



Essential Components of Educational Programs on Biomedical Writing, Editing, and Publishing

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The primary objective of educational programs on biomedical writing, editing, and publishing is to nurture ethical skills among local and international researchers and editors from diverse professional backgrounds. The *mechanics*, *essential components*, and *target outcomes* of these programs are described in this article. The mechanics covers the objectives, design, benefits, duration, participants and qualifications, program formats, administrative issues, and mentorship. The essential components consist of three core schedules: Schedule I Basic aspects of biomedical writing, editing, and communications; Schedule II Essential skills in biomedical writing, editing, and publishing; and Schedule III Interactive lectures on relevant topics. The target outcomes of the programs comprise knowledge acquisition, skills development, paper write-up, and journal publication. These programs add to the prestige and academic standing of the host institutions.

Keywords: Academic Program; Education; Editing; Publishing; Writing

INTRODUCTION

The importance of educational programs on biomedical writing, editing, and publishing has attracted growing attention in recent years, particularly in non-Anglophone countries. Such programs are not widely available, and there is still no strong evidence to support specific format and contents acceptable for trainees globally (1). Based on empirical experience, these programs can be successfully established in institutions with relevant departments, rendering science writing and editing services (2).

In the Asia-Pacific region, Tokyo Medical University is one of the few universities that provide biomedical writing, editing, and publishing programs to its faculty and staff (2). Educational programs at the Department of International Medical Communications of Tokyo Medical University are updated regularly to adjust their curricula to the upgrading standards of research reporting, ethical editing, and publishing. A variety of individual consultations, lectures, graduate courses, and services through an electronic editorial platform are now offered to faculty and visitors of the university.

The objective of well-structured educational programs in biomedical writing, editing, and publishing is to transfer essential knowledge and skills to those who wish to master science writing. The program's concept, organization, mentorship, evaluation, and follow-up require careful attention. Faculty of the department can tailor a specific program for a target group of participants by selecting and enhancing relevant training compo-

nents. The ultimate goal of the program is to facilitate publishing in leading biomedical periodicals. The mechanics and essential components of the program are described in this article.

MECHANICS

The mechanics described here cover some of the important logistical aspects crucial in developing the programs. These include the objectives, design, benefits, duration, participants and qualifications, program formats, administrative issues, and mentorship.

Objectives

The primary objectives of the program are to train qualified professionals to be competent in writing, editing, and publishing biomedical articles, and to be proficient in rendering a full range of assistance in any of these areas.

The specific objectives may include the following: 1) to teach effective writing and communication of research results, highlighting the importance and reliability of the study; 2) to pass on basic and advanced knowledge and skills in biomedical writing, editing, and publishing under the close supervision of senior biomedical mentors and science editors; 3) to provide in-depth knowledge and guidelines on key aspects of ethical publishing, peer review, journal indexing, and archiving; 4) to train biomedical writers and editors who will be ethical contributors of research publications; and 5) to promote international collaboration through joint local and international courses.

Participants completing these programs should possess advanced knowledge and skills in biomedical nomenclature, evidence-based writing, editing, and publishing.

Design

The programs should be designed to provide a foundation for manuscript writing in compliance with established research reporting standards. An additional value of the programs is to enhance post-publication communication skills of the participants.

The programs can be designed to help biomedical professionals, graduate students, and researchers publish their papers in the best target journals indexed by MEDLINE, Scopus, and Web of Science with high impact factors (IFs).

Benefits

By completing the training programs, participants may boost their confidence in biomedical writing and editing. Professional orientation can be realized through the exchange of experiences among the participants, aiming at enhancing writing skills and publishing capacity. A clear understanding of the ethical basis and benefits of biomedical writing, editing, and publishing can be achieved and new networks of competent writers, editors, and publishers can be established.

Duration

The duration of the programs can vary widely, depending on the needs of the target audience. Short courses can be organized daily for two weeks. Longer programs may take three to six months.

Participants and qualifications

To substantially benefit from the training programs, participants should have an academic degree in the natural sciences, medicine, linguistics, translation studies, or science journalism, or have work experience at a biomedical or pharmaceutical company.

Participants must have some science writing and editing experience, basic knowledge of the structure of a scholarly paper, and good interpersonal communication skills. Health professionals, researchers, educators, medical writers, authors' editors, and translators can also participate in the programs.

Intermediate to advanced knowledge of written English and spoken English skills are expected from each participant to benefit fully from the program and facilitate interactions.

Format of programs

At present, educational programs in the form of graduate degree courses are scarcely available and are mostly offered online. The Science Writing Program at Johns Hopkins University covers basic skills and a master's in science writing (3). The University of Chicago Graham School offers a certified program in medical writing and editing (4). On the other hand, the Master

of Science (MS) in Biomedical Writing at the University of the Sciences in Philadelphia offers instructions in basic skills for medical writers and electives focusing on regulatory or nonregulatory writing. Finally, there is a new MS program in medical writing which is offered by the University of Innsbruck in Austria (6).

The advantage of the present educational program is that it is not restricted to the graduate degree course format, but it can be arranged in the format of either internships, certified courses, symposia, seminars, webinars, public lectures, academic visits, fellowships, collaborative research, or graduate degree courses. As the main objective is to transfer essential knowledge and skills to those who wish to master science writing, faculty of the department can tailor a specific program for a target group of participants by selecting and enhancing relevant training components. This makes the program more flexible and adaptable. Moreover, the program puts emphasis in facilitating publishing in leading biomedical periodicals.

Administrative issues

Contents of the documents and manuscripts used for the trainings should be kept confidential. The roles of the coordinators and collaborators should be clarified at the start of the program, with careful planning of the participants' residence and expenses. Upon successful completion of a certain course, a certificate informing about its contents and academic hours is awarded. For the materials and manpower system, hosting universities or institutions should ideally have a special academic unit (or aim to develop one) with tenured faculty members who handle courses in medical English, communications, and writing. They will serve as a team of editors developing the editing, writing, and publishing materials and the programs; providing editorial support using electronic editorial services; and promoting international publications.

Mentorship

Good educational programs should be spearheaded by experienced academic mentors who generously share their knowledge, skills, and experience. The academic mentors must be highly skilled medical doctors or biomedical experts with a record of high-quality scholarly publications, extensive experience in teaching biomedical courses or editing, and history of successful academic mentorship.

ESSENTIAL COMPONENTS

The essential components of the programs can be divided into three schedules: I. Basic aspects of biomedical writing, editing, and communications; II. Essential skills in biomedical writing, editing, and publishing; III. Interactive lectures on relevant topics.

Table 1. Schedule I: Basic aspects of biomedical writing, editing, and communications

Topics	Core activities	Acquired skills
1. Basic grammar usage (7)	- Identifying correct grammar use in scientific language - Editing text by correcting grammar	- Correct use of grammar in scientific texts
2. Editorial/scientific style (8)	- Correct punctuations, hyphenations, spelling, capitalization, surnames, trademarks, abbreviations, numbers, units of measure, and plurals	- Attention to details of editorial/scientific style - Consistency in language and style
3. Sentence structures and patterns (9)	- Mastering different sentence structures and patterns - Rewriting incorrect sentences - Correcting use of language - Identifying useful style guides and other language resources	- Recognition of sentence structures and patterns - Upgrading sentence constructions - Proper use of scientific language
4. Proper use of statistics for biomedical writers and editors (10)	- Familiarizing with basic statistical terminology and methods - Identifying study designs and corresponding statistics for data analysis	- Proper use of statistical tests and concepts
5. Tables, graphs, and biomedical images (11)	- Identifying and editing different types of tables, graphs, and images	- Correct use of tables, graphs, and images
6. Components of a scientific paper (12)	- Appropriate use of style and words - Identifying and editing different components of a scientific paper	- Mastery of article components - Familiarity with different types of articles
7. Conference communications (13, 14)	- Learning how to draft effective oral presentations - Preparing poster presentations - Writing informative and reflective conference reports	- Upgrading oral and poster presentation skills - Accuracy in conference report writing
8. Preparing an article for publication (15-17)	- Familiarizing with different types of articles - Correct citing and referencing - Improving visual presentation of data	- Familiarity with different types of articles - Organization of manuscript and data

Schedule I: Basic aspects of biomedical writing, editing, and communications

This schedule involves lectures, presentations, workshops, and feedback on the following topics: basic English grammar, editorial/scientific styles, sentence structures and patterns, statistics for medical writers and editors, tables and graphs, components of a paper, conference communications, and preparing an article for publication (Table 1).

The following areas are discussed in detail: 1) basic writing and correct use of words, phrases, and clauses; 2) types and structures of biomedical articles; 3) composing titles, structuring abstracts, designing methodologies, reporting results, writing discussions, and formatting references; 4) editing tables and graphs, diagnostic images in clinical medicine and analytical images in basic sciences; and 5) interpreting statistical analyses.

Schedule II: Essential skills in biomedical writing, editing, and publishing

This schedule covers lectures, presentations, or workshops and feedback to build skills in biomedical writing, editing, and publishing. Participants critically appraise biomedical manuscripts and develop skills in substantive editing and copyediting of different parts of a manuscript (Introduction, Methods, Results, and Discussion). These activities are also aimed at evaluating the scientific merit of the results and the validity of the conclusions.

Participants also gain skills in searching through bibliographic databases, institutional repositories, detecting scientific misconduct, and communicating with authors, reviewers, and editors. Practical exercises cover scientific authorship (criteria of authorship, inappropriate authorship), conflicts of interest, plagiarism detection, and other issues in publication ethics. Fa-

miliarizing with study designs, research reporting guidelines of the Enhancing the QUALity and Transparency Of health Research (EQUATOR) Network (<http://www.equator-network.org/>), and guidance from global editorial associations are also included in this schedule (Table 2).

Schedule III: Interactive lectures on relevant topics

Schedule III involves interactive lectures, presentations, workshops, and feedback on topics in medical writing, editing, and publishing. These activities allow improvement in analytical thinking. The topics covered range from peer review, journal indexing, impact indicators, editorial management systems, research designs, publication misconduct, editorial decision-making, open access, and digital publishing (Table 3).

EVALUATION AND FEEDBACK

Participants of the program will receive a written evaluation regarding their performance for the activities covered. To reinforce the learning process, feedback emphasizing points for improvement is provided. Verbal evaluation and feedback may also be provided daily during the programs.

Halfway through the program, participants receive evaluations regarding their ability to 1) consistently correct the English or scientific language, 2) identify and correct ambiguities and inconsistencies, 3) edit to the journal language requirements, and 4) write the required statements, disclosures, and information.

At the end of a program, participants receive evaluations regarding their ability to 1) evaluate the research design, 2) determine the internal validity of the results and conclusions, 3) identify potential errors and biases that may distort the results or study interpretation, 4) suggest new sentences or sections for

Table 2. Schedule II: Essential skills in medical writing, editing, and publishing

Topics	Core activities	Acquired skills
1. Appraisal of a scholarly article (18)	<ul style="list-style-type: none"> - Editing, writing, formatting, reviewing, and confirming scientific text - Correct use of format, style, grammar, words, and phrases - Accurate use of terminology - Presenting research methods clearly - Use of scientific nomenclature 	<ul style="list-style-type: none"> - Analysis of research significance - Assessment of research methodology and results - Attention to study details - Appraisal of a scientific paper in terms of style, format, syntax, language, content, logic, and overall impact
2. Composing an effective cover letter (19)	<ul style="list-style-type: none"> - Checking text and tone - Highlighting significant findings and novelty - Acknowledging contributors' efforts - Disclosing any conflict of interest - Listing potential peer reviewers - Disclosing funding 	<ul style="list-style-type: none"> - Synthesis of the article - Detail orientation - Presenting novelty
3. Understanding and interpreting editorial decisions	<ul style="list-style-type: none"> - Interpreting decisions regarding acceptance, revision, and rejection - Clarifying journal instructions regarding revision and resubmission 	<ul style="list-style-type: none"> - Interpretation of editorial decisions and reviewer comments - Response formulation and organization - Critical thinking of research implications - Analysis of study relevance
4. Resubmission	<ul style="list-style-type: none"> - Providing point-by-point responses to reviewer comments - Reviewing manuscripts - Re-editing and proof-checking of rebuttal letters - Cross-checking of text revisions 	<ul style="list-style-type: none"> - Reassessment of manuscripts - Appraisal of logical flow in the manuscripts - Novelty assessment - Correctness of revisions
5. Composing responses to reviewer comments (20)	<ul style="list-style-type: none"> - Copying and pasting of all comments into the response (rebuttal) letter - Providing point-by-point responses to the comments - Explaining revisions made in the text and cover letter - Writing polite and evidence-based rebuttals - Preparing ready-to-deliver files with responses and changes clearly differentiated 	<ul style="list-style-type: none"> - Accurate interpretation of comments - Composing clear responses - Adhering to the journal instructions - Acknowledging reviewers and editors collaborative efforts
6. Rejection and resubmission	<ul style="list-style-type: none"> - Careful analysis of all previous comments - Addressing important points - Choosing a new target journal - Following new target journal guidelines - Resubmitting the manuscript 	<ul style="list-style-type: none"> - Article reassessment - Choosing best target journals and avoiding 'illegitimate/predatory' journals
7. Editing poster presentations (21)	<ul style="list-style-type: none"> - Streamlining/organizing headings and content - Checking tables and figure resolution - Evaluating layout and presentation script 	<ul style="list-style-type: none"> - Familiarity with poster preparation - Editing and formatting presentations - Detail orientation
8. Editing oral presentations (22)	<ul style="list-style-type: none"> - Editing text to ensure interactivity - Audio and video recording at various speeds - Coaching presentations 	<ul style="list-style-type: none"> - Composing interactive script - Use of appropriate language - Adherence to presentation time - Proficiency in audio and video recording
9. Conforming to journal instructions (16, 23)	<ul style="list-style-type: none"> - Identifying the type of submission - Meeting the word count limits - Structuring abstracts - Dividing the manuscript into sections - Formatting references - Adhering to ethics and reporting standards 	<ul style="list-style-type: none"> - Meeting text and format requirements - Editing required and unnecessary parts - Assessment of target journal level - Detail orientation
10. Online submission (24)	<ul style="list-style-type: none"> - Preparation of all necessary files - Creating a journal log-in account/password - Following all author instructions - Completing the online submission step-by-step - Preparing all disclosures - Suggesting potential reviewers - Completing submission checklists 	<ul style="list-style-type: none"> - Familiarity with online submission systems - Accurate preparation of online submission files - Competence in preparing disclosures and supplemental files - Listing relevant reviewers
11. Galley proofreading (25)	<ul style="list-style-type: none"> - Handling PDF files of galley proofs - Annotating PDF-formatted galley for errors in spelling, typescript, punctuation, grammar, and formatting 	<ul style="list-style-type: none"> - Handling and editing PDF files - Meeting proofreading deadlines - Communicating with journal editors and publishers before publication
12. Citing web resources (26)	<ul style="list-style-type: none"> - Citing non-print materials, including grey literature - Referencing e-publications, post-publication peer reviews, and supplements 	<ul style="list-style-type: none"> - Citation of and familiarity with online materials
13. Editing references (17, 27)	<ul style="list-style-type: none"> - Correcting citation format - Checking reference accuracy - Formatting references - Confirming reference linking - Using digital object identifiers (DOI) 	<ul style="list-style-type: none"> - Detail orientation - Accuracy in following journal instructions - Mastery of reference formatting
14. Title and abstract editing (28)	<ul style="list-style-type: none"> - Title and abstract formatting, editing, and styling 	<ul style="list-style-type: none"> - Structuring titles - Summarizing studies - Learning rules of title and abstract writing

(Continued to the next page)

Table 2. Continued

Topics	Core activities	Acquired skills
15. Author-reviewer-editor relationship (2)	<ul style="list-style-type: none"> - Clarifying author-reviewer-editor relationship - Writing queries to authors - Following reviewer and editor comments/ instructions 	<ul style="list-style-type: none"> - Improved author-reviewer-editor communication
16. Identifying different types of studies in medical research (29)	<ul style="list-style-type: none"> - Recognizing various types of studies - Meeting formatting and structural requirements of each study type - Conforming to research reporting guidelines 	<ul style="list-style-type: none"> - Acuity in identifying research study types - Familiarity with research study designs - Knowledge of research reporting standards
17. Identifying manuscript sections (30)	<ul style="list-style-type: none"> - Highlighting manuscript sections - Checking appropriateness of each manuscript section 	<ul style="list-style-type: none"> - Mastery of manuscript sections - Accurate organization of data - Correct presentation of text according to the manuscript sections
18. Familiarizing with conflicts of interest disclosures (31)	<ul style="list-style-type: none"> - Understanding financial and nonfinancial conflicts of interest - Writing conflicts of interest statements 	<ul style="list-style-type: none"> - Familiarity and knowledge of appropriate disclosures
19. Searching through online databases (32)	<ul style="list-style-type: none"> - Searching online databases such as Scopus, Web of Science, MEDLINE 	<ul style="list-style-type: none"> - Enhanced skills in searching through search engines to retrieve biomedical information
20. Choosing target journals (33)	<ul style="list-style-type: none"> - Assessing manuscript level and matching it with the best target journals - Identifying journal rankings according to traditional and alternative impact indicators - Clarifying the journal's scope, aims, and editorial policies 	<ul style="list-style-type: none"> - Familiarity with journal rankings - Enhanced skills in journal appraisal and suitability assessment
21. Familiarizing with global editorial associations and their educational resources (34)	<ul style="list-style-type: none"> - Explaining the importance of editorial guidelines and reporting guidelines - Ensuring good publishing practice 	<ul style="list-style-type: none"> - Familiarity with good publishing practice

Table 3. Schedule III: Interactive lectures on relevant topics

Topics	Subtopics
1. Peer review	<ul style="list-style-type: none"> - Restraining 'rational cheating' in peer review - Open-access publishing and cascading peer review - Instructions for reviewers - Models of peer review - How to pick best peer reviewers
2. Impact indicators	<ul style="list-style-type: none"> - Traditional, alternative, and spurious impact indicators
3. Writing courses	<ul style="list-style-type: none"> - Biomedical writing and editing course for medical graduates - Writing modules for publication writers
4. Editorial management systems	<ul style="list-style-type: none"> - Academic editing systems and writing programs - Editorial services for medical universities
5. Research methodology	<ul style="list-style-type: none"> - Research study designs - Writing qualitative research
6. Internships	<ul style="list-style-type: none"> - Medical editing internships - Editorial internship and mentorship
7. Publication misconduct	<ul style="list-style-type: none"> - Scientific authorship and contributorship - Responsibilities of authors - Conflicts of interest - Research misconduct - Plagiarism - Retractions of biomedical articles
8. Scholarly publishing	<ul style="list-style-type: none"> - Elements of biomedical journal editing and indexing - Illegitimate or predatory publishing - Upgrading instructions for authors
9. Editorial policies and processes	<ul style="list-style-type: none"> - Main points in author guidelines/instructions - Editorial credentials and editorial board selection
10. Open access	<ul style="list-style-type: none"> - Open access, open peer review, and data sharing - Open access and research impact indicators
11. Digital publishing	<ul style="list-style-type: none"> - Online submission and publication - Editing PDFs of galley proofs
12. Elements of proper biomedical writing	<ul style="list-style-type: none"> - Roles of authors, reviewers, editors, and publishers in ensuring reference accuracy - Searching, writing, preparing, and publishing scientific papers - Use and abuse of citations, auto-citations and citation 'cartels' - Guidelines in writing medical papers in English
13. Global editorial associations	<ul style="list-style-type: none"> - Science editors' associations - Educational resources for science editors
14. Journal publishing	<ul style="list-style-type: none"> - Reference cross-checking and linking (DOI) - How to maximize visibility, impact, and citation of research
15. Introductory biomedical statistics	<ul style="list-style-type: none"> - Basic statistics for scholarly articles
16. Scientific publication quality	<ul style="list-style-type: none"> - Improving the quality of scholarly articles - Research validation standards

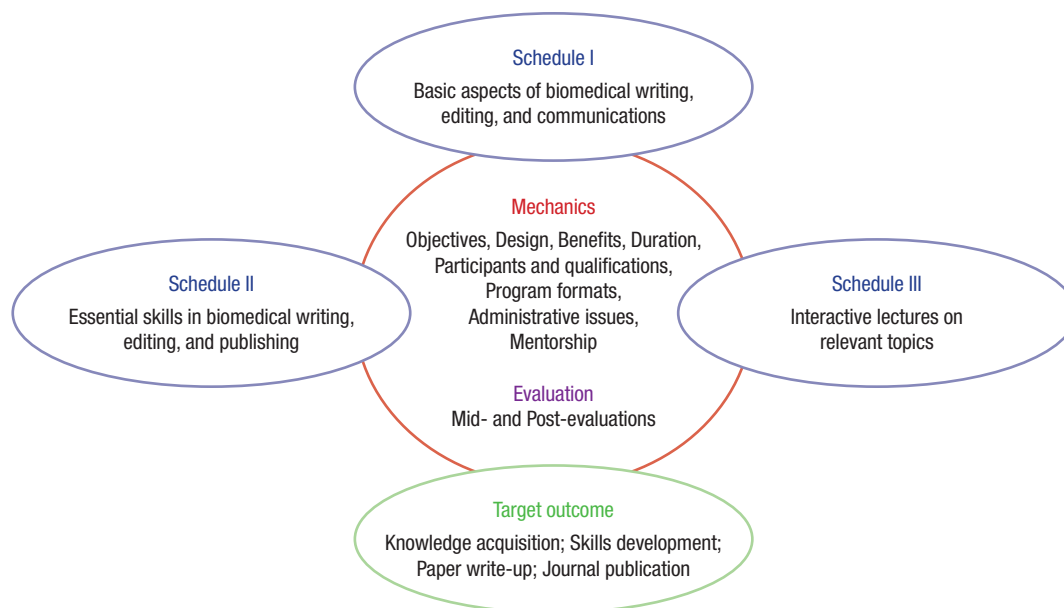


Fig. 1. Essential components (Schedules I, II, and III), mechanics, evaluation, and target outcome of educational programs in biomedical writing, editing, and publishing.

omission, and 5) give advice for manuscripts that fail to meet content and formatting guidelines.

TARGET OUTCOME

Upon completion of a certain educational program, participants will be encouraged to write a publishable paper on one of the topics covered during the program. The paper will be submitted to a suitable target journal indexed in MEDLINE, Scopus, and Web of Science.

CONCLUSION

Educational programs in biomedical writing, editing, and publishing should be organized to provide a foundation for improving skills and competence in these fields, as well as for gaining in-depth knowledge and understanding of research methodology, science communication, and scholarly publication (Fig. 1).

DISCLOSURE

The authors have no potential conflicts of interest to disclose.

AUTHOR CONTRIBUTION

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