

Scientific Writing

Lesson Plan Outline based on *Communicating Science: A practical guide for engineers and physical scientists* – R&E Boxman, WSP, 2017 ©Raymond and Edith Boxman, 2018

Target audience: graduate students, who need to write journal articles, theses, and thesis proposals. Course is most effective for students who have research results, and are ready to write them up.

Plan for 1-semester course, with 13 2-hr class meetings, comprised of lectures and student participation.

Week	Topics	CommSci sections	Class discussion, exercise	Homework assignment	Take-away points
1	Introduction Organizing Files Word processor hints The Research Report (journal paper, thesis, internal report) Research Question (RQ)	1 10.1.2 10.1.3 2.1 2.2.1	Each student writes (RQ) for their research. Ask students to read aloud, and discuss.	Find a journal article in their field which is particularly well written. Bring it to subsequent classes. Identify implicit RQ in article chosen.	<ol style="list-style-type: none"> Can save time using advanced word processing features. Good research report is designed around a well framed research question.
2	Detailed outline Consider the reader Composition Principles Structure of the research report The Introduction Intro. Structure Background	2.2.3 2.2.4 10.2 2.3 2.4 2.4.1	Examine 1 st sentence of Intro in journal papers brought in by students. Discuss if it will be totally understood by the journal readership.	Write an introductory sentence for a future paper by the student on his research that will be fully understood by everyone one in the class, including the instructor.	<ol style="list-style-type: none"> Conventional research report organization is reader-friendly. A detailed outline produces well organized reports. Good paragraph and sentence structure help develop key points. Bring all the readers into the picture with stage 1 of the Introduction – Background.
3	Introduction (cont'd) Literature review Gap Statement of Purpose Compatibility Grammar module	2.4.2 2.4.3 2.4.4 2.4.7	Read sample homework opening sentences, and “vote” if understood by all. Find Gap in journal papers brought in by students, and discuss if it meets all	Write compatible (a) research question, (b) gap sentence, and (c) statement of purpose for the student’s research.	<ol style="list-style-type: none"> Lit. rev. should focus on work closest to current research. Use mix of sentence types as appropriate. Explicit, well defined, negative Gap critical for paper acceptance.

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	Verb Tenses	10.3.1	criteria (e.g. explicit, negative, not “wishy-washy”).		<ol style="list-style-type: none"> Well defined SOP requires good scientific thinking. RQ, Gap, and SOP must be compatible. Gap says the RQ has not been answered yet; SOP says that the objective is to answer the RQ. Besides temporal connotation, past tense indicates statement is specific to conditions, e.g. experimental result, present indicates general truth, e.g. physical law, and modal auxiliary indicates tentative or speculative statement (e.g. for explanations and extrapolations).
4.	<p>Intro – optional parts Value statement Preview Methodology</p> <p>Grammar module Definite and indefinite articles, Word repetition, Pronouns</p>	<p>2.4.5 2.4.6 2.5</p> <p>10.3.3 10.3.4</p>	Discuss students' h.w. Examine and discuss apparatus and methodology diagrams from journal papers which students brought in. ¹	Write a value statement. Prepare a table of fixed parameters and experimental (or numerical) variables for students' research (see Table 2.20)	<ol style="list-style-type: none"> Value statement motivates reader re. importance of report. Preview makes long reports more reader-friendly. Methodology must be sufficiently detailed to allow exact duplication of every result elsewhere. Correctly use articles and pronouns (especially important for non-native speakers of English).
5	<p>Results</p> <p>Grammar module Describing Results Modifiers, Conjunctions and Sentence Connectors</p>	<p>2.6</p> <p>10.3.5- 10.3.9</p>	Find and label L, P, and C sentences for a single result in journal papers brought in by students	Write-up a single result, including preparing a figure, caption, and the body text, with L, P, and C sentences labeled.	<ol style="list-style-type: none"> Results section is the heart of the research report. All variables must be defined for each result. Text should be understandable without looking at figure (blind person's rule). Figure (with caption) should be understandable without referring to the text.

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					5. Precise descriptions.
6	Theoretical papers Grammar module Mathematical grammar	2.7 10.3.14	Present and discuss students' homework	Make a 2-column nomenclature table for the student's research	<ol style="list-style-type: none"> 1. Theoretical and experimental papers follow the same principles and overall organization. 2. Theoretical papers differ in the organization of the "body" of the paper (what you did; what you got), and have more variety. 3. Must be sufficiently detailed to be duplicated elsewhere by a beginning M.Sc. student.
7	Discussion Conclusions Grammar module Prepositions, Abbreviations, Punctuation, Capitalization	2.8 2.9 10.3.11 - 10.3.13	Examine and discuss Conclusions of journal papers brought in by students. Is the RQ answered explicitly?	Copy the research question from HW3. Write one sentence of the Conclusions which explicitly answers the RQ. (The answer can be fictional but feasible if the research has not yet answered the question.)	<ol style="list-style-type: none"> 1. Discussion converts information (i.e. results) into knowledge. 2. While results are duplicable facts, statements in the Discussion may contain a degree of uncertainty and speculation. The language chosen should convey the degree of certainty or speculation. 3. The Conclusions section conveys the bottom line of the research and the key points that the author wants the reader to remember, including the answer to the Research Question. It should not repeat goals or methods.
8	Abstract Title Authors Grammar module Especially (but not just) for non-native English Speakers – learning by imitation, dictionary use	2.10 2.11 2.12 10.4	Examine and discuss abstract of journal papers brought in by students. Are they informative?	Students start work on writing a publishable journal paper based on their research. NO MORE weekly HW assignments.	<ol style="list-style-type: none"> 1. Abstract must be informative, i.e. summarize results and conclusions (and not merely indicative, i.e. only indicating what work was done). 2. Title should convey the new results presented in the paper. 3. Authors are those who made substantive intellectual contribution to the paper.

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	Writing discipline – getting started and keeping going	10.1.1			
9	Review and publication process	3	Discuss ethical issues. Make sure that students understand that “cut and paste” is unacceptable. Ask students to report progress on writing paper, and discuss difficulties encountered.	(students working on writing publishable journal paper)	<ol style="list-style-type: none"> 1. Understand ethical issues: scientific integrity, plagiarism, copyright, and double publication. 2. Reviews should be considered <i>a priori</i> as honest expert feedback and addressed by revising the manuscript. 3. Comments which are erroneous or impossible to execute may be rebutted in a reply to the editor. The rebuttal should be polite and factual, not personal.
10	Lectures and Posters	4	Students should share experiences in attending conference: terrible presentations they experienced (and what made them bad) and great presentations (what made them good), and networking experiences.	Optional: prepare 1 lecture slide. (otherwise – students work on writing journal paper)	<ol style="list-style-type: none"> 1. Select material to present according to the time allotted for lecture. 2. Lectures slides and posters should be legible – sufficiently large lettering and not too busy. 3. Concentrate on the main points and avoid detail. (Details will be in the paper, not in lecture or poster). 4. Most important session in a conference is the coffee break.
11	Research proposals	5	If assigned, project and discuss student lecture slides	(students working on writing publishable journal paper)	<ol style="list-style-type: none"> 1. To get funding, a proposal must be more than merely good – it needs to be convincing, and among the x% of the best according to the competitiveness of the fund. 2. Critical to explain the specific importance of achieving the proposed goals.

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12 13	<p><i>Choose topics according to time available and interest of students and instructor from the following:</i></p> <p>Business Plans Patents Popular Media Correspondence and Job Hunting</p> <p>Course Summary</p>	6 7 8 9	Students report progress and problems in writing a paper on their research. Discuss how to overcome problems.	(students working on writing publishable journal paper)	<ol style="list-style-type: none"> 1. Business plan is analogous to research proposal in the business world – but goal is to generate profit. 2. Patent discloses new invention. Claims must succinctly summarize what the patent will protect, and must exclude all prior art. 3. Reports to the popular media should concentrate on the main ideas, not use jargon, and emphasize relevance to the readers or society. 4. Business letters are short and to the point. Long information can be conveyed in an appendix or appended report. 5. CV or resume is key document used in job search and summarizes education, experience and accomplishment of the applicant. 6. Use personal contacts whenever possible in searching for a job.

Grading:

“The proof of the pudding is in the eating”. Suggest basing final grade (which can be pass-fail) on a journal paper composed by the student based on his/her research, and suitable for publication in a target journal in the field, with the expectation that the paper will in fact be submitted to that journal. This requires that the students have results which they want to write up for publication when they enroll for the course. The expectation is that the students will start writing their paper in parallel with the course, and immediately practice what they learned. Evaluation of the paper should include (and emphasize) organization and structure, but also include English grammar and usage. One resource efficient grading method is for the instructor to check only key points (informative abstract, sufficiently general opening sentence, explicit and negative gap sentence, clear objective which is compatible with the gap, detailed methodology description, clear result figures with L,P, and C sentences in the body text, and Conclusions which includes a specific answer to the research question) and having an assistant with good English skills (but not necessarily experience in journal paper writing) check and correct the English throughout the paper.