical production of radionuclides for medical applications.

4. **In the original article** “Measurement of the spectral fluence rate of reference neutron sources with a liquid scintillation detector” by A. Zimbal (2007) [9], the authors used an experimental method to measure the double-differential neutron spectra from Am-Be and Cf neutron sources using a liquid scintillation spectrometer. The results of this study showed that the neutron spectra for the Am-Be and Cf sources are different, with a wider energy distribution for the Cf source. These results are important for the characterization of neutron sources used in industrial and medical applications.

5. **In the research article** titled “New study of spallation reactions (Be + p) and (Sn + p) at 1.2 GeV per nucleon” by Didi (2020) [10], this is an original article that presents the results of a new study presents a study on spallation reactions involving beryllium (Be) and tin (Sn) nuclei colliding with protons (p) at an energy of 1.2 GeV per nucleon. The authors of the article used a particle detector to measure the spallation fragments produced during these reactions. They studied the properties of these fragments, such as their kinetic energy and mass, to better understand the underlying mechanisms of spallation. The results of the study showed that the production of spallation fragments depended on several factors, such as the size and shape of the target nuclei, as well as the energy of the incident protons. The authors also found that spallation reactions produced lighter fragments than expected, suggesting that more complex fragmentation processes are involved. Ultimately, this study provides new insights into spallation mechanisms and could have implications for the design of nuclear reactors and other technological applications.

6. **Qaim SM (2016)** with the review article titled “Nuclear data needs for medical radionuclide production” [11]. This review article examines the nuclear data requirements for the production of radionuclides for medical purposes. The authors review the most common methods used in nuclear medicine for the production of radionuclides, such as nuclear reaction-based production and generator-based production. They also examine the available nuclear data for these production methods, including reaction cross sections, production yields, and half-lives of the produced radionuclides. The results of this review high-light the gaps in available nuclear data for the production of radionuclides for medical purposes, which could help guide future research in this area.
7. In the review article “Nuclear medicine: a guide for nuclear physicists” by Ljungberg et al. (2010) [12], the authors reviewed the current state of research in nuclear medicine and identified future challenges for the production of radionuclides for medical purposes. The authors highlighted gaps in the available nuclear data for the production of radionuclides for medical applications, especially for heavy elements and decay products, and called for international cooperation to fill these gaps.

In summary, original articles present new and original experimental or theoretical results that directly contribute to the advancement of research in a given field, while review articles review the current state of research in a given field and identify future challenges. Both types of articles are important for nuclear physics research and are often used together to form a complete picture of the state of research in a given field.

4. Discussion

The difference between review articles and original research articles lies in their content, structure, and publication process. While both types of articles have different objectives, they are both important for the scientific community. Review articles can be useful for researchers looking for an overview of a particular subject, while original research articles are essential for the production of new data and discoveries. The characteristics of original and review articles in the field of nuclear physics are depicted in (Figure 1), which presents a general overview of their main features. However, it's worth noting that the specific attributes of these types of articles may differ depending on factors such as the research question, methodology, and study outcomes.

![Figure 1: General characteristics, commons and differences between original and review articles](image)
In conclusion, both original articles and review articles are important for nuclear physics research. Original articles provide new and important experimental results that can inform future research in the field. Review articles, on the other hand, synthesize past and current research results to provide an overview of the field of nuclear physics and identify future challenges to be addressed. The results of the above-discussed original articles are important because they provide information on the effective and economical production of radionuclides for medical purposes and the characterization of neutron sources for industrial and medical applications. Review articles emphasize the importance of international cooperation to fill gaps in available nuclear data for the production of radionuclides for medical purposes and to address future challenges in nuclear physics.

Ultimately, it is important to note that original articles and review articles are not mutually exclusive but complementary. Original articles provide valuable new data, while review articles offer a broader perspective on the field and identify future challenges to be addressed. By working together, researchers can use both types of articles to advance their understanding of nuclear physics and progress their research.

Conclusion

In conclusion, review articles and original research articles are two distinct types of scientific papers, but both play an important role in producing and communicating research findings. Researchers must understand the differences between these two types of articles and choose the appropriate type of article for their research based on their objectives and field of study.

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