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Post-Publication Review: The Role of Science News Outlets and Social Media

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This article explores the significant role of post-publication review in maintaining research integrity and the potential of science news outlets and social media to improve the process. By examining recent cases, this article reveals the vulnerabilities of pre-publication peer review and suggests a more inclusive approach. The importance of broader public scrutiny is emphasized, as retractions in these cases occurred only after gaining significant attention on social media. The term "peer-review" should be expanded to include various experts and platforms beyond traditional academic journals. The incidents examined in this study underscore the necessity of openness and vigilance in maintaining research integrity, especially in the era of artificial intelligence and digital platforms. Researchers need to understand that research integrity extends beyond journal-led pre-publication reviews. They should also apply their scientific intellect by conducting post-publication reviews.

Keywords: Pre-publication reviews, Post-publication reviews, Journal-led peer review, Community-led peer review, Academic misconduct, Research integrity

Introduction

The integrity of scientific research is crucial for the advancement of knowledge and societal progress [1]. Traditional pre-publication peer review has long been the cornerstone of ensuring research quality [2]. However, the emergence of digital platforms and social media has exposed the limitations of this process [3]. This article explores the significant role of post-publication review in maintaining research integrity and the potential of science news outlets and social media to improve the process.

The integrity of scientific research is crucial for advancing knowledge and societal progress. Ensuring the quality and reliability of research findings is fundamental not only for the scientific community but also for the public, which relies on scientific evidence to make informed decisions in healthcare, technology, policy-making, and education [4,5].

Traditional pre-publication peer review has long been the cornerstone of ensuring research quality. In this rigorous process, experts evaluate the validity, significance, and originality of a manuscript before it is published. This critical filter helps reduce the chances of flawed or unsubstantiated findings from entering the scientific literature [6].

However, the traditional peer review system is not without its flaws and limitations. Issues such as reviewer bias, conflicts of interest, and the occasional inability of reviewers to detect all errors or fraudulent data have been well-documented. Moreover, the peer review process can be time-consuming, often leading to significant delays in the dissemination of important findings. As science evolves and the volume of research outputs grows exponentially, the traditional publishing and reviewing system is increasingly strained, prompting calls for more efficient and transparent methods of quality control [7]. This was particularly evident during the COVID-19 pandemic in which scholars have observed a strong shift in publishing and overall dissemination practices along with growing integrity issues [8,9].

The emergence of digital platforms and social media has highlighted the limitations of traditional

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peer review [10]. In today's fast-paced, interconnected world, scientific findings can be shared instantly with a global audience, bypassing traditional publication channels. This shift has changed how research is disseminated and scrutinized. While these digital platforms democratize access to scientific knowledge and encourage broader engagement, they also present challenges in maintaining the integrity and credibility of the information shared [11–15].

In this context, post-publication review has become important for ensuring research quality. Unlike traditional peer review, which occurs before publication, post-publication review involves evaluating and critiquing research after it is publicly available. This ongoing process allows for a more dynamic and inclusive assessment of scientific work, leveraging the global scientific community's collective expertise. Post-publication review can include formal commentary in academic journals, informal discussions on social media, and evaluations on dedicated platforms like Pub Peer [16–19].

Science news outlets and social media play a significant role in this evolving landscape. These platforms facilitate the rapid dissemination of research findings and serve as venues for public engagement and post-publication critique. Science journalists and communicators have the expertise to interpret and contextualize complex scientific information for a broader audience, potentially identifying and highlighting both strengths and weaknesses in newly published studies. Social media platforms, with their vast reach and interactive features, enable real-time discussions and debates among scientists, journalists, and the public, enhancing the transparency and accountability of the scientific process [16–21].

This article explores the significant role of post-publication review in maintaining research integrity. It examines how integrating science news outlets and social media into the post-publication review process can improve the quality and reliability of scientific research. By providing a platform for continuous scrutiny and discourse, these digital tools can help identify errors, validate findings, and highlight important research that might otherwise be overlooked. The article also addresses the challenges and potential pitfalls of relying on these platforms, including the risk of misinformation, the variability in the quality of commentary, and the need for effective moderation and fact-checking.

Ultimately, integrating post-publication review with traditional peer review represents a more holistic approach to maintaining research integrity. By embracing both pre- and post-publication scrutiny, the scientific community can better ensure that research findings are robust, reliable, and beneficial to society. This article aims to contribute to the ongoing dialogue about leveraging new technologies and platforms to enhance the integrity and impact of scientific research.

Case studies

Seven recent significant academic cases, three of which involve Indonesian authors (in chronological order), were considered and examined in this article.

Case 1 (2010)

In January 2024, the American Society for Microbiology (ASM) journals that published, in the 2010, seven studies from Institut Méditerranée Infection (IHU-MI), announced that it retracted all seven studies on the grounds of ethical issues in how the research was conducted. This stems from an article by Franck et al. which highlighted concerns with ethics approval practices of 456 papers published by the same institute [22]. Following this article, an independent investigation reached the conclusion that many of the studies (15 retracted so far) did not obtain proper ethics and/or legal approvals for the studies they conducted on human beings in a clinical setting. The overall investigation on this matter, summarized by O'Grady for Science [23], highlight severe failures of control processes and the work done by "dogged scientists" outside of the classical peer review system as well as their efforts and issues to try and get French institutions and publishers to react.

This case clearly highlights the specific issues that whistleblowers may face when reporting on potentially unethical or illegal practices within an institute. Nonetheless, it has sparked discussions on the importance of more transparency in ethical procedures and their approvals and perhaps the upload of documents supporting those.

Case 2 (2021)

A prominent paper on COVID-19 and the usefulness of lockdowns to reduce the number of cases was published by Savaris et al. in March 2021 in *Scientific Report* and retracted in December 2021 [24]. The article found, in essence, that lockdowns do not help reduce the number of COVID-19 cases. However, concerns raised on Pubpeer and through a preprint rapidly arose since the Savaris et al. study

was massively shared on social media. Concerns were raised by independent teams of researchers who found the article through social media and acted quickly to post their methodological concerns: Meyerowitz-Katz et al. failed to replicate the original results using a synthetic dataset [25], while Góes found issues with the model being used mathematically [26].

While the article was eventually retracted, its impact, for the nine months it was online for, was incredible, in particular considering how it may have impacted public health measures. In this case, the correction and retraction of the article is definitely too slow and may negatively impact citizens directly, echoing calls for a faster correction of the scientific literature [11].

Case 3 (2023)

More generally, on the use of language manipulation to avoid plagiarism detection, the recent discovery by Cabanac et al. of tortured phrases is important[27]. The authors discovered that known scientific expressions are being changed to nonsensical ones to avoid being found by plagiarism checks in the case of paper mills products. Similarly, papers and reviews generated by Chat GPT seem to be found because authors and reviewers have also copied and pasted the "regenerate response" button into their main text [28].

In both cases, these manipulations did not seem to be spotted by pre-publication peer review and it is a post-publication assessment that is bringing light onto them. The use of tortured phrases appears to be quite common and its detection is now automated thanks to the Problematic Paper Screener [29], which prompts post-publication reassessment of papers found to contain tortured phrases [30].

Case 4 (2024)

The article by Dr. Danny Hilman Natawidjaja and his team, published in *Archaeological Prospection* [31], claimed that the megalithic site of Gunung Padang in Indonesia was constructed as a pyramid around 25,000 years ago. This conclusion was based on ground-penetrating radar surveys and radiocarbon dating results. The study initially generated significant interest due to its implications for our understanding of ancient human civilizations.

However, the article was later retracted after experts in geophysics, archaeology, and radiocarbon dating raised substantial concerns. The primary issue identified was the misapplication of radiocarbon dating techniques. Specifically, the researchers dated soil samples that were not directly associated with any man-made artifacts or structural features, which led to an erroneous interpretation of the site's age. These soil samples provided dates that were significantly older than the actual construction of the megalithic structures, thus invalidating the claim of a 25,000-year-old pyramid.

This case underscores the importance of proper methodology in scientific research and the critical role of peer review and post-publication scrutiny in maintaining research integrity. By highlighting potential methodological flaws, the scientific community can correct the record and ensure that future research builds on accurate and reliable data.

Case 5 (2024)

A scientific study published in *Frontiers in Cell and Developmental Biology* claimed to use an artificial intelligence (AI) image generator to produce groundbreaking biological images [32]. However, the images were later revealed to be nonsensical and generated without any meaningful scientific basis. The publication faced widespread criticism from the scientific community, leading to its retraction.

Experts pointed out that the AI-generated images did not represent any real biological phenomena and that the study lacked the necessary rigor and validation. This incident underscores the critical importance of thorough peer review and the responsible application of AI technologies in scientific research. It highlights the potential risks of integrating advanced technologies without adequate oversight and emphasizes the need for stringent review processes to ensure the credibility and reliability of published research. By addressing these issues, the scientific community can safeguard against the dissemination of misleading or erroneous information and maintain the integrity of scientific literature.

Case 6 (2024)

Kumba Digdowiseiso, a young professor and Dean at Universitas Nasional Indonesia, faced serious allegations of academic misconduct [33]. The controversy arose when lecturers from Universiti Malaysia Terengganu discovered that their names had been listed as co-authors on several of Kumba's publications without their consent. This unauthorized inclusion of international academics as co-authors has raised significant concerns about academic integrity.

The issue has sparked widespread discussions in Indonesia about the ethical standards and practices

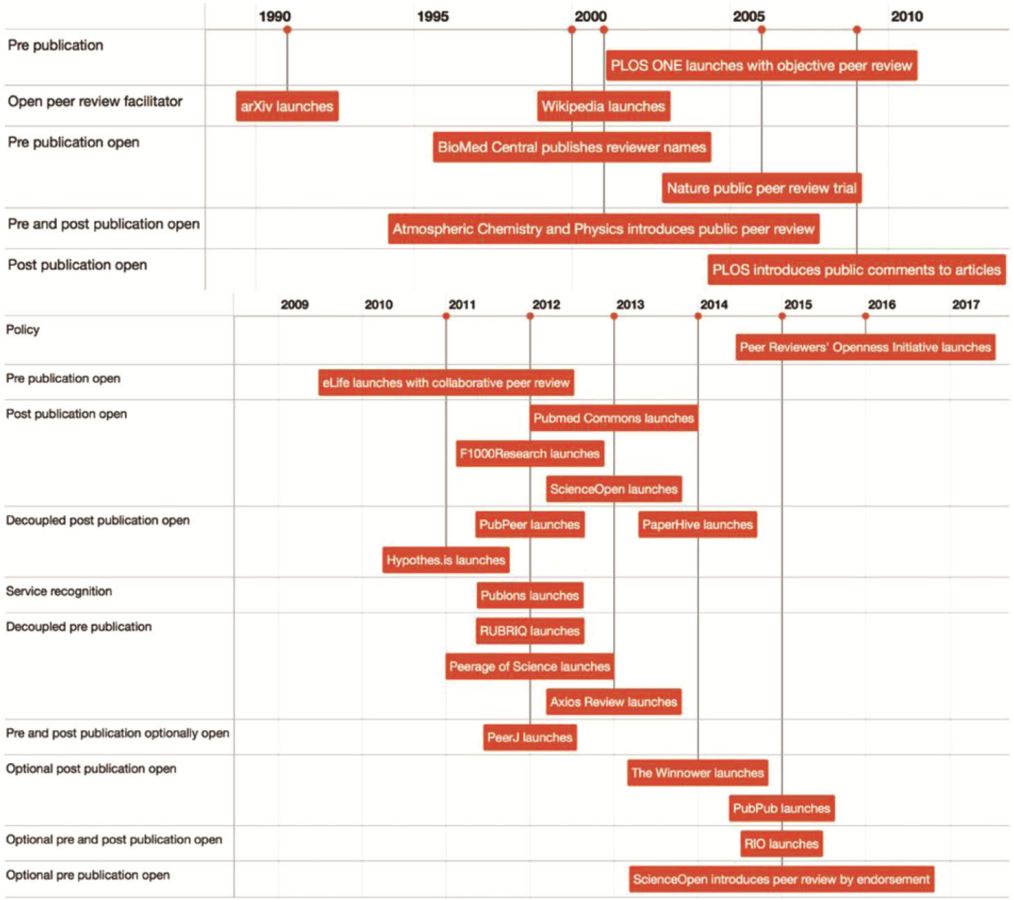

Fig. 1 — A brief timeline of the evolution of peer review: The revolution (Tennant et al., 2018).

within the academic community. It highlights the need for stricter enforcement of ethical guidelines and transparency in the publication process. The incident has also led to calls for comprehensive reforms in higher education policy to prevent such misconduct in the future and to protect academic freedom. Ensuring the integrity of academic work is crucial for maintaining the credibility and trustworthiness of scholarly research, and this case underscores the importance of vigilance and accountability in academic publishing.

Case 7 (2024)

The potential misuse of AI technology for plagiarism has become a growing concern in the academic community. A recent incident highlighted this issue when an author [34] [35] discovered that their original manuscript had been copied and subtly rephrased using AI, then subsequently published by another individual [36]. This blatant disregard for intellectual property rights not only disrespects the original author's work but also contributes nothing new to the body of knowledge.

This case underscores the dangers of using AI to facilitate academic dishonesty. Such practices dilute the value of genuine research and undermine the trust that is fundamental to scholarly communication. The incident has sparked discussions about the need for robust plagiarism detection tools and stricter enforcement of ethical standards in publishing. It also emphasizes the importance of educating researchers about the responsible use of AI and the significance of intellectual property rights. Ensuring the integrity of academic work is essential for maintaining the quality and credibility of scientific research, and this case highlights the need for vigilance and accountability in the era of advanced technologies.

Reflecting on Traditional Pre-Publication Review

While this article isn't intended to review the history of peer review, the following articles provide insight into the situation. Peer review has a rich history that dates back to the 17th century, when it originated with national academies in Europe, as has been presented beautifully as R-Shinyapps and

published in [37,38] (Figure 1). During this period, it evolved from informal discussions to more structured and organized evaluations. As we transitioned into the 19th century, the concept of peer review underwent further formalization and professionalization, fuelled by the rapid proliferation of scientific journals during this time.

Following World War II, peer review became a widespread practice in academia and publishing. Innovations such as open peer review and digital platforms have emerged in recent years to enhance transparency and efficiency. Even though peer review plays an essential role in ensuring the quality of research and also significantly influences academic prestige and career progression, it has been subject to criticism due to perceived biases and a lack of transparency. There is also a limited understanding of the responsibilities of editors and the biases of reviewers. To address these issues, it is suggested that there should be increased accountability, standardization of practices, and improved data infrastructure to support the study of peer review [38,39].

Peer review is crucial for research validation and career progression but faces challenges like biases and inefficiencies. Innovations have arisen to address these issues, but adoption is slow. The rise in publication volume has led to reviewer fatigue and uneven workload distribution globally. The traditional research moderation and quality control are evolving into a more collaborative and engaging system, allowing unrestricted content types and formats, and a semi-automated review matching system. Researchers' activities will be measured based on engagement quality, and identification will shift from closed to fully transparent systems tied to academic profiles. This new framework aligns with the 'open science' movement and encourages debates on peer review, pushing for a more rigorous scholarly evaluation method and exploration of the scholarly communication ecosystem [40–43].

The Role of Post-Publication Review

Challenging Science via Post-Publication Review

Each of the fore-mentioned cases was brought to light by an observant individual (in case number 4, it was one of the authors) who noticed the flaws and/or misconduct, and posted about them on social media. While the first case could be seen as an over-analysis of data, the remaining instances represented clear misconduct. Notably, in all these situations, the decision to retract was taken only after the posts had gained significant attention and gone viral on social media platforms.

These cases highlight the significant role of post-publication review in challenging science, as they were unveiled by observant individuals who posted about the flaws or misconduct on social media. Notably, retractions were decided only after these posts garnered significant attention on these platforms, demonstrating the power and importance of public scrutiny in maintaining research integrity.

This evidence suggests that the term "peer-review" should be broadened in terms of its timing and its reviewers:

1. With respect to the timing of the review process, it's important to note that scientific publications should not be exclusively dependent on the traditional method of pre-publication evaluation. This traditional approach has demonstrated its vulnerabilities over time, as it has been known to approve articles that are, upon further review, questionable in their validity or scientific integrity. Therefore, it is crucial to consider alternative or additional methods to ensure a more thorough and rigorous review process.
2. From a journal and scientific perspective, critical assessment of a piece of the literature in one's own article should be, de facto, considered as a form of peer-review. When citing articles, scientists often have to judge the quality and applicability of the findings. Their citations could therefore be considered as peer review of past work and help scientists, laypeople, and publishers better understand the value of a published piece. This would further highlight the limitation of considering "citations" as a metric of success. Not only could those be gamed and manipulated, but they are also, if used as a metric, hiding the value of the citation. In other words, a negative citation as a positive impact on one's career, which seems counterproductive.
3. From a reviewer's standpoint, assessments of an article should not be limited to two or three experts assigned by a journal. A more comprehensive peer review process would involve, for instance, statisticians, methodologists, general scientific experts, or practitioners with extensive experience. The medium for commentary should not be confined to academic journals (in form of commentary article), but should expand to various science news outlets like The Conversation, and various social media platforms, including YouTube, or general researchers can use specialized tools or platforms like: Hypothesis

(http://hypothes.is) to write comments or annotations directly on the web page.

4. In addition to their development, science news outlets and social media can play a critical role in reviewing preprints as part of pre-publication reviews. This occurs when a journal mandates public discussion of a manuscript. This concept has been popularized by community-led movements such as Prereview (https://prereview.org/) and Peer Community In (https://peercommunityin.org/).

While it's important to acknowledge that this particular method isn't universally applicable, and it's certainly true that not all research can be thoroughly examined in this manner, its value cannot be understated. It is, in fact, extremely useful in specific contexts and scenarios. This method is particularly valuable for uncovering clear errors or instances of unethical behavior. These could be subtle inconsistencies that might initially go unnoticed or more blatant transgressions that blatantly defy ethical standards. In either case, this method serves as a powerful tool in maintaining the integrity of research efforts.

Enhancing Scientific Understanding through Post-Publication Reviews

Post-publication reviews in the scientific community should serve as vital tools for deepening our comprehension of research outcomes. Facilitated by platforms such as social media and scientific news outlets, these reviews offer a space for further discussion, analysis, and exploration of the respective research article. This process fosters a more detailed and nuanced understanding of the research findings, surpassing the preliminary conclusions of the published article [44].

These discussions and debates naturally lead to fresh insights, new interpretations, and inspiration for new research. They highlight previously overlooked aspects of the study, and challenge researchers to view their work from different perspectives. This provides an invaluable source of inspiration for future studies by identifying gaps in existing research and suggesting potential avenues for further exploration [45].

Post-publication reviews hold substantial influence beyond the academic community. By making these discussions available to the public, they can improve scientific literacy among non-experts. However, a scientific article is less likely to gain as many readers as an engaging YouTube podcast would garner viewers. This exposure can foster a better appreciation for the scientific process, stimulate critical thinking, and promote informed decision-making.

University students and early career researchers could also practice their knowledge by reviewing published articles via journal clubs. They would have more opportunities to engage with the original authors when asking questions or clarifying unclear points. This practice not only enhances their critical thinking and analytical skills but also fosters a collaborative academic environment where knowledge is continuously refined and expanded.

By participating in the review process, these emerging scholars can contribute fresh perspectives and insights, potentially identifying overlooked aspects or suggesting new interpretations. Additionally, post-publication reviews not only benefit the scientific community but also enhance society's overall comprehension of science.

Despite its advantages, like the opposing pre-publication review, post-publication review also encounters challenges such as the need for efficient processes, ensuring review quality and relevance, and addressing scope and standards issues [46].

Expanding the Definition of "Peer-Review"

The term "peer-review" should be expanded to encompass various experts and platforms beyond traditional academic journals. This broader approach includes:

- **For independent researchers:** Encourage researchers outside the immediate field to review and critique studies. For example, consider the interdisciplinary efforts seen in the critique of the power pose study [47].
- **For science journalists:** Leveraging their investigative skills to uncover potential issues, as demonstrated by pieces on the flaws in the Surgisphere data [48].
- **For citizen scientists:** The involvement of informed laypersons is incredibly valuable as they can provide unique perspectives and pose relevant questions that may not be considered by professional scientists. This is demonstrated by the significant contributions of patient advocacy groups in critiquing medical research. These groups have been instrumental in highlighting overlooked areas of study, advocating for patient-centered approaches, and ensuring that research outcomes are more widely disseminated and understood by the general public [49].

- **For social media platforms:** Utilize the vast reach and immediacy of social media to facilitate in-depth discussions and reviews among a diverse audience. This is illustrated by the extensive public discourse on platforms such as X surrounding the retraction of various high-profile studies. Social media enables rapid dissemination of information and allows for real-time feedback and engagement from a global audience. Additionally, it provides a space for experts and laypersons alike to share insights, debate findings, and collectively enhance the quality and transparency of scientific research [50].

Science News Outlets and Social Media to Democratize Review Process

Science news outlets and social media platforms have democratized the review process by allowing a broader audience to scrutinize research findings. This expanded "peer-review" includes experts from various fields and laypersons who can contribute valuable insights. The retractions in the cases mentioned above occurred only after these broader public reviews gained traction, as shown by the following roles:

- **To invite evaluation from diverse expertise:** Involving a wider range of experts can identify issues that traditional peer reviewers might miss. For instance, the rapid critique of the Surgisphere studies [51,52], by epidemiologists, data scientists, and clinicians highlighted issues that were not caught in the initial review.
- **To increase transparency:** Public scrutiny ensures greater transparency and accountability in the research process. The open discussion of the STAP cell controversy on platforms like PubPeer and X (formerly Twitter) brought transparency to the retraction process [53]. In 2014, a study claiming the creation of pluripotent stem cells through a simple acid bath (STAP cells) was published in *Nature*. Initial peer review did not catch critical errors. However, after extensive scrutiny from the scientific community on PubPeer and social media, numerous inconsistencies and image manipulations were identified, leading to retraction of the articles and an investigation into research misconduct.
- **To detect errors faster:** The rapid dissemination of information on digital platforms can lead to quicker identification and correction of errors. This efficiency is particularly evident in how the scientific community can promptly address inaccuracies. For instance, the swift response to the flawed COVID-19 studies exemplifies this capability, where researchers and experts around the world were able to collaborate and rectify the mistakes in a timely manner. The process not only enhances the reliability of the information but also fosters a more transparent and accountable environment. An example of such a swift response can be seen in the rapid correction of some of the flawed COVID-19 studies [51].

Implications for the Scientific Community

It's crucial for researchers to understand that research integrity extends beyond journal-led pre-publication reviews. They should also (see Figure 2):

- **Engage in Post-Publication Reviews:** Actively participate in reviewing published research to identify and address errors or misconduct. This process is crucial for maintaining the integrity and reliability of scientific literature. Consistent engagement in post-publication reviews ensures that any discrepancies, mistakes, or unethical practices are promptly corrected. This is especially important in fields with rapid technological advances, such as AI and biotechnology, where the pace of innovation can lead to frequent updates and revisions in research findings.
- **Foster a Culture of Openness:** Encourage transparency and openness in the research process to build and maintain public trust in science. Researchers should promote practices that make their work more accessible and understandable to the public. Initiatives such as open data and open access can assist in achieving this aim by allowing anyone to review and replicate studies. Additionally, holding open forums and discussions about research processes and findings can further enhance public engagement and trust.
- **Leverage Digital Platforms:** Utilize social media and other digital platforms to disseminate findings and engage with a broader audience. By actively sharing research updates and insights on platforms like Twitter, LinkedIn, and Research Gate, scientists can reach individuals who might not traditionally engage with academic journals. Indonesian researchers can benefit from participating in global scientific discussions and critique, thus gaining diverse perspectives and potentially fostering international collaborations. Engaging with a wider audience through digital means also helps in raising

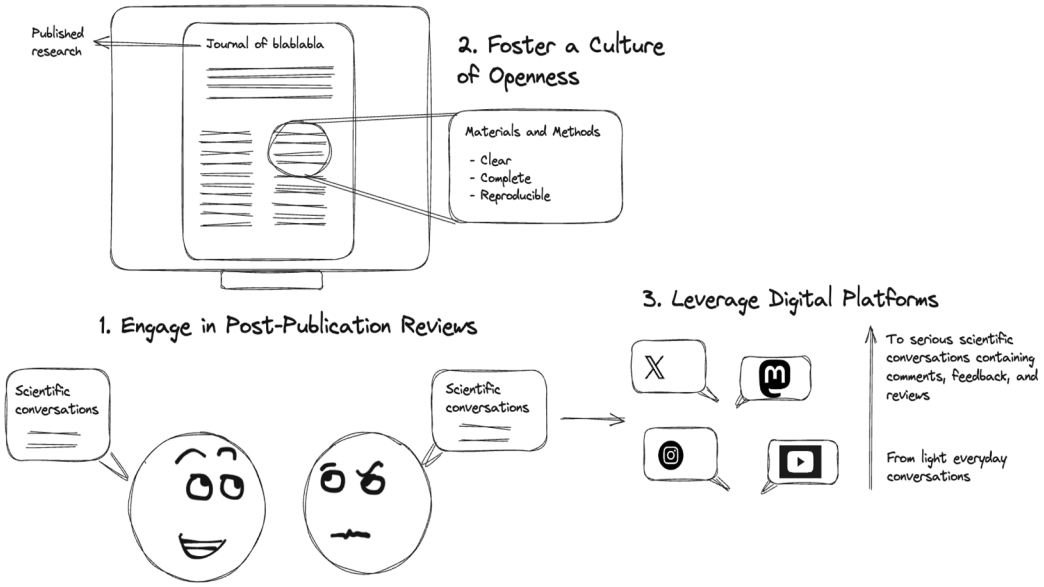

Fig. 2 — The Implications of implementing post-publication review for the scientific community.

awareness and appreciation of scientific work among the general public.

Conclusions

The incidents examined underscore the necessity of openness and vigilance in maintaining research integrity, especially in the era of artificial intelligence and digital platforms. Scientific misconduct, especially when it gains visibility through social media, can significantly impact the credibility and reputation of the academic and scientific community.

Researchers worldwide, and particularly in Indonesia, must understand the importance of maintaining research integrity, recognizing that this responsibility extends beyond traditional pre-publication reviews.

As we move forward, it is essential to emphasize the role of post-publication reviews in identifying potential mistakes or issues that might have been overlooked. Researchers should continue to apply their scientific knowledge and critical thinking skills to review studies even after they have been published. This ongoing scrutiny is a crucial part of maintaining and enhancing the overall quality of scientific research.

By expanding the definition of peer review and embracing broader public scrutiny, the scientific community can better safeguard the quality and credibility of research. Researchers must recognize the value of post-publication review and contribute to a more inclusive and transparent scientific process.

The digital era calls for a new approach to scientific research and review. Open discussions, enabled by social media and other platforms, are key to addressing and learning from instances of scientific misconduct. By fostering a culture of continuous review and learning, we can improve the credibility, accuracy, and overall quality of scientific research.

Data Availability

No data is used in this study.

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Contributions

DEI conceived the presented idea. All authors discussed and wrote the manuscript.

Conflicts of interest

The authors declare no conflicts of interest relevant to the content of this manuscript.

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