

A UNIVERSITY LABORATORY COURSE TO IMPROVE SCIENTIFIC COMMUNICATION SKILLS

Perspectives on Scientific Writing from Students and Faculty

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SUMMARY. A written survey was conducted to ascertain the respondents’ attitudes and approaches toward scientific writing. The survey was administered to two groups: 32 students of the class “Communication Skills for Scientists” at the University of Helsinki during week 1 in October 2008 (UH) and 44 of the roughly 90 attendees of the 14th Cyclone Workshop in Quebec, Quebec, Canada, in September 2008 (CW). Although nearly all the members of the UH group were early in their careers, the CW group was separated into two groups: an early-career group composed of 17 students and postdoctoral fellows (CW-EC) and 26 professors, scientists, and forecasters (CW-Rest). Their responses showed that more-experienced authors generally support multipart manuscripts and the use of first-person pronouns in the body of a scientific paper, whereas the early-career groups were more evenly split. In contrast, early-career authors were more amenable to open-access journals. Respondents typically read the parts of a manuscript out of order, starting with the title and abstract, then proceeding to the introduction or conclusions and figures next, leaving the discussion, tables, and data/methods to the end. Respondents usually write their manuscripts out of order, as well. Most create the figures first, then write the data/methods and introduction next, ending with the conclusions, title, and abstract, although a few authors write the title first. Responses to the rest of the 30 questions in the survey are discussed in this supplement.

A written survey was answered by 32 students in week 1 of the class “Communication Skills for Scientists” at the University of Helsinki in October 2008 (responses denoted by UH), discussed by Schultz (2010c). Their responses are compared to those from 44 of the roughly 90 attendees of the 14th Cyclone Workshop in Quebec, Quebec, Canada, [in September 2008 (Quebec, Canada, responses denoted by CW; information about previous Cyclone Workshops can be found in Bleck et al. (1993) and Gyakum et al. (1999)]. The questions arose during the writing of *Eloquent Science* (Schultz 2009), as I wondered what students and other scientists in the atmospheric sciences felt about these issues.

DEMOGRAPHICS. A large difference existed between the UH and CW groups. Of the UH group, all but one (3%) was not a native English speaker, whereas all but 3 (7%) of the CW group were native English speakers.

Whereas the UH group was composed of 24 (86%) students, 2 (7%) junior scientists, 1 (4%) forecaster, and 1 (4%) other, the CW group was composed of 15 (35%) professors, 14 (33%) students, 10 (23%) researchers and scientists, 3 (7%) postdoctoral students, and 1 (2%) scientist/forecaster. Thus, the CW group was split into an early-career CW group (17 students and postdoctoral students, designated CW-EC) and the other 26 respondents (CW-Rest). (One respondent did not answer the question about their professional status.) This partition allowed a comparison

between two early-career groups: one primarily of native English speakers from North America and one primarily of nonnative English speakers from Finland. This partition also allowed comparison within the CW group between those early in their career and professors and research scientists.

Whereas 41% of the UH group had published a peer-reviewed scientific article, 82% of the CW-EC group had. There was an almost complete separation between the two CW groups by the number of peer-reviewed publications. Most respondents in the CW-EC group had 0, 1, or 2 publications, with four respondents having 4, 5, 6, and 7 publications. In contrast, most of the CW-Rest group had 10 or more publications, except for five respondents who had 2, 3, 5, 7, and 7 publications.

Percentages below are based on the total number of respondents to each question. Totals may not add up to 100% due to roundoff.

WRITING SCIENTIFIC ARTICLES.

1) *I consider the use of a question appropriate in the following title of a scientific journal article: “Are more observations necessarily required for improved forecasts?”*

UH:	TRUE 58%	FALSE 42%
CW-EC:	TRUE 76%	FALSE 24%
CW-Rest:	TRUE 77%	FALSE 23%

I asked this question to gauge how respondents felt about provocative titles for articles. The UH group was more conservative than the CW group.

2) *I believe it is appropriate for a first-person pronoun (“I” or “we”) to appear in the body of a scientific paper. (For example, “we selected the top 20 cases for inclusion in the climatology.”)*

UH:	TRUE 58%	FALSE 42%
CW-EC:	TRUE 47%	FALSE 53%
CW-Rest:	TRUE 73%	FALSE 27%

3) *I believe it is appropriate for a single author to use “we” in the body of a scientific paper.*

UH:	TRUE 36%	FALSE 64%
CW-EC:	TRUE 18%	FALSE 82%
CW-Rest:	TRUE 44%	FALSE 54%

I asked these two questions because most modern books and articles have suggested that limited use of the first person is acceptable (and even encouraged) in scientific manuscripts to make the writing more accessible. I agree that limited use of the first person is acceptable (Schultz 2009, 76–77). [Whitburn (1976) provides an impassioned plea arguing for more personality in scientific writing.] I wanted to see what people’s perceptions were about this topic. Although the UH and CW-EC groups were evenly split, the more-experienced CW-Rest group generally supports the use of first-person pronouns.

Personally, I recognize that “we” when meaning “you the reader and I the author” should be acceptable, although I would avoid “we” in a solo-authored paper of my own. Most respondents in all groups seem to agree.

4) *A conclusion section should not contain any information that was not already presented in the text.*

UH:	TRUE 82%	FALSE 18%
CW-EC:	TRUE 81%	FALSE 19%
CW-Rest:	TRUE 24%	FALSE 76%

Geerts (1999) argued that the readability of journal articles has decreased, in part because the authors have not written clear conclusion sections. He advocates not putting any new information in the conclusion

section that was not already presented in the text. Although the UH and CW-EC groups felt pretty strongly that conclusions should not contain any new information, the more-experienced authors in the CW-Rest group felt differently. (Some of the CW-Rest respondents noted the double negative in the question. Tough crowd.)

5) *I know the difference between an en dash and an em dash and how to use each one.*

UH:	TRUE 6%	FALSE 94%	
CW-EC:	TRUE 31%	FALSE 69%	
CW-Rest:	TRUE 35%	FALSE 62%	Maybe 4%

Hyphens (-), en dashes (–), and em dashes (—) are the least correctly used punctuation marks in scientific manuscripts. I wanted to see how many respondents were aware of the difference and how to apply each one. Most respondents, however, did not know.

6) *I believe multipart manuscripts (Part I, Part II, etc.) are acceptable.*

	1=IN ALL CASES	2=IN MOST CASES	3=IN SOME CASES	4=RARELY	5=NEVER
UH:	0%	25%	59%	16%	0%
CW-EC:	0%	41%	53%	6%	0%
CW-Rest:	0%	54%	46%	0%	0%

Multipart papers generally cause trouble for editors. Because they are two manuscripts linked, potential reviewers are reluctant to take them on, reviewers want more time to review two manuscripts, and reviewers are often more critical, all leading to longer times to publication, if not rejection (Schultz 2009, section 3.3; Schultz 2010b). I would advocate to any authors considering multipart papers to write them as independently as possible and submit them as separate manuscripts. Although the two early-career groups were lukewarm to multipart papers, more experienced authors in the CW-Rest group tended to favor multipart papers in most cases.

PUBLISHING. After implementing the first survey to the CW group, but before giving it to the UH group, I changed the wording on these next two questions so that they read more clearly.

UH: 7) *In deciding on a journal to publish my research, the cost of page charges (if any) is an important factor for me to consider.*

1=STRONGLY AGREE	2=AGREE	3=NEUTRAL	4=DISAGREE	5=STRONGLY DISAGREE
3%	36%	42%	18%	0%

CW: 7) *In deciding on a journal to publish your research, how important are page charges to you?*

	1=VERY MUCH	2=A LITTLE	3=SOMEWHAT	4=NOT MUCH	5=NOT AT ALL
CW-EC:	20%	33%	27%	20%	0%
CW-Rest:	19%	27%	50%	0%	4%

The cost to publish a manuscript can be free for some journals to several thousand dollars in other journals (particularly AMS journals). I wanted to get a sense of what the respondents thought about page charges. The early-career groups tended to worry less about page charges, but the CW groups exhibited slightly more concern about page charges.

UH: 8) *In deciding on a journal to publish my research, an open-access journal is an important factor for me to consider (i.e., immediate and free access of your published article online to everyone).*

1=STRONGLY AGREE 2=AGREE 3=NEUTRAL 4=DISAGREE 5=STRONGLY DISAGREE

23% 55% 23% 0% 0%

CW: 8) *In deciding on a journal to publish your research, how important is open access to you (i.e., immediate and free access of your published article online to everyone)?*

1=VERY MUCH 2=A LITTLE 3=SOMEWHAT 4=NOT MUCH 5=NOT AT ALL

CW-EC: 13% 38% 38% 6% 6%

CW-Rest: 16% 36% 24% 16% 8%

9) *I have considered or would consider publishing in an online journal only (no print copy).*

UH: TRUE 70% FALSE 30%

CW-EC: TRUE 88% FALSE 12%

CW-Rest: TRUE 72% FALSE 28%

10) *I post (or will post) my articles online (on your web page or on an internet archive) after they are published.*

UH: TRUE 47% FALSE 53%

CW-EC: TRUE 67% FALSE 33%

CW-Rest: TRUE 52% FALSE 48%

These last three questions were aimed at exploring the attitudes of respondents to open access. Articles published in open-access journals are considered to be more downloaded, to be more highly read, and to produce more citations (e.g., Lawrence 2001; Antelman 2004; Hajjem et al. 2005; Eysenbach 2006), although not all studies reach that conclusion (Craig et al. 2007). Even articles that are self-archived online get more citations (e.g., Lawrence 2001; Henneken et al. 2006). My experience is that Europeans are more likely to embrace open access, although North American early-career scientists are more likely to embrace detailed personal Web pages. The results of questions 8 and 10 support my experience, although the results to question 9 do not.

ETHICS.

11) *If I publish a graphic created from a dynamic Web page application (e.g., CDC Reanalysis page, Wyoming soundings, Plymouth State surface maps), I should cite the source in my manuscript.*

UH: TRUE 97% FALSE 3%

CW: TRUE 100% FALSE 0%

I am very happy to see that nearly everyone would give the source credit. Not every author does. In fact, some authors try to hide any indication of the source. That is unethical.

12) *An M.S. student graduates and leaves the field of atmospheric science. The supervising professor writes up the manuscript and submits it for publication. I believe the author order should be Student and Professor, not Professor and Student.*

UH: TRUE 63% FALSE 37%

CW-EC: TRUE 44% FALSE 56%

CW-Rest: TRUE 36% FALSE 44% Depends 20%

I designed this question to be somewhat vague. Arguably, this question did not provide complete information about the situation, as the experienced authors of the CW-Rest recognized. Was the original idea for the research project the professor's or the student's? That might make a difference how respondents answered this question. Not surprisingly, students, especially the UH group, would want the student's name first.

13) *I find it acceptable to republish the methods section (e.g., description of a mesoscale model) verbatim in multiple papers to the same journal.*

UH:	TRUE 27%	FALSE 73%
CW-EC:	TRUE 24%	FALSE 76%
CW-Rest:	TRUE 31%	FALSE 69%

Responses to this question were relatively consistent among all three groups. There are several ways to plagiarize your own writing, this question presenting one. Likely, you do not own your own writing once it is published if you signed a copyright agreement with the publisher. There is an excellent Web page on plagiarism and self-plagiarism at <http://facpub.stjohns.edu/~roigm/plagiarism>.

14) *Submitting a conference abstract on research that has not been started yet is acceptable.*

UH:	TRUE 39%	FALSE 61%	
CW-EC:	TRUE 76%	FALSE 24%	
CW-Rest:	TRUE 58%	FALSE 38%	Depends 4%

Known as fabstracts, Fairbairn and Fairbairn (2005, 4–5) said that submitting such conference abstracts was unethical. I wanted to see what the respondents felt about this. The UH group was least tolerant of fabstracts, followed by a more evenly split CW-Rest group, whereas the CW-EC group heavily favored fabstracts.

PEER REVIEW.

15) *As a reviewer, I should perform all derivations in the manuscript myself to ensure their accuracy.*

UH:	TRUE 55%	FALSE 45%
CW-EC:	TRUE 75%	FALSE 25%
CW-Rest:	TRUE 63%	FALSE 37%

Opinions vary about how much effort reviewers should put into verifying details of the manuscripts, with roughly half of the UH group believing in performing the derivations to three-quarters of the CW-EC group believing in performing the derivations.

UH: 16) *I think the editor should rely on the reviewer comments in deciding whether to publish a manuscript.*

1=STRONGLY AGREE	2=AGREE	3=NEUTRAL	4=DISAGREE	5=STRONGLY DISAGREE
10%	72%	10%	10%	0%

CW: 17) *How much should the editor rely on the reviewer comments in deciding whether to publish a manuscript?*

	1=VERY MUCH	2=A LITTLE	3=SOMEWHAT	4=NOT MUCH	5=NOT AT ALL
CW-EC:	47%	18%	35%	0%	0%
CW-Rest:	84%	12%	4%	0%	0%

Editors are entrusted with making the decision about publishing manuscripts. Reviewers provide guidance to that decision. Presumably, if the editor has chosen good reviewers and the reviewers provide good reviews, then the editor should rely heavily on the reviews. But, situations may arise where the editor needs to depart from the reviews. Interestingly, the more experienced CW-Rest group wanted editors to follow reviewers recommendations very closely. Remember that the next time you hear an author complain about the reviewers' comments.

17) *What do you think the average (mean) rejection rate is among 42 leading atmospheric science journals?*

Individual journals published by the AMS reject 19–39% of manuscripts. For 46 journals that publish in the atmospheric sciences, the mean rejection rate is 37% (Schultz 2010a). (The 46 journals are more than the 42 that I had data for at the time the surveys were administered.)

Figure 1 shows the results of this question. The UH and CW-EC responses exhibited similar distributions (although the CW-EC group had no values more than 70%), and the most prolific publishers (CW-Rest) were tightly packed around the average value.

18) *A manuscript describing a case study of explosive cyclogenesis in the eastern United States is submitted to Monthly Weather Review. Although this case has not been described in the literature, no new scientific results are presented in the manuscript. Should the journal reject this manuscript?*

UH:	YES 43%	NO 40%	Maybe 7%	Other 10%
CW-EC:	YES 44%	NO 56%		
CW-Rest:	YES 27%	NO 55%	Depends 18%	

19) *A manuscript describes the improvement in the numerical forecasts of a tropical cyclone by assimilating satellite data using existing techniques. No new scientific results are presented in the manuscript. Should the journal reject this manuscript?*

UH:	YES 23%	NO 70%	Other 7%
CW-EC:	YES 44%	NO 56%	
CW-Rest:	YES 41%	NO 41%	Depends 18%

These questions were asked because *Monthly Weather Review* (the journal I serve as chief editor for) receives a number of papers that are simply synoptic case studies, numerical model simulations, or data assimilation case studies that lack new scientific results. Discussion among the editors about what to do with these manuscripts is ongoing. It would seem that respondents are generally split about what to do.

WRITING AND SPEAKING PREPARATION.

20) *What percent of your writing projects are started with an outline?*

Figure 2 shows the responses to this question. The majority of the respondents (59%) said that they started an outline 100% of the time. More experienced authors in the CW-Rest group were bimodal, with most either writing an outline or not writing an outline. Early-career groups (CW-EC and UH) had modes at 100% but were widely spread over most of the range.

UH: 21) *How many times do you typically rehearse a 10–15-minute conference talk out loud before presenting it?*

CW: 21) *How many times did you rehearse your talk out loud before this week's presentation?*

Figure 3 shows the responses to this question. The majority of the respondents (75%) rehearse their talk three times or fewer. The mode of the experienced group (CW-Rest) is zero with 42% of respondents, whereas all of the CW-EC group members practiced their talk at least once.

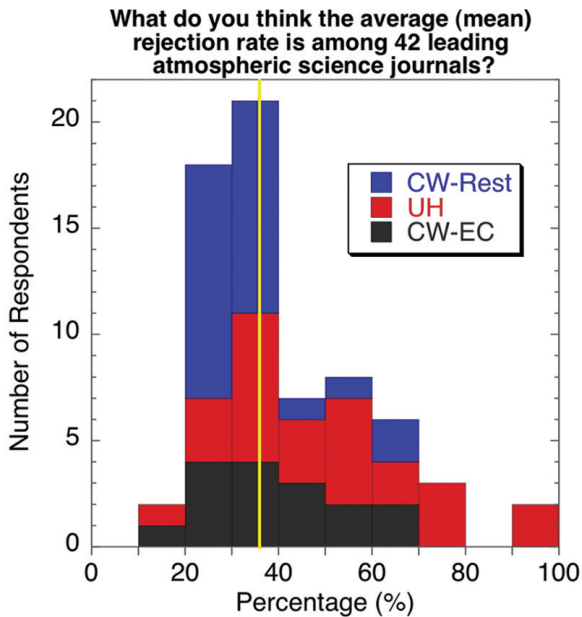


FIG 1. Number of respondents to the question “What do you think the average (mean) rejection rate is among 42 leading atmospheric science journals?” The yellow line represents the mean rate of 37% (Schultz 2010a).

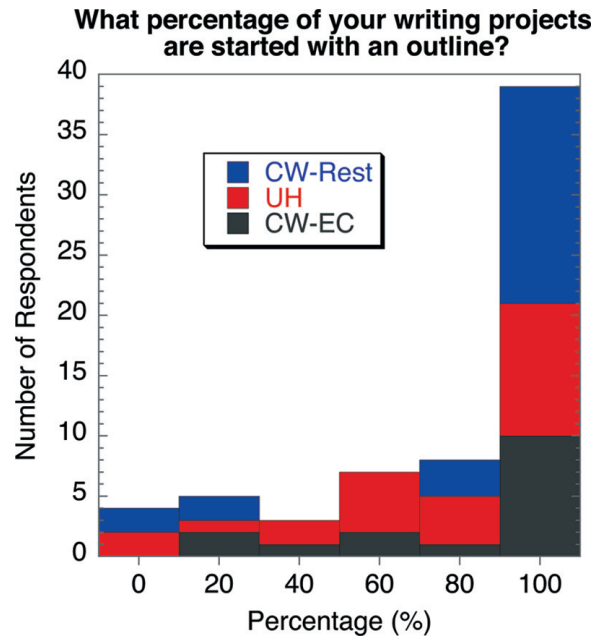


FIG 2. Number of respondents to the question “What percentage of your writing projects are started with an outline?”

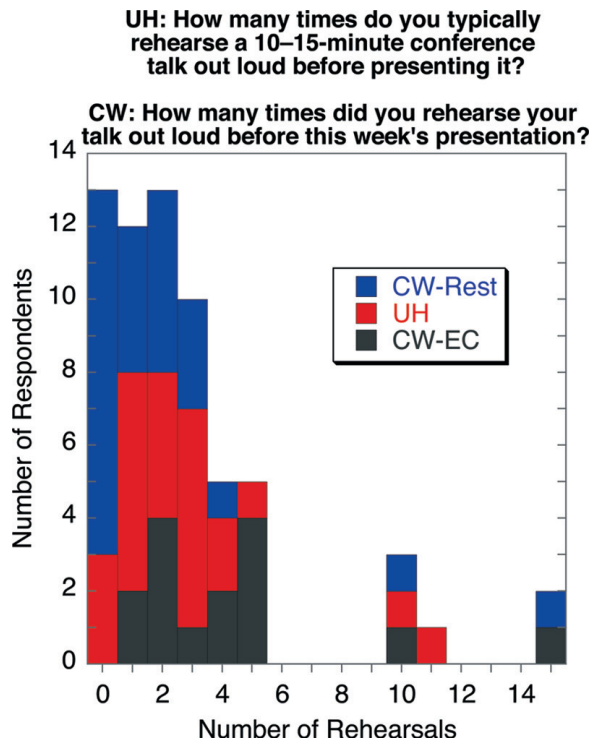


FIG 3. Number of UH respondents to the question “How many times do you typically rehearse a 10–15-minute conference talk out loud before presenting it?” and number of CW respondents to the question “How many times did you rehearse your talk out loud before this week’s presentation?”

PERCEPTIONS ON WRITING WITHIN THE UH GROUP. I asked these next three questions of the UH group to see how I could better focus the content of the course. As discussed in Schultz (2010c), even with the strong focus of writing in the course, many of the students indicated in the week-14 evaluation that they wanted even more writing as part of the course.

UH: 22) What do you feel are your biggest challenges in writing a scientific manuscript?

- English 7
- Starting the project/beginning 6
- Clear text 4
- Don't know scientific field /weak knowledge of science/references 3
- How to present results 2
- No time to write 2
- Most important issues and motivation 2
- Keeping short while telling important facts/being concise 2
- Focusing argument 1
- Not knowing what is publishable 1
- Lack of support from job for publishing 1
- Write longer 1
- Following structure without repeating information 1
- To say the things in my head understandably 1
- Introduction/conclusion/discussion 1
- Logical structure 1
- Maintaining exactness and readability 1
- To attain to what I show and not to what I'd have shown 1

UH: 23) What do you feel are your biggest weaknesses in writing using the English language?

- Vocabulary/not knowing the right words 7
- Sentences: structure, too long, too complex 6
- Grammar 4
- Writing fluently/style 3
- Stating things clearly 3

TABLE 1: Responses to the question, "What order do you typically read a scientific article?" Number of respondents who ranked each section of the paper in a particular order. **Bold-faced values represent the maximum value in each column; italicized values represent the secondary maximum or maxima.** Numbers in each column or row may not add up to the total number of respondents (74) because not all sections were ranked by all respondents.

Rank	Title	Abstract	Introduction	Figures	Tables	Data/methods	Results	Discussion	Conclusions
1	73							1	
2		70		3		1			
3		1	34	13	1	3	1	1	20
4			12	19	8	11	8	2	12
5			6	18	<i>12</i>	12	18	8	7
6			3	9	<i>12</i>	11	13	<i>17</i>	7
7			8	4	<i>12</i>	12	<i>16</i>	12	8
8		1	3	4	10	10	13	22	3
9	1	2	8	1	14	12	3	11	<i>16</i>

Language skills and inexperience 2
 Transition 2
 Punctuation 2
 Articles (the/an/a) 1
 Too simple language 1
 Spelling 1
 Prepositions 1
 Not knowing what to say 1
 “Redundant fluff” 1

UH: 24) *What resources do you use when you need help writing your scientific articles (e.g., more experienced coauthors, other classes at the university, writing center, Web pages, colleagues)?*

Coauthors 17
 Colleagues/professors 10
 Literature 4
 Web pages 3
 Supervisor/group leader 3
 Dictionary 2
 Student friends/peers 2
 Husband (or other native English speakers) 2
 Google 1
 Reviewers 1
 Style guides 1
 Brother (physicist) 1

ORDER OF READING AND WRITING A SCIENTIFIC ARTICLE.

25) *What order do you typically read a scientific article? Place a number (1–9) under each section.*

Title, abstract, introduction, figures, tables, data and methods, results, discussion, conclusion

26) *What order do you typically write a scientific article? Place a number (1–9) under each section.*

Title, abstract, introduction, figures, tables, data and methods, results, discussion, conclusion

TABLE 2: Responses to the question “What order do you typically write a scientific article?” Number of respondents who ranked each section of the paper in a particular order. Bold-faced values represent the maximum value in each column; italicized values represent the secondary maximum or maxima. Numbers in each column or row may not add up to the total number of respondents (69) because not all sections were ranked by all respondents.

Rank	Title	Abstract	Introduction	Figures	Tables	Data/methods	Results	Discussion	Conclusions
1	17	4	8	20	2	18		1	1
2	4	5	10	14	18	9	10		
3			12	17	9	17	15	1	1
4	1	2	8	6	19	14	13	6	1
5	3		10	5	4	5	16	22	5
6	3		7	2	6	5	7	23	16
7	6	6	10		5	1	5	9	27
8	16	24	5	3	2		1	7	9
9	19	28		1	3				9

These two questions were asked to gauge how authors read and wrote articles. The results are presented in Tables 1 and 2, combining all three groups to improve the results. Schultz (2009, section 4.2) describes nonlinear reading, where most busy people will read by skipping around through the manuscript to the parts that are most interesting to them. Respondents will read the title and abstract first, then proceed on to the introduction or conclusions, the figures and the interior of the manuscript, leaving the discussion, tables, and data/methods toward the end (Table 1). Fourteen of the 74 people who responded read an article straight through (including several that omit some parts).

In contrast, respondents tend to create the figures and write the data/methods first, followed by the introduction, body of the paper, and conclusions, ending with the title and abstract (Table 2). Although, a few authors will write the title first (Table 2). In contrast, only 4 of the 69 respondents will write the paper straight through from title to conclusions (perhaps excluding the figures and tables).

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