Research Writing in Japan Today and What We Can Do to Improve It

P. J. Matthews and J. Akamine eds. Research Writing in Japan
Senri Ethnological Reports 49: 29-40 (2004)

Research Writing in Japan Today and What We Can Do to Improve It

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日本におけるリサーチ・ライティングの現状とその向上のためにおこなえること

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Abstract

Scientific research is one of the most important investments by technologically advanced societies. Scientific publications are the final product of basic research. Japan invests more in research and development in total than almost all other countries, but its share of contribution to the world scientific literature does not match its investment. Several problems constrain Japanese research writing. Among these problems, I believe the most serious are inadequate research planning and problems in organizing the writing process. English is also a problem, but with well planned and executed research and well organized writing, English problems are usually easy to fix. Various actions could increase the quality and quantity of Japan's research publications. Among these are educational reforms to encourage independent, critical, and creative thinking; reform of research administration; additional formal training in scientific writing; and increased use of professional editing. I also suggest ways that authors can improve their use of professional editors and ways that editors can improve the way they work with authors.

科学研究は、技術先進国が行うもっとも重要な投資のひとつである。また、科学論文は、基礎研究の最終産物である。日本で研究開発に注ぎ込まれる金額は諸外国にひけをとらないが、国際的に日の目を見る科学論文の数は、その投資額にみあっていない。いくつかの問題が日本におけるリサーチ・ライティングを拘束している。この問題のなかで、もっとも深刻と思われるのは、研究計画が不十分であることと、論文作成時に生じる論理構成の諸問題である。確かに英語も、問題のひとつではあるが、研究を入念に計画し、実行した上できちんと系統立てた書き方をすれば、英語に関する問題は、たいていの場合、容易に修正がきく。改善のためのさまざまな行動計画を実施することによって、日本の研究論文の質を向上させ、その量をふやすことは可能なのである。たとえば、行動計画として、自主的、批判的かつ創造的な物の考え方を奨励するような教育改革、各研究機関に関わる行政の改革、さらに科学論文の書き方の正規訓練の充実、専門家による論文校正の多用などがあげられる。私は、著者が専門の校正者を活用できるような方法、および校正者と著者とがよりよい共同作業をおこなえる方法を提言する。

Introduction

Modern science has been remarkably successful in developing an understanding of the natural world that results in reliable and useful predictions. Every economically and technically advanced society today puts substantial resources into basic scientific research, which underpins technological advancement and economic growth. Japan is no exception; in 1999 Japan spent about 3% of GDP on public and private scientific research and development, behind only Sweden and Finland in the world in percentage terms (Japan Almanac 2003). Of Japan's total research and development spending in 1999, 71.0% was spent by industry, similar to the proportion in Finland and less than those in the United States and Sweden (European Commission 2003).

Japan's huge investment in research is not proportionately represented in the published scientific literature, arguably the most important repository of the results of scientific research achievement. Although the proportion of Japan's contribution to the world's scientific literature (indexed by the Institute for Scientific Information, Philadelphia, PA, in *Science Citation Index*, which includes 5,900 leading science journals, including many published in languages other than English) has increased from 6.2% in 1981 to 9.5% in 1998 and the proportion of Japan's high impact (=frequently cited) papers has increased at an even faster rate during that period, in 1998 Japan's proportion of all high impact papers was only about 6% (Science-Watch 2000). For the 5-year period from 1998 to 2002, the number of citations per published Japanese paper was below the average for every field except materials science (In-cites 2003). One of the constraints on increased Japanese research productivity is the difficulty many Japanese researchers have in communicating effectively in English, but that might be a less serious problem than insufficient research planning and poor organization of the writing process.

In this paper, I will first define science and scientific research and mention the importance of scientific writing in science. Then I will report observations of some common problems in Japanese research writing, speculate about causes of some of these problems, and make suggestions that might lead to improved Japanese research writing; these suggestions are in the areas of education, research administration and culture, and editing.

What is Science?

Scope

Science can be understood to encompass at least three things:

i. scientific information
ii. the scientific method, which is the fundamental approach used by scientists to discover and test scientific information

iii. the people involved in scientific careers as researchers, teachers, administrators, technicians, etc.

Scientific information is distinct from other kinds of knowledge in that it is demonstrably accurate, in this context meaning reliable, consistent, and non-arbitrary. In modern science, accurate does not mean true, because among human endeavors, only mathematics has provable truth. In science, the reliability of concepts is tested repeatedly. Only concepts that are testable or at least potentially testable can be considered scientific. Those that stand up to repeated testing are accepted as scientific facts.

The scientific method

The scientific method is an epistemological framework for scientific research that seeks to maximize the accuracy of scientific information by requiring the testing of scientific ideas. No idea can be scientifically evaluated unless it is at least potentially falsifiable. The four steps of the scientific method are (i) observe phenomena, (ii) form a hypothesis to explain them, (iii) use the hypothesis to predict new observations, and (iv) test the predictions experimentally. Of course there are many cases where a test fails to falsify predictions of a false hypothesis; thus, demonstrating the truth of predictions does not prove that the hypothesis is true. The only conclusive proof this scientific method provides is for false hypotheses for which requisite predictions are demonstrably false in our experimental tests and observations.

The scientific method in scientific publishing

I mention the scientific method here, because it is an integral part of the research process and its effective use makes research results convincing; research is not valuable unless it is both convincing and disseminated. For this reason, the scientific method and publication of results should be considered when planning any research program. Research is successful when it contributes to advances in our understanding. Only after dissemination can successful research actually lead to further advances in the research field; thus, research is incomplete until it is published and understood. Failure to consider the writing and publication processes when planning research is a common mistake.

The importance of scientific publishing

Recognition in Japan of the importance of publishing research in the international scientific literature is growing. Some universities now require doctoral candidates in the sciences to publish peer-reviewed papers in international journals before graduating. Many institutions increasingly consider research publications in hiring

and promotion decisions. This recognition of the importance of scientific publishing is reflected in the increasing share of all international research papers that originate from Japan. However, Japan's share still lags behind that of most other advanced countries, including many nations that spend smaller fractions of their GDP on research. Many factors may be constraining further increases in Japan's contribution to the world scientific literature.

Problems in Research Writing in Japan

Lack of a clear thesis

The purpose of research writing is to communicate research results in a way that scientifically literate readers can completely and easily understand. Reader comprehension absolutely requires a clear, well organized thesis. Some authors have not thoroughly thought out their own ideas before trying to write about them. There are many examples of research papers that are hard to follow because the main point is not clear to the author. This fundamental fault can often be avoided if the author carefully considers the research plan, including publication goals, when contemplating and planning the research program; i.e., before observation and experimentation actually commence. Answering the following questions in the research planning stage can often facilitate research success all the way through to publication stage: What is the main research question? What are the hypotheses and their predictions? How will the predictions be tested? What would be a convincing result? What statistics will be used? What sample size is necessary to demonstrate the statistically significant differences needed to test hypotheses?

Scientific format

Reader comprehension is best achieved with a standard format that provides the elements of a scientific research story—basically an application of the scientific method. One such standard format is IMRAD, which has been published by the American National Standards Institute (1979). The IMRAD format was designed to describe research in a logical progression that makes the specific application of the scientific method clear; readers of well written IMRAD papers know what kind of information to expect in each section of the paper. However, many scientists have never received any formal training in how to write scientific papers and are not clear about what kinds of information belong in each section of the standard IMRAD paper.

Organized writing

Even if research has been well conceived and conducted, during the writing process the author must select which information to report and which to omit. Sometimes

too little information is included; other times, too much. This and other problems can often be avoided by preparing and following a detailed outline of the paper before writing a draft. Outlines help authors to focus on the main point of the paper and to organize the flow of information to support that main point. Outlines help to build focus, context forward, linkage backward, logic, and flow. Outlines help authors to recognize and avoid information irrelevant to the main thesis and insufficient or excessive use of references.

Writing in English

To the benefit of native English speakers and the disadvantage of others, English has become the dominant language of international science. Most of the important journals are published in English. Many Japanese researchers have difficulty communicating in English because of limited English ability. The level of English writing in research papers authored by Japanese varies from excellent to absolutely unintelligible; the typical level that I have seen is inadequate for clear expression of scientific reasoning.

Communication style

The difficulty Japanese scientists face in producing effective scientific communication for international audiences is not just the use of a foreign language, but also the use of a style of scientific communication that differs from 'Japanese communication'. In Japanese culture, it is sometimes considered insulting to spell out a conclusion; more preferable would be to obliquely mention the supporting evidence and then let the reader draw the conclusion for him or herself (Motokawa 1989). In contrast, the most effective scientific writing summarizes all evidence in support of each conclusion to make the assertion more convincing. In papers by Japanese authors, some conclusions that are rock solid from the evidence presented are announced with softer, more qualified words. Ideally, confidence in the strength of each conclusion (or lack thereof) should be accurately expressed by the author in terms that are neither too strong nor too weak. Ambiguity is sometimes intentional in 'Japanese communication'; in scientific writing, however, ambiguity is almost always a weakness that detracts from reader comprehension. For example, the antecedents of pronouns must be clear. I recommend to my students that they never begin a sentence with the word 'it'; beginning a sentence with 'it' is often grammatically correct, but ambiguous.

Take-home message

The stress position of each unit of discourse, be it a sentence, paragraph, section or entire paper, is near the end of that unit (Gopen and Swan 1990). The most important new information should be consistently placed in the stress position.

Many Japanese authors do not take advantage of position in the paper to emphasize their points. In particular, the most important conclusion, i.e. take-home message, should appear at the end of the Discussion. Furthermore, because the Discussion requires the author to go from the known results and previously published results to generalizations, this section is often particularly weak. If fuzzy or incomplete thinking in a research paper is a problem, then it is usually most apparent in the Discussion. Some authors combine the Results and Discussion sections because they do not know what to write in the Discussion section; unfortunately, this strategy almost never improves the resulting paper. Particularly in the Discussion section, the flow of reasoning should be explicitly described and all logical links mentioned; a detailed outline can be particularly helpful toward this end.

Suggestions

Education

There are many other common mistakes in Japanese research writing and general problems to overcome, but there is hope for improvement. Some solutions are relatively easy to implement, others difficult. The differences in communication style between Japanese culture and science might seem difficult to resolve; however, I think this can actually be dealt with easily. Japanese culture is among the most context sensitive in the world. Japanese people always adjust their style of communication to the situation at hand; the culture has multiple levels of politeness and a distinct language-specific vocabulary for each of these levels. Linear, direct writing is not 'better' than 'Japanese communication'; rather it is simply more appropriate in the context of scientific communication because it more effectively communicates science as it is practiced today. Researchers who do not already understand the direct, linear style of scientific communication must learn and apply it in their writing. Scientific writing can be taught in courses. Some scientific writing courses are available in universities and through scientific service companies and consortia; more such courses are needed. One of the best textbooks on scientific writing (Day 1998) has recently been translated into Japanese (Day 2001).

Of course one of the most important changes needed to improve Japanese research writing for international dissemination is enhancement of the functional level of English proficiency among Japanese researchers. Language learning in adulthood is not easy. The Monbukagakusho secondary school English curriculum covers six years, but most Japanese have not achieved functional bilingualism by the time they graduate from high school. I believe that this failure is due to the curriculum's emphasis on reading and writing. Literacy skills appeared fairly recently in human history; but spoken language is much older. Early humans must

have developed language just as babies learn their mother tongue today: by listening to and copying sounds from the people around them. The human mind may be especially adapted to learning language in this way. The Monbukagakusho English language curriculum should be made more effective, with greater emphasis on spoken rather then written communication. Non-native English speaking students and researchers who find opportunities to speak and listen to English every day will find that their ability improves steadily.

Teaching effective writing skills in any language is difficult. At primary and secondary levels, perhaps it is more effective to encourage students to read more excellent writing in any genre. The level of literacy in Japan is among the highest in the world, but many Japanese, particularly young people, read *manga* (comics) that have little literary value and serve as poor models of effective writing skills for exposition. Japanese primary and secondary schools should require more reading of excellent literature.

While on the topic of educational reform, an additional urgent goal should be encouragement of independent, critical, and rigorous thinking. These skills are essential in scientific research, as the scientific method requires them. However, Japanese education places greater emphasis on rote memorization and cramming for examinations. Related to this need for greater cognitive flexibility, Japanese researchers should encourage more constructive criticism of each other's work. Criticism provides the feedback and intellectual stimulation that are essential for scientific progress. Cultural resistance to increased criticism might be high, as Japanese society emphasizes respect for elders and authorities.

Research administration

Research administrations could tackle resistance to constructive criticism by implementing meaningful reforms of institutional structures and practices. Research writing is the final product of the research process; thus, scientific papers are the best evidence of research quality and value. Consequently, if a goal of research administration is to increase research quality, then the quality of each applicant's publications should be one of the most important criteria for hiring and promotion decisions.

Policies that effectively stimulate and enhance research effectiveness should increase the quality of publications. One such measure might be stimulation of scientific thinking by increasing exposure to presentations about other research. As an American who has worked at a Japanese national research institute for six years and a national university for more than six years, one of my greatest surprises has been how little scientific interaction there is among researchers within and between departments, let alone between institutions. It is usually difficult to find information about seminars and meetings outside one's own institution. Furthermore, participation

in seminars within institutions is often low. Exposure to other research is a powerful intellectual stimulant and a catalyst for creative scientific thinking. The world's leading science departments in both institutes and universities schedule regular seminars, often on a weekly basis. Though busy, the research staff at such leading research institutions find time to attend and participate in discussion of other research, even when that research is only marginally related to their own. Japanese research institutions should implement programs to enhance the cross fertilization of scientific ideas within and between institutions.

Professional editing can help authors more than courtesy editing

Reforms in education and research administration could do much to improve research writing by Japanese scientists; however, for the foreseeable future I expect that there will remain problems that can be most effectively addressed by hiring professional scientific editors or translators. Results from both editors and translators are best when the editor or translator has technical knowledge of the research field. I myself cannot translate, so I restrict my further remarks here to editing.

By editing, I do not mean proofreading, which is the final check of a paper before submission or printing. Neither do I refer primarily to copyediting, which is the process of correcting spelling, punctuation, and to some extent, grammar, often to make a text conform to the style of a particular publication. Rather I am talking about substantive editing with the goal of making the text clearly communicate the author's intended meaning; this includes some copyediting, but copyediting is not the main goal. Good substantive editors try to avoid imposing their own personal stylistic preferences, though the author's stylistic preferences should be changed where they hinder comprehension or fall outside the specific journal's style, as specified in the instructions to authors. Sometimes drastic rewriting is necessary. At other times, editors must struggle to preserve the author's style while clarifying the text.

Because the author's intended meaning is often not clear, editors must use their detailed technical knowledge of the research specialty to read 'between the lines' and make educated guesses. Sometimes editing a research paper is like a puzzle. When the puzzle is too difficult to solve, then the editor's ability to improve the writing is limited. In my experience, the most serious and difficult-to-fix problems in research writing arise from unclear thinking and poor organization; editing a paper with major logical and/or organizational flaws can be an exercise in frustration. On the other hand, with clear thinking and good organization, even very weak English can usually be fixed quickly and effectively.

The need for specialized technical knowledge to 'read between the line' argues against institutions hiring in-house editors to handle research writing in a variety of

fields for other staff members, because few editors have detailed knowledge of many fields. Native English speaking students or co-workers can help with courtesy edits, but they are not always available and courtesy edits, even if compensated fairly, are usually not to the same editing standards that are maintained by professional scientific editors; I know these things from personal experience. Students and colleagues are usually not professionally certified as editors. Although many uncertified editors do excellent work, certification does demonstrate a minimum level of editing proficiency that some courtesy editors do not have. One organization that professionally certifies editors is the Board of Editors in Life Sciences (http://www.bels.org/).

Possible ways to engage the services of a professional editor include contacting a freelance editor directly or working with an editing service. Editing services are usually more expensive than individual freelancers, because they have more overhead expenses. Fortunately many Japanese research institutions do allow research funds to be spent on professional editing services. If a researcher can find a skillful freelance editor with the necessary technical expertise in the research field, then working with the same freelance editor repeatedly may result in highly satisfactory results; furthermore, the working relationship can grow even more effective over time as the author and editor become accustomed to each other's working style and specialized expertise. Editing services have the advantage of working with rosters of editors who collectively can have expertise in a range of scientific fields. Also, some editing services, like Egawa Language and Scientific Service, use a double check system in which each edit is reviewed by a second professional editor. This second editor can catch oversights and add a bit more polish to the manuscript; no matter how skillful the first editor is, a second editor will always catch some mistakes or passages that can be further polished to increase writing effectiveness.

Although substantive editors are not journal reviewers, an editor's scientific expertise and experience can enable him or her to point out flaws in the research that would be problems at the review stage. Some authors are offended by such substantive criticisms from editors; this is a shame, as such feedback is valuable and can result in major improvements to the quality of the research being reported, just as often happens in the indirect interaction between peer reviewers and authors.

Authors should try to give advance notice about editing requests. Skillful editors are busy because they are knowledgeable professionals who provide a valuable service. Authors should be realistic about how fast the work can be done; a careful and thorough editor usually cannot edit more than about 3000 to 4000 words/day. Most editors charge higher rates for faster service. Some editors work only with electronic document formats; others work only on paper. Authors should clarify the details of how to submit the manuscript to the editor before the writing is

finished. When asking an editor for a substantive edit, authors should send the finished, entire manuscript including all accessories to the text (references, figures, tables, captions, and so on). If these materials are necessary for the journal editor, peer reviewers, and readers to understand the paper, then they are certainly necessary for the substantive editor who tries to clarify the author's intended meaning.

Finally, editors are not authors. All authors bear full responsibility for the entire content of each manuscript that bears their name. Editors do not share this responsibility. Editors try to clarify meaning, but sometimes must guess about what the author intended. The meaning expressed in edited text sometimes differs from what the author intended. It is the author's responsibility to check carefully whether the revisions suggested by an editor express what the author wants to say.

Suggestions for editors

Editors should be realistic about what fields they can edit with technical expertise and should politely refuse work offered in fields they do not understand. When an editor is unsure of a proposed revision, he or she should direct the author's attention to that passage and ask the author to confirm that the revision is consistent with the author's intention. Of course, all comments to authors should be polite and respectful.

Editing requires great concentration. Doing it optimally requires that the editor find a comfortable working style. What is comfortable for one editor might not be comfortable for others. I know editors who like to work interactively with clients; I am not good at interactive work. I prefer to receive the entire manuscript in one batch, then sit down alone in a comfortable, quiet place and work through the entire text at least twice. After finishing, I return to the author the entire edited manuscript with my comments. When an author has questions about my editing, I prefer to receive them all in one batch. Editors should establish policies that help them to work most effectively. In addition to working style, the policies should cover working hours, prices, types of service offered, and so on.

Editors should take responsibility for their work. To improve as an editor requires feedback. Editors should seek and use feedback to sharpen their skills. Professional certification is useful to demonstrate proficiency and also for networking with other editors. There are many professional organizations and list servers on the internet related to editing; I mention some in an appendix.

Conclusions

Research is a huge activity in Japan, but the quality of some Japanese research suffers from poor writing and some Japanese research writing suffers from poor research. Both need to be improved. Results-oriented reforms of education and institutional structures can encourage creativity, flexible thinking, and increase effectiveness in research planning, execution, and communication. In addition, there will remain a role for professional editors and translators in helping Japanese researchers to effectively communicate their results to the international scientific community.

Acknowledgements

I thank Prof. Kenneth Ruddle of Kwansei Gakuin University for encouraging me to edit professionally and Dr. Robert Lewis of Technology Launch Management for encouraging me to teach scientific writing the first time. For helpful suggestions, I am grateful to Dr. Peter Matthews (National Museum of Ethnology); ELSS editors Susan Duhon, Matthew Stevens, and Dr. Marjorie Tiefert; and ELSS translator Rick Davis.

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Copyedit-L. Internet, http://ce-l.technology-corner.com/celfaq/

Council of Science Editors (CSE).
Internet, http://www.councilscienceeditors.org/

Egawa Language & Scientific Service (ELSS). Internet, http://www.asahi-net.or.jp/~bg3n-wsbr/elss/

European Association of Science Editors (EASE).
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