On the concept and connotation of science popularization ethics

Xuan Liu, Fujun Ren and Haitao Ge
National Academy of Innovation Strategy, China

Abstract
Some ethical norms should be followed in science popularization. Such norms are related to, but also different from, the ethics of science and technology, communication and education. This paper explores the definition of science popularization ethics in Chinese and foreign literature and reflects on the concept and connotation of the ethical norms that should be followed in science popularization in China. It suggests that the ethical norms that people should follow in science popularization should be defined as ‘science popularization ethics’ in China.

Keywords
Science communication, science popularization, science popularization ethics

Science popularization is an important part of socialist material and spiritual civilization. The development of science popularization is a long-term task in China and has a long-term impact on improving the scientific literacy of the population, promoting the development of science and technology and constructing a cultural ecosystem. Inappropriate science popularization will hinder the dissemination of the scientific spirit in society and weaken scientific culture. Therefore, clear ethical boundaries must be established to set the norms for the content, form and goals of science popularization.

Given the distinctive features of science popularization, there are certain connections and crossovers between science popularization ethics and ethical norms in other similar fields, so it is necessary to identify and distinguish science popularization ethics from those alternatives. In addition, as there are several ways to understand this topic in China and abroad – such as science popularization, science communication and public understanding of science – it is important to define and choose a concept that is suitable for the Chinese context and appropriate for describing the ethical norms of science popularization in China.

I. Science popularization ethics compared with the ethics of science and technology, communication and education

There are connections and also differences between science popularization ethics and the ethical norms...
in other fields, such as science and technology ethics, communication ethics and education ethics.

1.1. Science and technology ethics and science popularization ethics: Value orientations

Science and technology ethics is an ethical system that addresses science and technology’s relationship with people and nature. It concerns the responsible and positive development of science and technology. Advances in science and technology affect all aspects of human life. Due to significant emerging issues, the tension between science and technology development and ethics is increasingly evident. In this context, science and technology ethics has placed more emphasis on basic principles, such as human well-being, respect for people, justice and responsibility (Lei, 2020).

Science and technology are the content of science popularization, which makes it different from other communication processes. The value orientation of science and technology ethics determines the value orientation of science popularization content. As important themes of science and technology ethics, the principles of ‘being responsible’ and ‘working towards positive results’ are also the spiritual core of science popularization ethics. For example, respect for human life and dignity, respect for academic freedom and independence, avoidance of prejudice and discrimination, protection of the right to information and openness and transparency are important components of science and technology ethics, and they are also the values advocated by science popularization ethics.

1.2. Communication ethics and science popularization ethics: Code of communication

Communication ethics consists of a set of norms that should be followed by all communication media and communication actors, including norms regarding the values, content and activities of communication (Zhou, 2018). In the new-media environment, it has gained great relevance. Communication ethics includes the norms of behaviour for players in both professional media and non-traditional media, and even involves expectations for the quality of the audience. Communication ethics is reflected in the code of media ethics, the code of journalism, the code of self-media communication and other specific acts of communication, such as the regulations on the ‘5Ws’ (who, says what, in which channel, to whom and with what effect), and the bottom-line thinking that draws the boundaries of what should be advocated, permitted or prohibited.

Science popularization is a process that communicates scientific and technological knowledge and information, and thus it must also observe the common code of conduct of communication ethics and follow the basic principles of communication ethics, such as the requirements of laws and regulations, of moral ethics and of information authenticity. It is also important to uphold the basic duties of communication ethics in science popularization, such as shouldering the responsibilities of confirming or disproving information and educating the public about communication ethics. Communication ethics is reflected in the code of conduct of science popularization through providing guidance for communication behaviour.

1.3. Education ethics and science popularization ethics: Realization of the goal

Education ethics is an ethical system concerning moral relationships in the entire education process, including both formal and informal education (Cui and Zhang, 2016; Wang and Wang, 2014). As one of the applied ethical systems, education ethics is divided into different types of theories depending on the basic ethical theories on which it is built. However, all those types serve the purpose of education.

As a communication process, science popularization undertakes the social function of education and cultural inheritance, so the ethical norms of science popularization should be consistent with the ethical norms of education in terms of goal orientation. The goal of science popularization is to improve the scientific and cultural quality of citizens and promote economic development and social progress. In short,
the ethics of science popularization is guided by education ethics in terms of its ultimate purpose and desired influence. Education ethics is reflected in the goal orientation of science popularization ethics through its influence on those who are educated.

2. Defining science popularization ethics: ‘Science popularization ethics’ or ‘science communication ethics’?

Due to the different contexts in China and abroad, Western scholars normally use the concept ‘science communication’, while Chinese scholars tend to use the term ‘science popularization’. Yet, in essence, these two concepts are the same. In academic discussions, the terms ‘science popularization’ and ‘science communication’ are used and interpreted differently from different perspectives. Whether the ethical norms observed in the popularization and dissemination of science and technology should be defined as ‘science popularization ethics’ or ‘science communication ethics’ needs to be clarified. In addition, the connotation of science popularization ethics in the context of modern-day China should also be clearly defined.

2.1. Discerning the Chinese and foreign concepts of science popularization ethics

To have a clearer understanding of the scope of ethics discussed in the popularization and dissemination of science and technology, we summarized typical definitions of science popularization ethics in Chinese and foreign literature. Table 1 lists selected definitions in foreign studies.

Researchers focus on different points when they discuss the concept of science popularization ethics. Medvecky and Leach (2017, 2019), for example, focus on the place and boundaries of ethics in science communication and the four elements of science communication ethics, while Priest et al. (2017) study the activities of multiple groups and the importance of ensuring morality and improving the effectiveness of science popularization. As for other authors, some have explored the ethics of communication, believing that all stakeholders should shoulder their respective responsibilities in the dissemination of information to ensure the truthfulness and appropriateness of science popularization in a vast ocean of complicated information (Nerlich et al., 2009). Some believe that the authenticity and effectiveness of science communication should be maintained on issues vital to the development of human society (Clarke, 2009; Suhr, 2009), and that scientists should undertake social responsibilities in the communication and education of science issues (Reydon et al., 2012). Some authors, on the other hand, have taken a different approach and reflected on the traditional concept of science communication ethics, arguing that it is not equivalent to sincerity, openness and honesty and that overemphasis on these principles may cause certain social risks (John, 2017).

As part of our comparative studies, we also selected a few Chinese research papers on the concept of science popularization ethics (see Chen, 2016; Luo and Yang, 2018; Wang et al., 2007) (Table 2).

A comparison of Tables 1 and 2 shows that the focus of science popularization ethics varies at home and abroad, and different scholars have taken different approaches to discussing this concept. However, there are also commonalities in the definitions of science popularization ethics given by Chinese and foreign scholars. Their definitions of science popularization ethics involve different groups of people, such as science communicators, scientific researchers and the general public. The moral features of science popularization ethics differ from those of scientific research activities, and the ethical features of communication ethics are also part of it; its purpose is to coordinate the relationship between science and society and promote the sound development of science and science communication.

In the Chinese context, it is more appropriate to use the term ‘science popularization ethics’ rather than ‘science communication ethics’ when describing the ethical norms that should be observed in the dissemination of scientific and technological knowledge to the public. The reasons are as follows.

First, considering the practical need to promote the research and practice of science and technology communication and popularization, ‘science
‘Science popularization’ is a more appropriate expression. Therefore, ‘science popularization ethics’ is the correct term to use in describing the ethical norms under this concept.

Second, from the perspective of the history of science popularization in China, ‘science popularization’ can be seen as the sum of all related activities, including the dissemination and popularization of science and technology, public understanding of science and the promotion of public engagement in science. Using the term ‘science popularization ethics’ to refer to the ethical norms of the whole undertaking can better cover all related fields.

Third, the term ‘science popularization ethics’ can be more accurately understood. If the term ‘science communication ethics’ is used, it is easy to

### Table 1. Definitions of science popularization ethics in English-language literature.

| No. | Authors                     | Titles of articles/books                                      | Definitions                                                                                                                                 |
|-----|-----------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Medvecky and Leach (2017)   | The ethics of science communication                           | Perspectives on a range of issues about what makes science communication a good and ethical thing to do, and whether there are potential boundaries of ‘goodness’ in science communication. |
| 2   | Medvecky and Leach (2019)   | An Ethic of Science Communication                             | A series of questions to make science communication ethical, including four key elements: when (when to do or not to do); how (how to do); who (who should be involved) and why (why this should be done). |
| 3   | Priest et al. (2017)        | Ethics and Practice in Science Communication                  | An ethical code that involves researchers, science communicators and the general public to ensure the morality of science popularization activities and maximize the positive effect of science popularization. |
| 4   | Nerlich et al. (2009)       | Communicating Biological Sciences: Ethical and Metaphorical Dimensions | The responsibilities that scientific researchers, media workers and the general public must undertake to ensure the truthfulness and morality of the communication of scientific research information, promote public understanding of science and avoid ethical controversies. |
| 5   | Clarke (2009)               | Ethics of science communication on the web                    | How scientists can appropriately and truthfully communicate the results of scientific research and the latest news of scientific discoveries to the public in the confusing and even dangerous internet environment today. |
| 6   | John (2017)                 | Epistemic trust and the ethics of science communication: Against transparency, openness, sincerity and honesty | Opposition to the traditional virtues observed by scientists in communication, such as sincerity, openness, honesty and transparency; ethical norms of science communication should reject these obligations because this traditional view of science communication ethics is dangerous. |
| 7   | Suhr (2009)                 | Science communication in a changing world                     | How to effectively and accurately communicate science on issues such as climate change and ocean health to the public, which has limited knowledge and sources of information in a society in which scientific topics have become part of people’s everyday lives and have even penetrated into the political sphere and dominated news headlines. |
| 8   | Reydon et al. (2012)        | Genetics, genomics and society: The responsibilities of scientists for science communication and education | The social responsibilities of scientists in the discussion of scientific issues, the dissemination of scientific knowledge and news and science and technology education. |
mistake it as a branch of communication ethics, which does not properly reflect the uniqueness of this ethical field.

2.2. The connotation of science popularization ethics in the modern-day context

Based on the above analysis, this paper proposes that science popularization ethics should be the ethical norms to be observed by science and technology journalists, editors of science and technology journals, workers in science popularization venues, science popularization creators, scientists, science popularization enterprises and other people who are committed to science popularization. Those norms will define the ethical boundaries of the value orientation of science popularization content, the code of conduct of science popularization activities and the purpose and impact of science popularization. Science popularization is a broad concept. Considering its different aspects, it encompasses the ethical norms of science and technology museums, of science popularization creation and of science and technology reporting, among others. ‘Science popularization ethics’ is a general term for all the ethical norms to be followed in various types of science popularization activities.

Science popularization is part and parcel of modern science. Contemporary science popularization normally includes three aspects: first, cultivating the ability to understand science and culture; second, cultivating the ability to understand the scientific knowledge system; and third, understanding the application of scientific and technological knowledge (Li, 2004). Therefore, the actors of science popularization ethics include not only science popularization workers but also scientific researchers, social media, science and technology managers and decision-makers and members of the public (Xue and Guo, 2015). The scope of science popularization ethics should include the content, form, purpose and other elements of science popularization and cover the whole process. The purpose of science popularization ethics is to improve the scientific literacy of the population and promote economic development and social progress.

As an important component of science popularization, science popularization ethics has played a key role in shaping values, regulating behaviours.

| No. | Authors          | Titles of articles                                      | Definitions                                                                                                                                 |
|-----|------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Wang et al.      | A tentative study on two issues of science communication ethics | Science communication ethics are the ethics guiding the process of science and technology communication, and the ethics regulating the dissemination of scientific and technological knowledge. |
| 2   | Chen (2016)      | The ethical responsibilities of the scientific community in science communication | The scientific community undertakes the following ethical responsibilities in science communication: to ensure the truthfulness and transparency of the information of scientific results; to objectively and impartially communicate the values and social impact of scientific results; to respect the public's ability to understand science and present scientific knowledge in a less complicated way. |
| 3   | Luo and Yang     | A tentative analysis of the ethical features of science communication | The ethical features of science communication include: (1) the communicators and audience have their own moral judgment; (2) changes in the science communication model are subject to the influence of social morality; (3) the moral attribute of scientific knowledge itself. In addition to scientific and truthful content and standard procedures, scientific communication should also be conducted with fairness, justification and a critical attitude. |
and setting goals. With the advance of science and technology, new methods of information dissemination and new forms of social organization keep emerging; this also poses new challenges for effective communication and popularization of science and technology and for innovation in the model of science and technology communication and popularization.

3. Conclusion

General Secretary Xi Jinping has pointed out that science and technology innovation and science popularization are the two wings of innovative development. Science popularization should be given the same importance as science and technology innovation. Due to the rapid progress of science and technology and its growing importance to China’s national development, science and technology ethics has attracted greater attention. During the ninth meeting of the Central Committee for Deepening Overall Reform on 24 July 2019, the Proposal for the Establishment of the National Committee of Science and Technology Ethics was adopted, paving the way for the development of a comprehensive and systematic governance system of science and technology ethics in China. As the other half of the two wings, science popularization also needs the constraint and guidance of ethics. It needs to be further studied from a theoretical point of view to deepen understanding and explore a governance system of science popularization ethics that is suitable to China’s conditions.

The concept of science popularization ethics is both related to and different from the concepts of the ethics of science and technology, communication and education. The content and value orientation of science popularization must follow the value orientation of science and technology ethics, and the communication behaviours in science popularization should follow the norms of communication ethics. In addition, the ultimate purpose and desired impact of science popularization should follow the goals of education ethics.

The concepts related to science popularization ethics have been widely discussed both in China and abroad. In the Chinese context, it is more appropriate to use the term ‘science popularization ethics’ to define the ethical norms related to science popularization. Given the changing domestic and international situations, rapid advances in science and technology and the rise of new forms of social organization and innovation, science popularization ethics has a big role to play in raising the scientific literacy of the population, promoting the public understanding of science and cultivating scientific and innovation culture.

Acknowledgements

We would like to thank Dr. Cheng Donghong, Professor Liu Bing, Professor Jin Jianbin, Research Fellow Li Zhenzhen, Professor Tang Shukun, Professor Zhao Yandong, Research Fellow Zhao Yang and Dr. Li Xiang for their contributions to this paper.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

Chen FJ (2016) The ethical responsibilities of the scientific community in science communication. Science and Technology Management Research 36(22): 261–266 (in Chinese).
Clarke M (2009) Ethics of science communication on the web. Ethics in Science and Environmental Politics 9(1): 9–12.
Cui JY and Zhang J (2016) The conceptual analysis of non-formal and non-academic education in China and other countries. Journal of Higher Education 2(20): 1–2 (in Chinese).
John S (2017) Epistemic trust and the ethics of science communication: Against transparency, openness, sincerity and honesty. Social Epistemology 32(2): 75–87.
Lei RP (2020) The basic governance principles of science and technology ethics. National Governance Weekly (3): 44–48 (in Chinese).
Li YW (2004) On science popularization, science and scientific literacy. Journal of Tsinghua University
Luo HX and Yang L (2018) A tentative analysis of the ethical features of science communication. *Journal of Architectural Education in Institutions of Higher Learning* 27(3): 139–143 (in Chinese).

Medvecky F and Leach J (2017) The ethics of science communication. *Journal of Science Communication* 16(4): 1–5.

Medvecky F and Leach J (2019) *An Ethic of Science Communication*. Cham: Palgrave Pivot.

Nerlich B, Elliott R and Larson B (2009) *Communicating Biological Sciences: Ethical and Metaphorical Dimensions*. London: Routledge.

Priest S, Goodwin J and Dahlstrom MF (2017) *Ethics and Practice in Science Communication*. Chicago, IL: University of Chicago Press.

Reydon T, Kampourakis K and Patrinos G (2012) Genetics, genomics and society: The responsibilities of scientists for science communication and education. *Personalized Medicine* 9(6): 633–643.

Suhr S (2009) Science communication in a changing world. *Ethics in Science and Environmental Politics* 9: 1–4.

Wang BL and Wang M (2014) Educational ethics: A new issue and new field. *Educational Ethics Research* (1): 123–132 (in Chinese).

Wang HX, Qian WL and Li DS (2007) A tentative study on two issues of science communication ethics. *Science & Technology Association Forum* (7): 62–63 (in Chinese).

Xue DH and Guo GY (2015) The absence of responsibility ethics and control in science communication. *Science and Technology Management Research* 35(2): 242–245 (in Chinese).

Zhou HH (2018) On the construction of the connotation of communication ethics. *Theory Monthly* (4): 157–161 (in Chinese).

**Author biographies**

Xuan Liu, PhD, is an associate professor at the National Academy of Innovation Strategy, China. Her research areas include scientific culture, the academic environment and innovation ecology.

Fujun Ren is a professor, a PhD supervisor and an expert enjoying the State Council Special Allowance. He is the general director of the National Academy of Innovation Strategy and the chief editor of *Modern Science and Cultures of Science*. His areas of expertise include science popularization, innovative culture, scientific culture and scientific policy.

Haitao Ge, PhD, is a research intern at the National Academy of Innovation Strategy, China. His research interests include the history of science and technology, science and technology ethics and science popularization ethics.