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Original Article

Defining the Scientist: A Consensus-Based Approach

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Abstract

Introduction

The term "scientist" lacks a universally accepted definition, reflecting the evolving, interdisciplinary nature of scientific work and posing challenges for recognition, communication, and policy. This study aims to develop consensus-based definitions of the term "scientist" by engaging experienced scholars across diverse fields.

Methods

This study involved 156 scholars, each with at least 1,000 citations, recruited via convenience sampling. Fourteen scientist definitions, derived from literature and expert input, were assessed using a nine-point Likert scale via a structured google forms survey. The sample size was calculated using G*power (effect size = 0.5, power = 0.95), requiring at least 80 participants. Content Validity Index (CVI) was used for analysis. Definitions scoring ≥0.78 were accepted and included for final analysis, 0.70–0.78 were revised and re-evaluated, and <0.70 were excluded. Participation was voluntary and anonymous, ensuring ethical compliance and confidentiality.

Results

Of the 14 proposed definitions, six (42.9%) were excluded (CVI < 0.70), seven (50.0%) were accepted (CVI > 0.78), and one (7.1%) underwent revision (CVI 0.70–0.78). The highest-rated definitions were refined into two consensus-based versions: a short definition ("A scientist is a person who conducts research") and a detailed one emphasizing hypothesis formulation and knowledge dissemination. Final validation yielded CVIs of 0.82 and 0.84, respectively, confirming strong expert agreement on both definitions.

Conclusion

This study developed two validated definitions of "scientist" emphasizing systematic research and knowledge dissemination. These definitions clarify the concept of scientific identity, providing a flexible yet rigorous framework applicable across academic, interdisciplinary, and policy-making contexts.

1. Introduction

The term "scientist" has undergone significant transformation since its inception, reflecting the dynamic nature of scientific inquiry and the evolving landscape of knowledge. This lack of clarity stems from the diverse roles and contributions of individuals in scientific fields, the evolving nature of research, and the interdisciplinary scope of modern science. Historically, figures such as Galileo and Newton were regarded as natural philosophers, a reflection of an earlier framework for knowledge production that has evolved alongside modern scientific advancements. Before twentieth century, the term "scientist" was commonly referred to as a "man of science," "natural philosopher," or by various other designations [1,2].

In contemporary contexts, scientists operate across a broad spectrum of fields, including medicine, biology, chemistry, physics, and social sciences, each employing methodologies tailored to their specific inquiries. For instance, biologists may design experiments to test hypotheses about living organisms, while social scientists might use qualitative methods to explore human behavior [3]. The Science Council defines a scientist as an individual who methodically collects and applies research and evidence to develop hypotheses, performs experiments, and shares results to advance knowledge in their field [4]. While National Cancer Institute defines a scientist as an individual with a background in science, particularly someone actively engaged in a specific area of research [5]. This diversity in practices underscores the challenge of defining "scientist" in a way that captures the breadth of their contributions.

The plurality of definitions extends to global organizations and frameworks. For example, the United Nations Educational, Scientific, and Cultural Organization highlights the critical role of scientists in addressing global challenges and promoting sustainable development. This definition broadens the scope to include individuals working in multidisciplinary teams or applying scientific knowledge to public policy and societal issues. Similarly, some academic discussions focus on the characteristics of a scientist, such as curiosity, skepticism, and a commitment to evidence-based conclusions, rather than formal qualifications or job titles [6].

Unlike well-defined professions such as medicine or engineering, where specific educational pathways and professional titles (e.g., "doctor" or "engineer") confer clear identities, the term "scientist" lacks a universally recognized credentialing system. This absence can lead to underrepresentation or misrepresentation of scientific expertise, especially in interdisciplinary and collaborative contexts [7]. For example, the growing integration of data science in biology or physics illustrates the importance of understanding who qualifies as a scientist to ensure effective communication and collaboration among stakeholders. The absence of a standardized definition poses practical challenges for scientific communication, policymaking, and inclusivity. This study aims to address this gap by engaging scholars across disciplines to develop a consensus-based definition of "scientist." By recognizing the diverse and interdisciplinary contributions of scientists, such a definition could enhance collaboration, improve public understanding, and inform policies that support the scientific community.

2. Methods

2.1. Study design and participants

A total of 156 scholars (out of 300 invited) participated in this study. Eligibility was determined based on the scholars' substantial academic expertise, evidenced by the achievement of at least 1,000 citations within their respective fields. This criterion ensured that participants had significant research experience and were highly qualified to contribute to the formulation of a consensus-based definition of "scientist." Participants were recruited through a convenience sampling method, and data were collected via a structured survey administered through google forms. While convenience sampling was used due to the accessibility of high-citation scholars, efforts were made to ensure disciplinary diversity to mitigate potential bias. Personalized invitations were sent via email to each scholar to facilitate their inclusion in the study.

2.2. Sample size determination

The sample size was determined using G*power statistical software (version 3.1.9.7), employing a two-tailed goodness of fit test with an effect size of 0.5, an alpha error probability of 0.05, and a statistical power of 0.95. According to the calculations, a minimum of 80 participants were required to achieve statistically valid results. Consequently, 156 scholars were recruited to participate in the study, ensuring robust representation and adequate statistical power.

2.3. Data collection

Fourteen proposed definitions of "scientist," curated from existing literature and expert contributions, were presented to the enrolled scholars for evaluation (Table 1). Each definition included a Likert scale with nine response options, ranging from "strongly agree" to "strongly disagree." Responses were systematically recorded and compiled in an Excel sheet for subsequent analysis. This process facilitated the systematic capture of scholarly consensus on each definition.

2.4. Data analysis

The Content Validity Index (CVI) was employed to assess the relevance and agreement of the definitions. Definitions with a CVI below 0.70 were excluded, as they failed to meet the minimum threshold for consensus. Definitions with a CVI between 0.70 and 0.78 underwent a second round of evaluation, with refined wording sent back to the same scholars for further review. Definitions achieving a CVI above 0.78 were deemed sufficiently valid for inclusion in the final analysis [8]. These definitions formed the foundation for the development of a unified, consensus-based definition of "scientist."

2.5. Ethical considerations

Participation in the study was entirely voluntary, and all responses were anonymized to preserve participant confidentiality.

3. Results

Initially, out of the 14 proposed definitions of the term "scientist," six (42.9%) received a CVI score below the threshold of 0.70 and were consequently excluded from further consideration. In contrast, seven definitions (50.0%) demonstrated strong content validity with CVI scores equal to or exceeding 0.78 and were therefore retained for subsequent synthesis and analysis. Only one definition (7.1%) fell within the intermediate range, with a CVI between 0.70 and 0.78 (Table 2).

Through a rigorous, iterative evaluation process involving expert feedback, the definitions with the highest CVI scores (those above 0.78) were integrated and refined into two distinct, consensus-based definitions of the term "scientist." The first was a concise definition: “A scientist is a person who conducts research.” The second was a more comprehensive and elaborated definition: “A scientist is someone who systematically conducts or gathers and uses research to formulate hypotheses and test them, in order to gain and disseminate understanding and knowledge.”

These two final definitions were subsequently circulated among the panel of scholars for a second round of evaluation, during which they were asked to rate the definitions for content validity. The short definition received a CVI of 0.82, while the more detailed definition attained a slightly higher CVI of 0.84, reflecting strong agreement among the experts. Although no

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Table 1. Respondent Agreement on Various 'Scientist' Definitions.

Proposed Definitions	Options								
A person studying or has expert knowledge of one or more natural or physical sciences. (Oxford Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
An expert who studies or works in one of the sciences. (Cambridge Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A person learned in science and especially natural science. (Merriam-Webster Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A scientist is someone who systematically gathers and uses research and evidence, to make hypotheses and test them, to gain and share understanding and knowledge. (Science Council)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A scientist is someone who has studied science and whose job is to teach or do research in science. (Collins Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
An expert in science, especially one of the physical or natural sciences. (Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A scientist is a person with some kind of knowledge or expertise in any of the sciences. (Vocabulary dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A person who is trained in a science and whose job involves doing scientific research or solving scientific problems. (Britannica Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A person who has studied science, especially one who is active in a particular field of investigation. (National Cancer Institute)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
Someone who works or is trained in science. (Longman Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A person whose profession is investigating in one of the natural sciences. (Your Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A person who is engaged in and has expert knowledge of a science. (Free Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
Someone whose job or education is about science. (LanGeek Dictionary)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree
A scientist is a person who researches to advance knowledge in an area of the natural sciences. (Wikipedia)	Strongly Disagree	Moderately Disagree	Disagree	Slightly Disagree	Undecided	Slightly Agree	Agree	Moderately Agree	Strongly Agree

Table 2. Comparison of Agreement and CVI Across Proposed Definitions of 'Scientist'.

Proposed Definition	Agree	Disagree	Undecided	CVI	Status
Science Council Definition	146	8	2	0.94	Accepted
Britannica Dictionary Definition	136	16	4	0.87	Accepted
Cambridge Dictionary	130	20	6	0.83	Accepted
Wikipedia Definition	125	27	4	0.80	Accepted
Free Dictionary Definition	124	25	7	0.79	Accepted
National Cancer Institute Definition	124	25	7	0.79	Accepted
Collins Dictionary Definition	122	31	3	0.78	Accepted
Oxford Dictionary Definition	120	31	5	0.77	Revised
Longman Dictionary Definition	104	42	10	0.67	Excluded
Your Dictionary Definition	103	48	5	0.66	Excluded
Dictionary (generic) Definition	91	52	13	0.58	Excluded
Vocabulary dictionary Definition	88	58	10	0.56	Excluded
Merriam-Webster Dictionary Definition	81	64	11	0.52	Excluded
LanGeek Dictionary Definition	79	67	10	0.51	Excluded

CVI: Content Validity Index, CVI Thresholds: Accepted: ≥ 0.78, Revised: 0.70–0.78, Excluded: < 0.70

additional formal qualitative feedback was solicited at this stage; minor wording adjustments were made based on informal suggestions received during this validation round.

4. Discussion

The role of a scientist extends far beyond the stereotypical image of an individual in a white coat working exclusively in a laboratory setting. Careers grounded in scientific expertise are remarkably diverse, encompassing domains such as research, education, industry, and regulatory affairs. The Science Council categorizes scientists into 10 different types, highlighting the diversity of scientific roles beyond the stereotypical lab-based researcher. It includes types such as experimental scientists, theoretical scientists, data scientists, and more, reflecting the broad spectrum of scientific work today [9]. Definitions of the term “scientist” vary, yet they generally converge on the principles of systematic inquiry, evidence-based investigation, and the pursuit of knowledge across various disciplines. For instance, the Oxford Advanced Learner’s Dictionary and the Britannica Dictionary emphasize formal training and research functions, typically within the natural sciences such as biology, chemistry, or physics [10,11]. In contrast, contemporary perspectives, such as those discussed by the American Association for the Advancement of Science in 2024, recognize a broader spectrum of scientific engagement, encompassing both professional researchers and individuals committed to understanding the world through observation, experimentation, and analysis [12]. In light of this diversity, the present study aimed to clarify and formalize the definition of a "scientist" through expert consensus. Two definitions were developed: a concise definition “A scientist is a person who conducts research”, and a comprehensive definition “A scientist is someone who systematically conducts or gathers and uses research to formulate hypotheses and test them, in order to gain and disseminate understanding and knowledge.” These definitions encapsulate the core activities and guiding principles of scientific inquiry, emphasizing both methodological rigor and the essential role of knowledge dissemination across disciplines.

A key finding of this study lies in its recognition of the evolving tension between disciplinary specialization and the increasing importance of interdisciplinary collaboration. As highlighted in contemporary analyses of interdisciplinary research and development, scientists now frequently operate at the intersection of multiple fields, such as nanomedicine, where the diversity and dissimilarity of collaborators’ knowledge can significantly enhance research productivity [13]. The concise definition, "A scientist is a person who conducts research" captures this shift by avoiding constraints tied to specific disciplinary boundaries. In contrast, the more detailed definition explicitly incorporates the systematic formulation and testing of hypotheses, along with the dissemination of knowledge, thereby reinforcing the structured and communicative nature of scientific inquiry. These elements align closely with UNESCO’s 2019 call for stronger science-society engagement and underscore the ethical responsibilities inherent in modern scientific practice [14].

The study’s findings also contribute to ongoing debates surrounding professional identity within the scientific community. In contrast to regulated professions such as medicine, the absence of a universal credentialing system for scientists complicates formal recognition, particularly in non-academic and interdisciplinary contexts. This ambiguity is reflected in the National Cancer Institute’s pragmatic definition of a scientist, which emphasizes active participation in research rather than reliance on formal titles or qualifications [15]. By anchoring the term “scientist” in core research activities rather than occupational labels, the consensus-based definitions proposed in this study offer a more inclusive framework. This

approach accommodates emerging roles in fields such as data science and applied research, thereby addressing the risk of under recognition in collaborative and cross-sector environments.

The dual definitions, concise and comprehensive, offer flexibility for different contexts, a strategy aligned with the Science Council's emphasis on methodological diversity [4]. The detailed definition's focus on systematic inquiry and dissemination aligns with studies of interdisciplinary science, where "impassioned commitment" to shared goals drives innovation [13]. Simultaneously, the availability of a concise definition enhances clarity in public discourse and science communication, while the more detailed version provides the specificity necessary for institutional contexts such as policy development, research funding, and professional accreditation.

Notably, the study's findings also challenge enduring stereotypes of the "lone genius" scientist by highlighting the inherently collaborative and iterative nature of scientific practice. Contemporary frameworks, such as those emerging from computational biology, suggest that scientific identity is increasingly dynamic, pluralistic, and shaped by collective knowledge production [16]. The process undertaken in this study, involving successive refinement and expert validation of definitions, closely mirrors the recursive logic of the scientific method itself. This methodological alignment is particularly salient in fields like nutritional epidemiology, where the replication of findings remains a persistent challenge and iterative inquiry is essential for refining evidence [17].

Despite the methodological rigor and expert involvement, several limitations should be acknowledged. First, the study employed convenience sampling, which may introduce selection bias and limit the generalizability of the findings. Although participants were selected based on a minimum citation threshold to ensure scholarly expertise, this criterion may have inadvertently excluded emerging researchers or experts with significant practical contributions who have not yet achieved high citation metrics. Second, the use of an online survey format may have constrained participant engagement, as scholars with limited availability or preference for alternative formats may have been underrepresented. Additionally, response bias cannot be ruled out, as those with a particular interest in the topic or in defining scientific identity may have been more inclined to participate, potentially skewing the results. Future refinements of the definition should also consider voices from non-academic scientific contexts including those in industry, policy, and community-based science who are increasingly central to addressing complex global challenges.

5. Conclusion

By engaging experienced scholars across disciplines, this study establishes two validated definitions of "scientist" that emphasize systematic research activity and knowledge dissemination. These definitions offer a structured yet adaptable framework for understanding scientific identity, balancing clarity with flexibility. They help address the ambiguity surrounding the term "scientist," providing a foundation for improved communication, interdisciplinary collaboration, and evidence-informed policy development. Importantly, they remain open to future refinement as scientific practice continues to evolve.

Declarations

Conflicts of interest: The authors have no conflicts of interest to disclose.

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Use of AI: ChatGPT-3.5 was used to assist in language editing and improving the clarity of the manuscript. All content was reviewed and verified by the authors. Authors are fully responsible for the entire content of their manuscript.

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