12

Use of personal pronouns in science laboratory reports

Jean Parkinson

Introduction

Undergraduate students are often recommended to use personal pronouns sparingly in their writing. This is particularly true for scientific disciplines in which impersonal writing is often urged as a way to demonstrate objectivity. As Hyland[1] notes, even writing style guides are contradictory, with some guides recommending avoidance of personal pronouns and others welcoming their use. Blanket advice to include or avoid personal language is equally unhelpful, as personal language is used for restricted purposes in expert science writing. For example, although research article writers and successful students use personal language in their writing, they restrict its use to particular functions.

This chapter focuses on undergraduate writers' use of personal pronouns in science, specifically in student laboratory reports. The laboratory report is an important student genre in experimental science disciplines, because it is central to student acquisition of process and laboratory skills. In addition, as I have argued elsewhere[2] laboratory reports are a pedagogical version of experimental research articles, in that both report on experimental results and share the Introduction-Method-Results-Discussion macrostructure.

Appropriate use of personal pronouns is essential to student writers in expressing stance, that is, in talking about their attitudes, judgements, and assessments of their experimental work.[3] Examination of how writers use *I* and *we* to refer to themselves in their writing reveals how the writers view themselves, their roles, and their status in comparison with that of their reader and their subject matter.

In this chapter I compare findings from the analysis of reports written both by writers for whom English was a first language and novice writers for whom English was a second language, my purpose being to inform the teaching of students who are inexperienced writers, particularly those writing in a second language.

Literature review

Although use of personal pronouns in a number of academic genres has been investigated, no study has focused specifically on the laboratory report. Prior studies have investigated

use of pronouns in essays by undergraduates learning English as a foreign language (EFL),[4] essays by writers for whom English was a first language,[5] case studies by EFL engineering undergraduates,[6] final year EFL undergraduate reports,[7] MSc theses by native speakers (NS),[8] and research articles.[9]

Based on an examination of personal pronouns in 27 first-year ESL essays in Singapore, Tang and John[10] suggest seven possible roles represented by *I* in student essays. These range from least to most powerful assertion of authorial presence: from no use of *I*, through *I* as a representative, *I* as guide through the text, *I* as architect of the text, *I* as recounter of the research process, *I* as opinion holder, and *I* as originator of knowledge.

Petch-Tyson[11] considered personal pronouns in essays by native speaker undergraduates, and also by French, Dutch, Swedish, and Finnish undergraduates. She found that EFL students in her data used up to four times as many personal pronouns as native speakers. McCrostie[12] found that Japanese undergraduates' essays in English contained a higher level of personal pronouns than the NS writing in Petch-Tyson.[13] In their second year of academic study, however, use of personal pronouns dropped. This implies that experience as an academic writer may be more influential on students' use of personal pronouns than whether the writers are English native speakers or not. The focus of these studies was limited to essays written in an EAP context, compared to my focus on how students use personal pronouns in disciplinary writing.

There are a number of studies of personal pronouns in writing in science disciplines. The genres and levels of study of the writers differ from those in my study. They largely concern research articles or theses by masters' students[14] or final year undergraduate students. Since they concern science disciplines, however, their findings, which I now move on to review, are relevant to my study.

One study of use of personal pronouns in disciplinary writing is by Hyland.[15] He investigated use of personal pronouns in fourth-year undergraduate theses in eight disciplines in Hong Kong, comparing them to use of personal pronouns in research articles. He found that personal pronouns were four times more frequent in research articles (RAs) than in the student writing:[16] there were 41 uses of personal pronouns per 10,000 words in RAs, compared to only ten per 10,000 words in the student writing. This lower use of personal pronouns in student writing may, on the one hand, result from students being explicitly taught to avoid personal pronouns; alternatively it may be that by their final undergraduate year, students' awareness of the power relations between them and their readers made them hesitant to be too assertive.

Distinguishing singular pronouns (such as *I*) from plural pronouns (such as *we*), Hyland's findings[17] for science and engineering disciplines were that the students used singular pronouns more frequently than the RAs did (4.9 uses per 10,000 words, compared to 0.1 uses in RAs). However, the students used plural pronouns far less frequently (4.5 times per 10,000 words, compared to 30.6 times in RAs). Thus, students use singular and plural pronouns about equally frequently, but the RAs avoid singular pronouns almost entirely. This may be partly consequent on the different genres compared, and partly because science RA authors usually write in teams, while students write individually. To counter this possibility, in this chapter I compare two sets of writing from the same genre (student laboratory reports); in addition, texts in my data are written by individual writers.

As suggested above, personal pronouns are used with restricted functions. Hyland[18] identifies five functions for which personal language is used, including *Stating a goal*, *Explaining a procedure*, *Stating results/claims*, *Expressing self-benefit*, and *Elaborating an argument*. In his RA corpus, 57 percent of the pronouns in Biology RAs in his corpus and 46 percent of the pronouns in Physics RAs served the function of *Explaining a procedure*. In the student reports

Table 12.1 Use of *I* and *we* in MSc theses and RAs in computer science

	I per 1,000 words	*We per 1,000 words*
Student corpus	8.31	1.46
RA corpus	0.23	7.30

Source: Adapted from Nigel Harwood, '"I hoped to counteract the memory problem, but I made no impact whatsoever": Discussing Methods in Computing Science Using I', *English for Specific Purposes* 24, no. 3 (2005): 243–67.

Table 12.2 Use of *I* and *we* in science RAs

	I per 1,000 words	*Inclusive we per 1,000 words*	*Exclusive we per 1,000 words*
Comp	0.23	2.35	4.82
Phys	0.10	0.52	5.45

Source: Adapted from Nigel Harwood, '"We do not seem to have a theory… The theory I present here attempts to fill this gap": Inclusive and Exclusive Pronouns in Academic Writing', *Applied Linguistics* 26, no. 3 (2005): 343–75.

in his corpus, 32 percent of the personal pronouns in Biology reports and 29 percent of the Mechanical Engineering[19] reports served the function of *Explaining a procedure*. *Explaining a procedure* is clearly a central function in science, and this study includes investigation of pronouns for this purpose.

Another study that focused on student use of personal pronouns in disciplinary writing is Harwood.[20] He compared use of *I* and *we* in a 62,000-word corpus of MSc theses and an 88,000-word corpus of RAs, both in Computer Science. In the student corpus, *I* was used in preference to *we*, but the opposite was true of the RAs (see Table 12.1). Again, this is likely to be because science RA authors write in teams, but MSc thesis authors work individually. Harwood[21] reports that 86 percent of the students' use of *I* served to recount and justify their procedure, with only 7 percent of instances functioning to elaborate arguments.

Harwood's work is valuable in showing usage across disciplines and in comparing student use of *I* and *we* with use in RAs. However, his analysis does not extend to undergraduate student writing or focus on writers for whom English is not a first language, which my study will do.

Harwood's[22] study of research articles (RAs) distinguishes inclusive from exclusive use of the pronoun *we*. In inclusive use of *we*, writers include both themselves and the reader, while exclusive use of *we* denotes the writer only. Harwood's findings were that Physics and Computer Science RAs tended to use *we*, with exclusive use of *we* being particularly frequent (Table 12.2).

Harwood[23] identified a number of roles that *we* can play in a text, three of which are important to student writing in laboratory reports. Firstly, he notes use of inclusive *we* to involve the community in the writers' own argument. For example:

(a) if what a firm should do is partly determined by what its stakeholders will do, *we* need an account of what its stakeholders will do (Business and Management)[24]

This use of inclusive *we* is particularly prominent in mathematical argument:

(b) letting Yt denote aggregate production of intermediate goods, *we* have … (Economics)[25]

A second important role of use of *we* is methodological description. This may be used exclusively, referring to the authors only (Example c) or inclusively, including both readers and writer (Example d):

(c) in Figure 1 *we* present results for the condensate and noncondensate densities and the current density for a range of amplitudes, A, of the coupling strength (Physics)[26]
(d) thus, *we* are seeing a resurgence in questions about what organizations are and how we should relate to them (Business and Management)[27]

Harwood notes that in science disciplines, the majority of uses of methodological *we* were exclusive. A third role for *we* is in suggesting directions for further research:

(e) in general, *we* need more studies that connect institutional change to variation in the context of organizational practice (Business and Management)[28]

This brief review of literature provides evidence for use of personal pronouns in undergraduate EAP essays, in graduate students' science writing, and in science writing in RAs. It also distinguishes a number of functions for which personal language is used in academic writing. However, there has been no comparison of how experienced and novice undergraduate students writing the same science genre use personal pronouns, prompting the analysis below. My aim is to identify areas of language development that would be useful for writing teachers of novice writers of laboratory reports, writers for whom English is a second language, or writers who, for whatever reason, are inexperienced writers generally. I therefore make suggestions for teaching appropriate use of personal pronouns in science writing, as well as improving students' expression.

Method

Data sets

The findings in this chapter are based on data drawn from two sources. The first source was student writing from the BAWE corpus[29] (British Academic Written English) in Biology and Physics. BAWE texts may be regarded as exemplary in the sense that the BAWE corpus is limited to student work that was awarded a distinction or merit grade. To control variables, only BAWE writing by native speakers of English was included. The second source of data was writing in the disciplines of Biology and Physics by student writers for whom English was a second language. This data was collected at a South African university between 2005 and 2007. I refer to this data set as SASS (South African science students).

There are a number of differences between the BAWE and SASS data sets that make the BAWE writing a suitable target for the inexperienced SASS writers. Firstly, BAWE writing contains only Merit and Distinction texts. A second difference is that the SASS writers are novice academic writers, with little experience of academic writing at school. In order to address historical demographic imbalances in the South African university population, SASS writers were selected into university from schools that were under-resourced with regard to teachers and infrastructure. BAWE writers, by contrast, speak English as their first language, and range from first year to third year students compared to the SASS students who are in their first year. In addition, in the English system, university students do A-levels before university and first year students are a year more advanced academically than students in the South African system.

The length of the texts is also different: BAWE texts range from 1,600 to 3,500 words, while SASS texts are 600–650 words long. The BAWE corpus is more balanced than the SASS corpus, with each text on a different topic. In the SASS Physics writing there are only three topics, and only one topic in the SASS Biology writing. This is a limitation of this study. It might also have been preferable to compare the writing of the SASS students with writing by experienced students in the same context, but no such corpus was available.

Data analysis

Wordsmith Tools 5.0[30] was used to identify all uses of *I* and *we* in the data. Concordance lines were then coded with regard to the function of each use of *I* or *we*. The use of each personal pronoun in the data sets was considered, adapting categories developed by Tang and John[31] and by Harwood.[32] These are shown in the first column of Table 12.4. Following Tang and John,[33] Table 12.4 is organized from most to least powerful authorial presence.

Results

Table 12.3 shows the frequency of use of *I* and *we* in the four data sets: laboratory reports in the disciplines and Biology and Physics from the BAWE corpus and from the SASS corpus. Table 12.3 shows that SASS students used *I* and *we* more frequently than did the BAWE writers. This reflects their inexperience in academic writing, as McCrostie[34] also found. Although personal language is largely discouraged in undergraduate science writing, it was not completely avoided by the BAWE writers. As Table 12.3 shows, both groups used *we* more frequently than they use *I*. Among the BAWE Physics writers, frequency of use of personal language, both *we* and *I*, in Physics was about double that of the Biology writers. The SASS Physics writers used personal language more than twice as frequently as the BAWE Physics writers. The most frequent users of personal language were the writers of the SASS Biology texts, who used personal language about ten times more frequently than did the BAWE Biology writers.

Table 12.4 shows that *I* was seldom used by the BAWE writers, and *we* was used for the restricted purposes of representing the disciplinary community and recounting experimental procedure. The SASS writers used both *I* and *we* much more frequently than the BAWE writers did, but the purposes for which they used them were also in representing the disciplinary community and recounting experimental procedure. In addition, *we* was also frequently used by the SASS writers to state opinions and make knowledge claims.

In what follows, I consider use by the SASS and BAWE writers of *I* and *we* for the functions in Table 12.4.

Table 12.3 Use of *I* and *we* in Biology and Physics in the BAWE and SASS data sets

	N words	*N texts*	*N writers*	*Average text length*	*Use of I*	*I per 1,000 words*	*Use of we*	*we per 1,000 words*
BAWE Biology	52,255	33	17	1,583	10	0.2	46	0.9
BAWE Physics	49,179	14	8	3,513	22	0.4	124	2.5
SASS Biology	31,979	49	49	650	67	2.1	237	7.4
SASS Physics	30,092	48	35	627	26	0.9	177	5.9

Table 12.4 Functions for which *I* and *we* are used by writers in the BAWE and SASS Biology and Physics data (per 1,000 words)

	BAWE: use of I		*BAWE: use of we*		*SASS: use of I*		*SASS: use of we*	
	Biology	*Physics*	*Biology*	*Physics*	*Biology*	*Physics*	*Biology*	*Physics*
Stating results/making claims			0.10		0.38	0.07	**0.41**	0.20
Stating opinions	0.11	0.10	0.04	0.08	0.41	0.30	**1.22**	**0.53**
Disciplinary informant/ textbook voice					0.06	0.03	0.06	0.03
Defining terms					0.06			0.03
Recounting experimental procedure	0.08	0.28	**0.73**	**1.26**	**0.72**	**0.47**	**3.10**	**4.29**
Guide/architect of text		0.02		0.04	0.41		0.13	0.33
Representing community				**0.81**			**0.97**	**0.43**
Representing community (people in general)			0.02	0.22			0.38	0.00
Research participants							1.00	0.00
Total	0.19	**0.41**	**0.88**	**2.42**	**2.03**	**0.86**	**7.25**	**5.85**

Use of I *and* we *to state results or make claims*

Personal pronouns were used to *state results or make claims* only five times in the BAWE data (Example f). The low frequency of this purpose used with *I* and *we* is congruent with the fact that stating claims indicates high authorial presence and BAWE writers may view use of personal pronouns to make claims as overly assertive.

(f) here, *we* have shown that mean fecundity of *Acyrthosiphon pisium*, is greater when on a good quality *Vicia faba* than when on a poor quality V. faba. (BAWE Biology)

By contrast, the SASS writers used *I* and *we* to *state results or claims* much more frequently (39 times). As Example g indicates, this relates to lack of caution exercised by the beginning academic writers, who are unaware of the need to hedge strong claims. Similar lack of caution is displayed in the use of the verb *prove* in Example g. There was frequent appropriate use of the modal *can* (Example h), implying that the possibility of concluding this rests on the results collected.

(g) [my results] are reliable, because *I*'ve proved it myself and they give almost the same results (SASS Biology)
(h) *we* can conclude by saying that the shorter the rope, the faster the oscillation (SASS Physics)

I *and* we *as opinion holders/to elaborate an argument*

Second in level of authorial presence, the BAWE writers used *I* and *we* sixteen times to *represent the self as an opinion holder or elaborate arguments*. This represents rather sparing use by the BAWE writers. As with using *I* and *we* to state results/claims, most of the associated

verbs (*conclude*, *predict*, *believe, have*, *think*, *feel, were able to say*, *estimate*, *expected*), show how this category is associated with human cognition (Example i).

(i) but the phonons would have pushed the point higher, not lower so *I* **do not think** that it is the phonons taking the results off the linear trend

In contrast, the SASS writers used personal language more frequently to *represent themselves as opinion holders or to elaborate arguments*: they used *I* 22 times for this purpose and *we* 55 times. No fewer than 39 of the instances of *we* were produced by the SASS Biology writers. The higher frequency of this category for the SASS Biology writers may be at least in part because the students were writing on a single topic, which involved measuring the pulse rates of the class members while resting and after exercise. They compared their results to published norms and then advanced arguments for whether or not the class members were physically fit or not. One of the distinctions they made was between fitness rates for the male and female class members, a subject on which some writers held strong opinions (Example j). This necessity for extended argumentation may have contributed to the high frequency of use of *we* to express opinions and elaborate arguments. This finding is a reminder of the important influence of topic on the language of a report, and suggests the necessity for tentativeness in drawing conclusions from this data set. The other data sets are more diverse in topic, with each BAWE writer writing on a different topic, and the SASS Physics writers writing on three different topics. As with the purpose of *stating results/making claims*, there was evidence that SASS students expressed opinions over-emphatically (Example k)

(j) the gender may also have an effect on the result as the result implies that female pulse is less than male pulse rate but *we* cannot conclude on this because it maybe (sic) males exercised more vigorously than females from the class and maybe the males are fitter than the females as we know that the lower the heart beat the fitter (SASS Biology)
(k) the result were not (sic) done by the professionals and they were not accurate but they were good result and *we* can say that they were perfect (SASS Biology)

To define terms

Using *we* and *I* in *defining terms* was infrequent, with no uses by the BAWE writers and only three uses by the SASS writers (Example l). Associated verbs were *define*, *call*, and *say*.

(l) well as *I* define it *I* can say that it is a force which is exerted on the blood and forces it to flow through the body (SASS Biology)

Disciplinary informant/textbook voice

Use of *I* and *we* to occupy the role of *disciplinary informant or speak using a textbook voice* was peculiar to the SASS writers. It shows their inexperience as academic writers in that they appeared to be using textbook discourse as a model. In producing this category, writers view their role as not only to report on experimental work but also, inappropriately, to produce authoritative generalizations or give advice. It suggests an inappropriate construction of their audience, who, as their course lecturers, are likely to be both more knowledgeable and more powerful in the sense of ability to award grades. The SASS writers produced six instances (Examples m and n). Associated verbs included *answer, tell*, *advise*, *describe*, *call*, *know*.

(m) according to my introduction on pulse rate *I* will answer some questions that are going to make it easier for anyone to understand pulse rate (SASS Biology)
(n) before we can go any further *we* must know that the source of magnetic fields are electric currents (SASS Physics)

Recounting experimental procedure

The category of *Recounting experimental procedure* was found by Harwood[35] to be the most frequent in his corpus of MSc dissertations in Computer Science. It was similarly the most frequent use of *I* and *we* in my four data sets. The BAWE writers used *I* for this purpose 18 times and *we* 96 times. The SASS writers used *I* and *we* in recounting experimental procedure more frequently than the BAWE writers, with 37 uses of *I* and 228 uses of *we*.

Differences between BAWE and SASS writers included tense use and the kinds of verbs used. Only 13 percent of the verbs used by the BAWE writers used present tense, with 87 percent being past tense verbs. SASS writers, in contrast, produced equal numbers of past and present tense verbs. Many of these were clearly errors, in which the context indicated a past action, but the present tense had been used. In Example o, the first verb in the sentence, *kept*, is correctly in the past tense, as it reports on work done in the past. However, both *increase* and *obtain* are, incorrectly, in the present tense.

(o) on the second table where *we* kept the voltage constant at 9v and **increase** the number of turns *we* **obtain** exactly the same results as what was expected in the theory (SASS Physics)

In 40 percent of the verbs they used to express this function, BAWE writers constructed themselves as performing cognitive functions such as *assuming*, *calculating*, *determining*, *estimating*, etc., rather than actions such as *finding*, *increasing*, *obtaining*, *recording*, etc. In contrast, in using *I* and *we* to construct themselves as performing the methodology of their experimental work, only 20 percent of the verbs used by the SASS writers indicated cognitive functions such as *deciding*, *computing*, *investigating*, *comparing*, etc., and there was a higher proportion of verbs in which they performed actions such as *doing*, *using*, *measuring*, *decreasing*.

I or we *as architect or guide*

I or we as architect/To state a purpose

In *stating a purpose*, the SASS writers again produced more instances than the BAWE writers, who used *I* and *we* for this purpose only three times. An example is:

(p) in order to test that gamma decay was a random radioactive process that obeyed Poisson's statistics *we* wished to show that [FORMULA][36] (BAWE Physics)

SASS writers used *I* and *we* 16 times in stating a purpose:

(q) in this report *I* had put more concentration on the pulse rate because *I* want to produce a report about how physically fit the class members in my class are (SASS Biology)

I and we as guide

Use of *I* and *we* in conjunction with the purpose of *guiding the reader through the text* is also used relatively infrequently by both groups of writers. BAWE Physics writers used *we* twice (Example r) for this purpose, while SASS reports used *I* or *we* ten times to express this purpose (Examples s and t).

(r) if *we* refer to Figure 11 *we* can see that it takes a lot of readings for the average to fully converge to a given value (BAWE Physics)
(s) *I* have also included the table which shows the resting heart rate of people of different ages beat per minute (SASS Biology)
(t) if *we* can look at the student number three on the result sheet (SASS Biology)

Representing the community

Both Tang and John[37] and Harwood[38] include categories in which *we* represents the community. Tang and John's example[39] (*It resulted in this English* we *know today*) suggests that the community referred to is people in general rather than the disciplinary community. However, Harwood's examples refer to the disciplinary community (Example a above) and also include the special case in which *we* refers to the disciplinary community in mathematical argument (Examples b and u). I distinguish between these three purposes below.

(u) the value of x 2 degree of freedom is computed … *we* see that the quality of fit is quite poor (Physics)

Representing the discourse community

BAWE writers used *we* 16 times to *represent the discourse community*. For instance, Example v includes in *we*, readers with some understanding of physics, who therefore would expect certain theoretical values for this source. This does not include people uninformed about physics. Similarly, Example w includes in *we* those readers who have enough knowledge to agree with this conclusion that the sample was less affected than cytochrome. Most associated verbs expressed cognition. In addition, they were commonly used with the modal verbs *can* or *would* (examples v and w).

(v) the values of [FORMULA] used were [FORMULA] at 5° intervals, and these results were later compared to the theoretical values *we* would expect for this source at the same angles (BAWE Physics)
(w) as the haemoglobin sample moved only one and a half centimetres *we* can say that it was less affected by the electric field (i.e. it had a smaller potential difference) than cytochrome (BAWE Biology)

Representing the community in mathematical argument

Using *we* to *represent the community in mathematical argument* was not represented at all in the BAWE Biology data set; neither was it used by the SASS Biology writers. However, it was used 40 times by BAWE Physics writers. The associated verbs are mostly ones that are used in mathematical reasoning. These include cognitive verbs like *assume* (Example z), *consider*, *can add*, *can determine*, *can find*, *can see*, *know* (Example x), *write* (Example y), as well as *get*, *have*, *obtain* (Example x). Many are used as possibility modals (Example y) or in conjunction with conditional forms (Example z).

(x) using [FORMULA] *we* know one mole is 56g and hence *we* have 0.502mol in this sample (BAWE Physics)
(y) these last two mobility effectors are constant with respect to temperature whereas phonons are proportional to temperature, so *we* can write: [FORMULA] (BAWE Physics)
(z) if we consider only small pressure and volume changes then *we* can assume this adiabatic process is reversible and therefore obeys the Poisson equation: [FORMULA] (BAWE Physics)

Three SASS Physics writers each employed *we* once to represent the community in use of mathematical argument (Example aa).

(aa) step (2) is a necessary reactant for the first step (1). If these equations (1) and (2) are added up *we* get the net equation (SASS Physics)

Inclusive *we* is used in mathematics argument to represent both writer and reader. It allows the writer to include the reader in the argument and take the writer through the steps showing how the solution is reached. Control of this register feature is essential for speaking/writing mathematics, and although infrequent in the SASS data set, its presence is indicative of gradual development of the feature.

Representing people in general

As argued above, Tang and John's example (the English that *we* know today) uses *we* to *include people in general*. This use is found in the SASS data, but not in the BAWE data. In Examples bb, cc, and dd, the authors make generalizations about why everyone's heart beats slowly while they are asleep, or why people in general ought to exercise, or why people in general should protect the ozone layer.

(bb) your heart beats slowly when you're sleeping it's because there is nothing much *we* do when *we*'re sleeping *we* just breath in and out only (SASS Biology)
(cc) *we* have to keep on exercising and eat some healthy stuffs so as to live long life (SASS Biology)
(dd) *we* must take good care of the ozone layer because it is very important to nature and without it *we* were going to suffer and die because of disease like skin cancer (SASS Physics)

We *as research participants*

We was also used to *refer to the writer and classmates as research participants* (Example ee). Although this is restricted to the SASS Biology writers in my data sets, it is not peculiar to them and is a reflection of the fact the students were both researchers and research subjects. For the laboratory that they describe, they measured and recorded the classmates' pulse rates under conditions of resting and exercising. Similar usages are found in a Food Science report in the BAWE corpus in which the writer studied his/her own food intake over several days in order to assess the adequacy of his/her diet.

(ee) when we did the resting pulse rate we taken during *we* were in the bed before we waked up in the morning (SASS Biology)

Teaching implications: appropriate use of personal pronouns in academic writing

Based on this analysis, there are a number of issues that it would be useful to address for those teaching writing to novice science writers. These include the high overall frequency of use of *I* and *we* by the SASS writers, as well as some unexpected functions for which *I* and *we* are used.

This high use of personal pronouns indicates the need to hedge more and to be less definite. The incidence of personal pronouns in the highly graded BAWE texts shows that writers do not need to be entirely impersonal in their writing. However, SASS writers need to learn to use these pronouns, particularly *I*, more sparingly, in order to construct themselves as showing an appropriate level of caution in their opinions and claims. They also need to remove themselves to a greater degree from their account of their methodology.

Of concern is the extensive use of *I* and *we* by the SASS writers to *state opinions and make claims*. This needs to be addressed by giving writers rhetorical strategies for expressing opinions and making claims without foregrounding themselves as much. Working with an exemplary laboratory report, rhetorical strategies used by these more proficient writers could be pointed out in class discussion.[40] Students need to learn that attaching claims and opinions to themselves can weaken what they say in science. Expression of appropriate caution would also be useful to teach. For example, in Example g ('[my results] are reliable, because *I*'ve proved it myself') students could be guided to show appropriate caution by using a weaker verb than *prove*. They could be guided to foreground themselves less, and to foreground the results/experiment more. For example, students could be made aware of options for expressing Example b such as 'the results show/indicate'. Explicit discussion of real examples would be useful, as would pointing out, or asking students to identify, how claims and opinions are expressed in good laboratory reports.

There was evidence of attempts to *give opinions* assessing the reliability of findings. This function is important in experimental science and is another area in which students would benefit from examples, discussion, and options for how to claim reliability convincingly, express doubt about reliability, or make suggestions for mitigating shortcomings. An example of where such discussion would be useful is Example k, where the writer is over-emphatic and also contradicts him/herself by claiming that the results were 'not accurate but they were good result and *we* can say that they were perfect'.

Although only a few instances were found in the SASS data of students using *I* and *we* to project the voice of a *disciplinary informant or textbook*, their presence suggests the need to explicitly discuss with students their relationship as writers with their readers. Writers who use *I* and *we* in examples such as l and m have clearly misconstrued the role that the laboratory report calls on them to play. In taking on a role as a disciplinary informant or textbook writer, they fail to see that the laboratory report concerns their experimental work, rather than theory, as the textbook does. This misconception points to a need for students to be exposed to reading matter beyond textbooks. Ideally, students should have some exposure to research articles as well. Such exposure will assist students in developing a wider sense of audience. Laboratory sessions function to teach students process skills, not theoretical knowledge. The laboratory report ideally serves to convince the instructor that the laboratory has been carefully and skilfully undertaken with accurate consideration and measurement reliability of results, and that the results have been accurately reported and insightfully discussed. Yet the instructor is only the primary, most immediate audience. Students need an awareness of themselves as entering and contributing to a disciplinary conversation in which a secondary, imagined audience is other 'researchers'.

As reported in Hyland[41]and Harwood,[42] *recounting experimental procedure* is one of the most frequent uses of *I* and *we* in science writing. As discussed above, two linguistic differences between the BAWE and SASS data point to fruitful directions for teaching. The first is that the SASS writers (for whom English was a second language) often used the simple present tense to recount their experimental procedure, instead of consistently using the past tense. Use of the present tense was sometimes in contexts where a past tense verb had been used earlier in the sentence (Example o); presumably repeated signalling of past actions was regarded by writers as unnecessary. To sensitize writers to the necessity of using past tense consistently when recounting the experimental procedure, students can be asked to underline the verbs used for this purpose in a model laboratory report, before discussing the tense used and why.

The second linguistic difference between BAWE and SASS use of *I* and *we* in recounting the experimental procedure is that BAWE writers used more verbs indicating cognitive functions. For novice academic writers, it would be useful to provide examples of these in authentic sentences, ideally in the context of model laboratory reports.

Harwood's study,[43] as well as my own findings in this chapter, indicate the importance of the use of *we* to represent the community. As discussed above, I found three subtypes. The first two subtypes, *representing the discourse community* and *representing the community in mathematical argument*, are exemplified in Harwood[44] and found in both my BAWE data and my SASS data. The third subtype, *representing people in general*, is found only in my SASS data.

Using *I* and *we* in *representing the discourse community* is a persuasive rhetorical device, which invites the reader to follow the writer's argument and agree with it. Use of the modal *would* (Example v), together with use of *we*, is similarly a valuable rhetorical resource enabling the writer to compare what was observed with what would have been expected. Similarly, use of *we* plus modal *can* (Example w) enables the writer to show that they are able to draw conclusions based on measurements. Concordance lines can be used to sensitize novice writers to this rhetorical resource.

Use of *we* to *represent the community in mathematical argument* is important in the mathematical sciences. Explicitly pointing out this use of *we* to novice writers, together with activities to support noticing associated verbs like *assume* (Example z), *consider*, *add*, *determine*, *find*, *see*, *know* (Example x) ,*write* (Example y), would be useful to novice writers.

Examples of the third subtype, *representing people in general*, has similarities with the use of *I* and *we* to project a textbook voice. In Examples bb, cc, and dd, the writer appears to be attempting to educate the reader, which is inappropriate in a laboratory report. Once again, explicit discussion of writer role and relationship with the reader would be useful.

Conclusion

This chapter has provided empirical data comparing use of personal pronouns in highly graded laboratory reports from the BAWE corpus and reports by novice writers in English as a second language. It was found that the novice SASS writers use personal pronouns more frequently than the highly graded BAWE writers. Although writers in both groups use personal pronouns to *recount experimental procedure* and to *represent the community*, in addition to these core functions, the SASS writers also use personal pronouns more frequently and more emphatically than do the BAWE writers to express their opinions and claims. In addition, they use some functions absent from the BAWE data, such as projecting a *textbook voice* and *representing people in general*.

Pedagogical applications of this study include exposing novice writers to model laboratory reports and guiding them in noticing activities related to these functions and how they

can appropriately be expressed. In addition, explicit classroom discussion of writer role and relationship with the instructor as reader is also recommended. Ideally, such noticing activities and discussions will enlarge student writers' sense of themselves as entering the conversation of their discipline, their sense of who their audience is, and their insight into how best to write persuasively for this audience.[45]

Notes

1 Ken Hyland, 'Authority and Invisibility: Authorial Identity in Academic Writing', *Journal of Pragmatics* 34, no. 8 (2002): 1095.
2 Jean Parkinson, 'The Student Laboratory Report Genre: A Genre Analysis', *English for Specific Purposes* 45 (2017): 1; Jean Parkinson, 'Teaching Writing for Science and Technology', in *Discipline-Specific Writing: Theory into Practice,* ed. John Flowerdew and Tracey Costley (New York: Routledge, 2016), 95–113.
3 Douglas Biber, Stig Johansson, Geoffrey Leech, Susan Conrad, and Edward Finegan, *Longman Grammar of Spoken and Written English* (Harlow: Longman, 1999), 966.
4 Stephanie Petch-Tyson, 'Writer/Reader Visibility in EFL Written Discourse', in *Learner English on Computer*, ed. Sylviane Granger and Geoffrey Leech (London and New York: Longman, 1998), 107–18; Ramona Tang and Suganthi John, 'The "I" in Identity: Exploring Writer Identity in Student Academic Writing through the First-Person Pronoun', *English for Specific Purposes* 18 (1999): S23–S39; James McCrostie, 'Writer Visibility in EFL Learner Academic Writing: A Corpus-Based Study', *ICAME Journal* 32, no. 1 (2008): 97–114.
5 Petch-Tyson, 'Writer/Reader Visibility'.
6 María José Luzón, 'The Use of *We* in a Learner Corpus of Reports Written by EFL Engineering Students', *Journal of English for Academic Purposes* 8, no. 3 (2009): 192–206;
7 Hyland, 'Authority and Invisibility'.
8 Nigel Harwood, ' "I hoped to counteract the memory problem, but I made no impact whatsoever": Discussing Methods in Computing Science Using I', *English for Specific Purposes* 24, no. 3 (2005): 243–67.
9 Hyland, 'Authority and Invisibility'; Nigel Harwood, ' "We do not seem to have a theory… The theory I present here attempts to fill this gap": Inclusive and Exclusive Pronouns in Academic Writing', *Applied Linguistics* 26, no. 3 (2005): 343–75.
10 Tang and John, ' "I" in Identity', S29.
11 Petch-Tyson, 'Writer/Reader Visibility'.
12 McCrostie, 'Writer Visibility', 102.
13 Petch-Tyson, 'Writer/Reader Visibility', 112.
14 Harwood, 'Memory Problem'.
15 Hyland, 'Authority and Invisibility'.
16 Ibid., 1099.
17 Ibid., 1099.
18 Ibid., 1099.
19 Frequency for Mechanical Engineering is cited here, as Hyland's 'Authority and Invisibility' student corpus did not contain a Physics sub-corpus.
20 Harwood, 'Memory Problem'.
21 Ibid., 253.
22 Harwood, 'Theory'.
23 Ibid., 349.
24 Ibid., 358.
25 Ibid., 358.
26 Ibid., 352.
27 Ibid., 351.
28 Ibid., 364.
29 Hilary Nesi, Gerard Sharpling, and Lisa Ganobcsik-Williams, 'Student Papers across the Curriculum: Designing and Developing a Corpus of British Student Writing', *Computers and Composition* 21, no. 4 (2004): 439–50.

30 Mike Scott, 'WordSmith Tools Version 5' (Liverpool: Lexical Analysis Software, 2008).
31 Tang and John, ' "I" in Identity', S29.
32 Harwood, 'Theory'.
33 Tang and John, ' "I" in Identity', S29.
34 McCrostie, 'Writer Visibility', 102.
35 Harwood, 'Memory Problem', 243.
36 Mathematical formulae have been removed from the BAWE corpus.
37 Tang and John, ' "I" in Identity', S29.
38 Harwood, 'Theory', 257.
39 Tang and John, ' "I" in Identity', S27.
40 Examples of good student writing can be found in the MICUSP corpus, http://micusp.elicorpora.info.
41 Hyland, 'Authority and Invisibility'.
42 Harwood, 'Memory Problem'.
43 Ibid.
44 Ibid., 245.
45 Acknowledgements: the data in this study come from the British Academic Written English (BAWE) corpus, which was developed at the Universities of Warwick, Reading, and Oxford Brookes under the directorship of Hilary Nesi and Sheena Gardner (formerly of the Centre for Applied Linguistics, Warwick, previously called CELTE), Paul Thompson (Department of Applied Linguistics, Reading), and Paul Wickens (Westminster Institute of Education, Oxford Brookes), with funding from the ESRC (RES-000-23-0800).