Experts and students writing about science for a more general audience

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Abstract

Informing and engaging the public in new scientific findings is becoming increasingly important. Graduate students are thus encouraged to develop skill in writing for an audience beyond their discipline. This article concerns writing by master's biology students of an assignment-type modelled on News and Views articles. Published News and Views articles, which are written by experts, summarise and critique a newly published study for the wider scientific community. To be convincing, academic writers must project an authoritative stance towards their topic and developing this ability is important for postgraduate students. They also need to be skilled at engaging readers, taking account of their readers' prior knowledge and their readers' need for recognition as disciplinary members. Using Hyland's (2018) model of interactional metadiscourse, this article compares a corpus of 30 News and Views assignments by master's biology students with 55 biology News and Views articles written by experts. We found that experts were skilled at using stance resources to project an authoritative identity, while students hesitated to explicitly include themselves in their writing; students' use of stance resources also reflected the limited nature of their topic knowledge. Students were relatively skilled at using engagement resources to include readers in the text, but some misjudged the audience and wrote for a broader, less knowledgeable audience. Suggestions are made for how these findings can be used to guide students in expressing an authoritative stance and engaging their audience.

Keywords: stance, reader engagement, postgraduate writing, science writing, metadiscourse

Resumen

Expertos y estudiantes que escriben sobre ciencia para un público más general

Informar y hacer partícipe al público de los nuevos descubrimientos científicos es cada vez más importante. Por ello, se anima a los estudiantes de posgrado a que también desarrollen su capacidad de escribir para un público no especializado en su disciplina. En este artículo se analiza cómo redactan los estudiantes de máster de biología un trabajo basado en el modelo de los artículos "News and Views". Este tipo de artículo, escrito por expertos, resume y critica un estudio reciente para la comunidad científica en general. Para ser convincentes, los autores deben proyectar una posición de autoridad hacia su tema. Desarrollar esta capacidad es importante para los estudiantes de posgrado. También deben ser hábiles para atraer a los lectores, teniendo en cuenta el conocimiento previo y su necesidad de reconocimiento como miembros de su disciplina. Utilizando el modelo del metadiscurso interaccional de Hyland (2018), el presente artículo compara un corpus de 30 tareas de "News and Views" realizadas por estudiantes de biología de máster con 55 artículos de "News and Views" de biología escritos por expertos. Este trabajo evidencia que los expertos eran hábiles en el uso de recursos que proyectan una posición de autoridad, mientras que los estudiantes eran reticentes a incluirse de forma explícita en su escritura; el uso que los estudiantes hacían de recursos para marcar su posición (*stance*) también refleja su limitado conocimiento del tema. Los alumnos fueron relativamente hábiles a la hora de utilizar marcas de compromiso (*commitment*) para incluir a los lectores en el texto, pero algunos no identificaron bien a sus lectores y terminaron escribiendo para un público más amplio y menos informado. Por último, se ofrecen sugerencias sobre el modo en que se pueden utilizar estos resultados para guiar a los alumnos en la expresión de una posición de autoridad y en la apelación de su audiencia.

Palabras clave: posición *(stance)*, participación del lector, redacción de posgrado, redacción de ciencia, metadiscurso

1. Introduction

Learning to be appropriately critical in reviewing literature is important for postgraduate students (Swales & Lindemann, 2002; Kwan, 2008). Students must express a critical stance towards their subject matter and show a collegial relationship with their readers by gauging readers' knowledge and disciplinary allegiances. Focusing on the writing of biology master's students, this article uses Hyland's (2018) metadiscourse framework to analyse writers' expression of stance towards published research, and their engagement with

readers. In this article, we compare two related genres: published News and Views articles and student assignments modelled on News and Views articles (hereafter N&V). Written by experts, N&V articles provide a summary of the findings of a newly published study and a critique of the study. Published in *Nature*-branded journals, N&V articles are addressed to the wider scientific community, rather than to those researching the topic. They are thus an example of the trend towards open science, involving the communication of scientific findings to a broader audience (Fecher & Friesike, 2014), examples of which include blogs (Luzón, 2013) and news articles (Miller, 1998). The specific aims of N&V articles are firstly a description of the research and, significantly, a critical assessment. This combination of summarising a study, critiquing it, and writing for an audience within the discipline but outside the topic makes this genre useful in developing graduate students' critical literacy.

1.1. Using professional genres as student assignments

Many student assignments are based on professional genres. Examples are student case study assignments in business and engineering, which have similarities with and support development of professional writing in these fields. However, the difficulties for students in assuming professional identities and values in such assignments have been documented in studies such as Esteban and Cañado (2004), who describe the difficulties for students of assuming a different role from their usual academic/student role. Such assignments function to give students experience of professional genres and induct students into the values of the profession. As Berkenkotter and Huckin (1993) note, in acquiring a genre, we also acquire the values of the community that uses the genre. Thus, in learning to write a professional genre, students acquire linguistic features which are an expression of professional values, practices and identities (Duff, 2008). Likewise, student literature reviews, which have similarities with literature reviews in academic articles, function to scaffold students into a valued formal academic style, and draw students into the academic values of using literature in constructing arguments.

However, student assignments based on professional genres differ in purpose and audience from the genres on which they are based, posing a complication for student writers (Freedman et al., 1994); this is also true of N&V articles and the student assignments modelled on them. Published N&V articles have the purpose of keeping the wider community informed

by summarising and critiquing a new study; in contrast, the purposes of student N&V assignments include improving graduate students' skill at critiquing literature and at recontextualising a study for a broader audience. N&V articles are addressed to the wider scientific community, but while N&V assignments simulate an article addressed to the scientific community, their reader is the course instructor. Students therefore have the difficulty of writing with an authoritative stance, despite being relative novices. Another difficulty is addressing the broader research community, while being aware of their instructor as their real reader. To investigate their success in dealing with these difficulties, this article uses Hyland's (2018) stance and engagement framework, described in the next section.

1.2. Theoretical framework: Writer stance and reader engagement

A variety of approaches has been used in studying the language that writers use to signal their opinions and attitudes. These approaches include stance (Biber & Finegan, 1989), evaluation (Hunston & Thompson, 2000), and appraisal (Martin & White, 2005). Hyland's (2018) metadiscourse framework includes writer stance and reader engagement as elements of interactional metadiscourse. Stance refers to language that writers use to convey an attitude toward their subject. It enables the writer to give their assessment of how likely, how important, how innovative the subject matter is. Reader engagement refers to the language writers use to include the reader and to show assumptions about the readers' membership of the discipline. Both an authoritative stance and features that make the reader feel included function to persuade readers to accept the arguments that the writer advances.

Hyland's framework includes four different stance features: attitude markers, boosters, hedges, and self-mention. Attitude markers, used by academic writers to project an academic and critical stance towards research findings, are of three types (Mur-Dueñas, 2010). These are assessment (e.g. *elegant* and *powerful* in Example 1), emotion (e.g. *surprising* in Example 2) and significance (*remarkably* and *contribution* in Example 3).

> Example 1
>
> King et al.1 present an **elegant** and **powerful** method to study the lysine carboxylome. [Expert BSNV21][1]
>
> Example 2

This is **surprising**, noting how simple, reliable, and well understood the rat's vS I region is [Student NVSWS12]

Example 3

This represents […] a **remarkably** large **contribution** for a single study to make [Expert BSNV48][1]

Boosters, used to emphasise the significance of research findings, are also of three types (Hyland & Zou, 2021). Certainty boosters indicate writer conviction (e.g. *clearly* and *demonstrated* in Example 4). Extremity boosters emphasise the extremes of a continuum (e.g. *best* in Example 5 emphasises the value of the method used in the study being reviewed). Intensity boosters amplify emotive strength (Hyland & Zou, 2021) as exemplified by *particularly* in Example 6.

Example 4

The current study **clearly demonstrated** the physiological consequences of activating pre- and post-synaptic GABAB receptors. [Student, NVSWS30]

Example 5

Gong et al.2 report one of the **best** tools so far for the optical monitoring of neuronal activity [Expert BSNV11]

Example 6

A **particularly** impressive discovery by the authors was the specificity of OCNH for Lys-CO2. [Expert BSNV21]

By using hedges writers show appropriate caution. Plausibility hedges share with the reader the writer's assessment of likelihood (*might* and *speculate* in Example 7); rounders concern assessments of precision (*generally* in Example 8); downtoners moderate the strength of a statement (*just* and *only* in Example 9).

Example 7

The authors do report an interesting association of the 53 risk alleles with increased levels of circulating biomarkers for liver damage, on the basis of which one **might speculate** that this association is due to liver damage from excess liver fat [Expert BSNV9]

Example 8

It seems likely to be **generally** true for DNA targeting by CRISPR–Cas enzymes [Expert BSNV55]

Example 9

Previously, **just** one Na+-binding regulator was known, the NhaR transcription factor, which is **only** known to regulate a handful of genes. [Expert BSNV41]

Using attitude markers, boosters and hedges, writers persuade the reader by giving their assessment of how important, significant, and likely the ideas being discussed are. Such judgements support the writer's display of authority and expertise. To an even greater extent, writers present themselves authoritatively through explicitly mentioning themselves (e.g. *I*, *we*, *one*) (see *one* in Example 7) and their responsibility for ideas and actions.

Reader engagement features show recognition of the presence of the reader; through their use, the writer creates a relationship with the reader. Hyland's (2018) framework includes five means of engaging readers: use of reader pronouns, asides, questions, directives and references to shared knowledge. Reader pronouns (e.g. inclusive *we*, *our* and *us*) explicitly including the reader in the text (in Example 10 the reader is recognised as knowledgeable about the field of animal communication).

Example 10

This work strengthens **our** growing understanding of the field of animal communication. [Student NVSWS16]

Using asides (see Example 11), which share the writer's opinion or experience with the reader, the writer treats the reader as a fellow member of the discipline, almost as someone known to the writer.

Example 11

Although a threefold difference could have conferred a substantial early relative advantage, the important question is not **(and never was)** what level of complexity could be reached with mitochondria [Expert, BSNV37]

By using questions, writers steer readers' thoughts in a particular direction, as seen in Example 12.

Example 12

Although, **what happens when so much glutamate gets stored in astrocytes, isn't it toxic?** [Student NVSWS20]

Similarly, directives (e.g. *Note that…*) guide the readers' interpretation of the text. By referencing shared knowledge (*of course…*; *well-known*), the writer positions the reader as a disciplinary member.

Writers of academic texts use stance and engagement features to assist them to advance an argument and gain reader agreement with their arguments (Mur-Dueñas, 2010; Hyland, 2018). These features help them write authoritatively and persuasively, displaying an appropriate disciplinary identity. The ability to project themselves as authoritative while at the same time engaging and convincing the reader is important for N&V article authors. The N&V author is an expert in the field of the scientific study being assessed who is writing for peers who are less knowledgeable in the sub-discipline than the author is. To be persuasive, the writer must acknowledge the reader as a fellow disciplinary insider while not overloading them with technical detail. For students, writing a N&V assignment is a complex task, because despite being novices, they must display an authoritative identity and use stance features to persuade readers of their arguments. They must also write inclusively for an imagined audience which is more general than their usual academic audience and less knowledgeable about the topic than they are, and this must be achieved without patronising the reader.

2. Prior studies of stance and engagement

Hyland's (2005b) study of stance and engagement in research articles in eight disciplines indicates that discipline is an important factor associated with variation in the signalling of writer stance and attempts to engage readers. He reports higher frequencies of stance and engagement devices in the humanities and social sciences than in science and engineering, suggesting the reason that the humanities and social sciences are more interpretive and thus use more hedges and markers of writer attitude in order to be persuasive. Of interest for our study is that of the eight disciplines in Hyland (2005b), biology had the lowest frequency of reader engagement features, with only 16.4 engagement markers per 10,000 words (compared for example to 48.5 in Physics). Except for hedges, stance features in biology were also comparatively low. Similarly, Hyland (2004a) found that biology postgraduate students used less self-mention and fewer engagement markers of the six disciplines in that study.

In recent years, several studies have focused on stance and engagement features in genres that recontextualise science for a general audience. Depending on the genre, the audience can range from non-experts to members of the broader science community. Audience is likely to be less predictable than the audience of a research article (Zou & Hyland, 2020). In science blogs, Luzón (2013) found a range of strategies that engage readers, including humour, reader pronouns, questions, and popularising features like intertextual references. Zou and Hyland (2019) found that writers mentioned themselves more frequently in blogs than in research articles, suggesting that blogs are less formal and show greater reader-writer closeness. They also found significantly more reader pronouns (*we, us, our*) in blogs. Doing more to ensure readers feel included may be more necessary given the less predictable audience.

Investigating another recontextualising genre, three-minute thesis presentations, Hyland and Zou (2021) found a higher frequency of stance markers than in research articles or academic blogs: with strict limits on time and a non-expert audience, speakers need to do much to persuade their audience. Interestingly, they found more frequent stance markers in science than in social science presentations.

Our own prior study (Yin & Parkinson, 2021), comparing stance features in research articles and the N&V articles, found a greater frequency of all stance features excepting self-mention in N&V articles than research articles. However, we did not investigate student use of stance features. In the present study, we therefore investigate how students use stance resources to project an authoritative persona, as well as how they engage with readers in N&V assignments compared with expert use of these resources in published N&V articles.

Having reviewed prior studies of genres that recontextualise science and noted their more frequent use of stance and engagement resources, we now review studies of stance and engagement features of student writing. Hyland's (2004a) study of 240 doctoral and master's dissertations in 6 disciplines (three in science and engineering) found PhD writing to be closer to the writing of experts than master's writing. PhD writers used a greater frequency of all stance and engagement features than master's students, except for attitude markers. Most significantly, PhD writers mentioned themselves far more than master's students.

Hyland (2005a) concerned 64 final year undergraduate project reports. He found that published articles use more than double the frequency of reader

engagement devices. The difference for reader references was particularly marked (5.5/10,000 words for students and 24.8/10,000 words for experts). In interviews, students reported their view of academic writing as impersonal and objective and viewed use of reader engagement devices such as questions as inappropriate.

The influence of educational experiences on use of stance and engagement features is suggested by two studies of undergraduate writing. Firstly, Lee and Deakin (2016) stress the effect of prior teaching. They compared stance and engagement features in high- and low-graded argument essays by undergraduate students whose first language was Chinese and who were studying at a US university. Successful essays contained a higher frequency of hedges, although use of boosters and attitude markers was similar. By comparison with L1 essays, the ESL essays avoided self-mention. They suggest the Chinese students' reluctance to show their authorial presence reflects prior learning experiences that stressed an impersonal objective stance. A second study, by Li and Wharton (2012), notes the effect of current teaching. Their study concerned two groups of Chinese ESL writers, one China-based, and the other UK-based. They found low self-mention by the China-based group (5.5/10,000 words), but high use by the UK-based group (126.4/10,000 words). They suggest this corresponds to differences in tutor feedback on student writing in the two contexts. They also found that the China-based group used more boosters and fewer hedges than the UK-based group. They explain that in the Chinese rhetorical tradition writers make strong assertions to promote persuasiveness. Another study, by Lancaster (2016), compared patterns of stance and reader engagement in high- and low-graded writing in economics. Interviews with instructors showed that skill in use of these patterns influenced instructors' judgements of writers' critical reasoning.

Although the N&V genre is increasingly assigned to science graduate students at a range of universities (e.g., University of Technology Sydney; The Australian National University; University of Michigan; University of Notre Dame, USA)[2], few studies have investigated their linguistic features. In particular, no studies known to us have investigated student writing of the N&V genre. To do so, this study considers the following research questions:

1. How does use of stance and reader engagement resources compare in published N&V articles written by expert scientists and N&V-style student assignments?

2. How does use of stance and engagement resources in N&V articles and N&V-style student assignments allow writers (a) to project an authoritative identity and (b) to construct a relationship with readers.

3. Method

3.1. Context

Students' whose writing is analysed in this study were enrolled in a master's programme in biology at an Australian university. The programme was a regular master's programme rather than an EAP programme. The class included both Australian students (generally first language speakers of English), and students from other countries, most of whom spoke English as a second language. Similarly, the educational background of the students varied between those who had done their prior studies in Australia and those who had studied in their home countries. Thirty students gave informed consent[3] for their writing to be analysed. Also, the course instructor agreed to be interviewed about the assignment aims, and four students agreed to be interviewed about their experience of the assignment. We discuss the course and assignment in Section 4.

3.2. The corpora

Thirty student assignments were collected from 2021 to 2022. Fifty-five N&V articles, published between 2015 and 2022, were collected from a variety of *Nature*-branded journals from the broad discipline of biology. Five articles were collected from each of 11 different journals. This range of biology journals matches the similar breadth of interest of the student assignments, which ranged in topic from molecular biology to conservation biology.

	Student assignments	Expert N&V articles
Number of texts/writers	30	55
Words in corpus	29384	59878
Average words per text	979.5	1088.7

Table 1. The corpora of student assignments and expert News and Views articles

To analyse the corpora, Hyland's (2018) list of interactional metadiscourse markers was supplemented by additional attitude markers identified by Mur-

Dueñas (2010). Also, all expert and student texts were read by the first author and additional markers were identified to supplement Hyland's list. This supplemented list is reflected in the counts and instances of stance and engagement markers in Tables 2 to 12. Wordsmith Tools was then used to search the corpora for all instances of each marker of stance (hedges, boosters, attitude markers, self-mention) and engagement. These markers were examined in context and coded to ensure they were functioning metadiscursively. Markers of each type were quantified, and the two corpora were compared. Stance markers were deemed frequent in the expert corpus if they were used 10 or more times; in the student corpus the level was set at markers used 5 or more times. Levels of 6 for experts and 3 for students were used for engagement markers, which were less frequent than stance markers. The levels for frequent use for experts was set at twice that for student writers because the student corpus was half the size of the expert corpus (see Tables 3, 6, 9 and 12).

4. The purpose of the assignment

The assignments were collected from a master's biology course intended to benefit students' prospects for advancement in a biology career. The course focuses on preparing students for communication with both a scientific and a popular audience. In an interview, the course instructor outlined the assignment aim as allowing students:

> to communicate a complex scientific issue […] to communicate it to a more general audience, and also critically analyse [it] in their own words, so they can reflect on the robustness and the background, and the novel aspects of the research.

The instructor reported that the course prepares students for a range of careers. In addition to academic careers, students go into health-related fields, environmental consulting, or teaching. In these contexts, "if they were talking to academics, specialists, it's a little bit easier, but […] they need to be able to communicate the science to their colleagues, like to a non-specialist audience". This is interesting as it shows the value placed by this master's programme on communicating science to a public audience (Fecher & Friesike, 2014), and on teaching students to communicate with an audience beyond academia. Thus, the intended audience of the assignment must be

carefully considered by student writers. Instructions in the assignment prompt include that:

> You can assume that your reader has some knowledge of biology but is not a specialist in the area of your article. […] Articles should not read like textbooks: most readers will have a general scientific background but specialized terminology should be avoided. You will be assessed on how well you have explained your article for the general reader. Your assessors may not be experts in the area of the article you have chosen.

The assignment is thus a complex task in that student writers must critique complex research while presenting an academic stance. They must present themselves as being an authoritative disciplinary insider. While taking account of a reader who is not an "expert in the area of the article", they must avoid talking down to the reader by making the assignment "read like textbooks".

One student interviewed commented on the difficulty of striking the right balance between explaining complex information in an accessible way without patronising the reader:

> I think the hardest part is actually simply finding the information enough for like a general audience. I think you know the papers that we're working with are really technical, so having to like really simplify and make sure that explaining [without] oversimplifying is the hardest for me.

This shows student awareness of the need to take audience needs into account. The same student gave the following example of using synonyms to achieve this balance:

> my paper had worked a lot with like erythrocytes. So instead of using 'erythrocytes', I used 'red blood cells'.

5. Stance and engagement resources in N&V articles compared with N&V assignments

In this section we address our first research question by comparing stance and reader engagement resources used in published N&V articles by expert scientists with those in N&V assignments.

5.1. Attitude markers in expert and student writing

As Table 2 shows, expert texts used more attitude markers per 10,000 words, but this difference did not reach significance.

	Students			Expert			Log-likelihood
	N	%	/ 10,000 words	N	%	/ 10,000 words	
Attitude markers	**326**		**110.9**	**723**		**120.7**	**1.63 ns**
Assessment	199	61.0%	67.7	449	62.1%	75.0	1.45 ns
Emotion	24	7.4%	8.2	62	8.8%	10.4	1.01 ns
Significance	103	31.6%	35.1	212	29.3%	35.4	0.01 ns

Table 2. Attitude markers in student N&V assignments and expert N&V articles

Although expert and student writers used a similar number of attitude markers overall, Table 3 shows that experts used a broader range of attitude markers than students. Experts used a significantly wider range of assessment markers (which signal novelty and interestingness), and they used a wider range of attitude markers overall. This is likely to be at least partly because of experts' more sophisticated expression and greater experience of writing.

Attitude markers	Student	Expert	Total number of attitude markers
Assessment	65	115	194
Emotion	12	21	48
Significance	27	42	58
Total	**103**	**178**	**300**

Table 3. Range of different attitude markers used in in student N&V assignments and expert N&V articles

As Mur-Dueñas (2010) found in business management research articles, most attitude markers in our study are used seldom but a few are frequently used. Table 4 shows the markers used frequently in each set of writing. Markers used frequently in both sets of texts are bolded in Table 4.

Attitude markers	Students	Experts
Assessment	expected, **first, new, novel,** unknown, **challenge, interesting, limited,** insight **comprehensive,** successfully,	**first, new, novel, challenge,** challenging, **interesting,** interestingly, unclear, **limited, comprehensive** powerful
Significance	significant, **key,** critical, **important**	essential, importantly, notably, major, **key, important**
Emotion	surprising	impressive

Table 4. Frequent attitude markers in student N&V assignments and expert N&V articles

For both groups, frequent assessment markers emphasised whether the critiqued research was *novel*, *interesting*, and the extent to which findings were *limited* or *comprehensive*. Frequent in student but not in expert writing was *successfully* (Example 13), while *powerful* (Example 1 above) was frequent in expert but not student writing. *Successfully* assesses the fact that the researchers managed to achieve a goal, while *powerful* assesses the level of excellence in achieving a goal.

> Example 13
>
> The authors have **successfully** demonstrated that the glutamine transporter is regulated by electrical activity [Student NVSWS13]

In introducing the idea of limitations of the study being critiqued, student writers frequently used *unknown* (see Table 4); instead experts used *unclear* (see Table 4), followed by suggestions for the future direction that researchers could take to fill this gap (Example 14). In contrast, student writers merely stated that something was *unknown* (Example 15) or more vaguely said it could be researched in future.

> Example 14
>
> While the biological relevance of these distinct patterns is currently **unclear**, it provides a starting point for interrogation through future hypothesis-driven experiments. [Expert, BSNV42]
>
> Example 15
>
> their work only alleviates the mechanism of one form of glutamate recycling, where it is left **unknown** as to the other possible sources of glutamate [Student, NVSWS13]

As Table 4 shows, students' most frequent emotion marker (signalling emotional judgements) was *surprising,* as in Example 2. *Surprising* could signal student writers' limited level of knowledge compared with experts. Experts' most frequent emotion marker was *impressive* (Example 16) suggesting the experts' greater experience in assessing research findings on a range from *impressive* to less *impressive*.

> Example 16
>
> This is an **impressive** achievement, because intact mammalian tissue is opaque and can be naturally fluorescent [Expert BSNV11]

5.2. Boosters

Table 5 shows that student writers used significantly more certainty boosters than expert writers, but significantly fewer extremity boosters. Students used certainty boosters such as *found, demonstrated* and *clearly* (see Example 4), stressing their strong commitment to the claims and the findings of the reviewed studies. Experts used the extremity boosters *least, most, completely* and *best* more frequently than the student writers, (Example 5 and Example 17). This suggests that student writers expressed more certainty about what they said, but that experts were better placed to judge the quality of the studies on a continuum and identify excellent work; in Example 17 an expert favourably compares the reviewed study to *most studies today*.

	Students			Experts			Log-likelihood
	N	%	/ 10,000 words	N	%	/ 10,000 words	
Boosters	**285**		**97.0**	**494**		**82.5**	**4.66, p < 0.05**
Certainty	265	93.0%	90.2	419	84.8%	70.0	10.23, p < 0.01
Extremity	7	2.5%	2.4	55	11.1%	9.2	15.76, p < 0.0001
Intensity	13	4.6%	4.4	20	4.0%	3.3	0.61 ns

Table 5. Boosters in student N&V assignments and expert N&V articles

Example 17

Figure 1 … incorporates … metrics to provide a more comprehensive analysis … than is typically performed in **most** metagenome studies today [expert BSNV4]

Similar certainty boosters were used frequently by expert and student writers (Table 6). However, some certainty boosters used only by students and not by experts could be argued to reflect an overly certain attitude: *obviously, prove, sure, really, certainly, proved* (Example 18). Little difference was found in the range of boosters used by students and experts.

Boosters	Student assignments	Expert N&V articles
Certainty	known, **knowledge**, **discovery**, proved, know, shows, **thought**, evidently, **demonstrate**, clearly, **clear**, **evidence**, **finding**, **show**, showed, **demonstrated**, **found**	established, **knowledge**, **clear**, **thought**, reveal, shown, **discovery**, **demonstrate**, **demonstrated**, find (v), **finding**, indeed, **show**, **evidence**, **found**
Intensity	very	particularly
Extremity	**most**	(at) least, **most**

Table 6. Frequent boosters in student N&V assignments and expert N&V articles

Example 18

Transcription factor RORγt has been **proved** to be an essential part of transcriptional programming (Ivanov et al.1). [Student NVSWS27]

5.3. Hedges

Overall, Table 7 shows that student writers used slightly fewer hedges/10,000 words than expert writers, but this difference was not significant.

	Students			Experts			Log-likelihood
	N	%	/ 10,000 words	N	%	/ 10,000 words	
Hedges	**439**		**149.4**	**933**		**155.8**	**0.53 ns**
Plausibility	345	78.6%	117.4	724	77.6%	120.9	0.20 ns
Rounders	35	8.0%	11.9	119	12.8%	19.9	7.73, p < 0.01
Downtoners	59	13.4%	20.1	90	9.6%	15.0	2.92 ns

Table 7. Hedges in N&V assignments and expert N&V articles

However, expert writers used significantly more rounders. These stress the approximate nature of data or findings, so they show how certain or exact they are; they allow writers to make generalisations, which student writers may lack the knowledge to do. Also, as Table 8 shows, expert writers used a wider range of hedges.

Hedges	Students	Experts	Total number of markers
Plausibility	40	60	92
Rounders	11	22	23
Downtoners	5	10	18
Total	**56**	**92**	**133**

Table 8. Range of different hedges used in student assignments and expert N&V articles

Interestingly as Table 9 shows, the rounders frequently used by expert writers suggested meanings of typicality (*generally, largely, typically, usually, often*) (see *generally* in Example 8 above), while the rounders frequently used by student writers suggested meanings of approximation (*about, around*) (Example 19).

Hedges	Students	Experts
Plausibility	**can**, **may**, **could**, **would**, **potential**, **might**, suggests, suggested, **possibility**, **possible**, **likely**, **potentially**, implying, assumed, propose	**may**, **could**, **might**, **would**, **can**, **potential**, **suggests**, **likely**, **possible**, suggest, probably, **potentially**, unclear, suggested, perhaps, **possibility**, indicates, seems
Rounders	about, around, mainly, tend to	generally, largely, typically, usually, often
Downtoners	**only**, just	**only**, almost

Table 9. Frequently used hedges in student assignments and expert N&V articles

Example 19

They claimed that **around** 300 extracted proteins were identified as RBPs in Arabidopsis [student NVSWS6]

In expressing plausibility (estimation of likelihood), students relied heavily on the modal verbs *may*, *could* and *would* (Example 20). This finding agrees with that of Hyland (2004a, p. 140), who found *may*, *could* and *would* to be among the highest frequency items in his corpus of postgraduate theses. These modals accounted for 54% of the students' plausibility hedges, compared with only 36% in the expert data. Experts used a wider range of hedges than students, using more lexical verbs to express plausibility than student writers (*indicates*, *seem(s)*, *propose*, *predict*, *appears* etc.) and a wider range of downtoners (e.g. *broadly*, *merely,* see Example 9). In particular they used a wider range of rounders (e.g. *generally*, *largely*, *typically,* see Example 8).

Example 20

this remarkable finding … **may** indeed also contribute to our understanding of pathophysiology at the synapse. [Student NVSWS17]

5.4. Self-mention

Student writers used no self-mention at all (see Table 10). This agrees with Hyland's (2004a) finding that master's students were unlikely to mention themselves in their writing. Expert writers used self-mention rather sparingly, and this was mostly exclusive *we* (Example 21), or exclusive *one*, *our* or *I* (Example 7). Thus, expert writers stressed their own role in the ideas in their article, while none of the student writers felt able to foreground themselves by use of self-mention. A log-likelihood test showed this difference to be significant.

Example 21

Thus, **we** are tempted to speculate that a core component of the antibacterial response is direct killing mediated by mitochondria… [Expert BSNV12]

Self-mention	Expert	Log-likelihood
We (exclusive)	8	
One (exclusive)	6	
Our (exclusive)	1	
I	1	
Total	16	12.78, p < 0.001
/ 10,000 words	2.7	

Table 10. Self-mention in expert writing

5.5. Engagement markers

Overall, students used more engagement markers than experts. This difference, not quite significant at the p < 0.05 level, is accounted for by significantly higher use by students of reader mention (Table 11).

	Student			Expert			Log-Likelihood
	N	%	/ 10,000 words	N	%	/ 10,000 words	
Engagement markers	**165**		**56.2**	**279**		**46.2**	**3.55 n.s.**
Reader mention	67	40.6%	22.8	66	23.7%	11.0	17.22, p < 0.0001
Appeals to shared knowledge	35	21.2%	11.9	100	35.8%	16.7	3.12 n.s.
Questions	33	20.0%	11.2	56	20.1%	9.4	0.68 n.s.
Directive	30	18.2%	10.2	44	15.8%	7.3	1.88 ns
Asides	0			13	4.7%	2.2	10.38, p < 0.01

Table 11. Engagement markers in students and expert writing

Compared with Hyland and Jiang's (2016) findings for biology research articles, both students and experts in the current study used reader engagement resources more frequently. This was particularly the case for reader mention (used 1.8 times per 10,000 words in Hyland and Jiang, 2016). Also used far more frequently by both groups of writers in this study than by biology research articles (Hyland & Jiang, 2016) were questions and reference to shared knowledge. An exception is that Hyland and Jiang (2016, p. 33) report higher frequencies for directives in biology research articles than in our study.

Reader mention

As Table 11 shows, students included the reader significantly more often than expert writers, using the pronouns inclusive *we*, *our* and *us* (Example 10, Example 22).

Example 22

If **we** can know the mechanism of this alternative metabolic pathway, **we** will have a further understanding of the Apicomplexans parasite and will also help **us** provide a more complete solution for drug design. [Student NVSWS10]

Student writers also used *you* and *your* (Example 23), which were unused by experts. Example 23, from a student, has a textbook/journalistic style rather than a research article style: firstly, an everyday illustration is used involving the reader (*you*) cutting their finger while chopping vegetables; secondly, although the student writer is addressing a reader who is a trained biologist, or at least a member of the science community, they "translate" the technical term "regenerate" into lay language, "heal", which could be viewed as patronising. Instead, as suggested by the student we interviewed, *regenerate* could be replaced with *heal*. Judging how much to simplify for readers requires judgement for students, making this "the hardest part" as one of our student interviewees noted (Section 4).

Example 23

If **you** get hurt on **your** finger while chopping vegetables, the skin can regenerate (heal) after a few days [Student NVSWS20]

Although they did not use *you* and *your*, experts did use *us*, *our* and *we*, but significantly less often than students (see Table 11). Experts also used the more formal inclusive *one* (Example 24), which was unused by students.

Example 24

Why was the mitochondrion initially necessary then, if not for energetics? This question is inherently flawed. Rather, **one** should ask: what was its immediate benefit when engulfed? [Expert BSNV37]

Asides

Although experts used asides sparingly, student writers used none at all. In an aside, the writer adds their own personal comment and judgement.

Because expert writers know more, they are more likely to have well-developed opinions and judgements (see Example 11).

Appeals to shared knowledge

Experts used appeals to shared knowledge more than students, but this difference did not reach significance. This was the most common of the five reader engagement categories used by experts. The most common marker used by both groups was the marker of logical reasoning 'it is *adj* to' (e.g. Example 25).

> Example 25
>
> Thus **it is reasonable to** imagine that the mechanism is analogous to that of Cas9 [Expert, BSNV55]

Expert writers also used humorous titles such as the pun in Example 26, or titles that employ shared/common metaphors more commonly than student writers. Luzón (2013) reports humour in science blogs, and Carter-Thomas and Rowley-Jolivet (2020) report a similar use of catchy titles in three-minute thesis presentations, where they serve as a hook to draw in the audience.

> Example 26
>
> Synapses get together for vision (Expert BSNV6)

Directives

Writers in both groups had a tendency to use the obligation modals *need to*, *must*, and *should*, (Example 27) and both groups of writers used fewer directives in the form of lexical verbs. Use of modal verbs was particularly pronounced in the student writing.

> Example 27
>
> To depict a big picture of circadian clock regulation, further researches of these three pathways **should** be the main direction of future. [Student NVSWS14]

Questions

Experts and students used questions to engage readers equally often. A difference was that students invariably used questions framed as interrogatives (with a question mark). Example 12 is from a student, and

Example 24 is an expert example. Experts also quite frequently framed questions as "a question that arises is…" or similar.

As Table 12 shows, a limited range of markers were used with any frequency. Of interest is the frequent expert use of markers of typicality *established, normally, conventional, typical* (Example 28). Because they know more, they have knowledge of what is typical that students lack.

Engagement marker	Students	Experts
Reader mention	We, our, us, you, your	We, our, us, one
Appeals to shared knowledge	it is *adj* to, humorous title, of course, we know, well known	it is *adj* to, humorous title, established, normally, conventional, typical
Questions	?	?, 'question'
Directive- modals	Should, need to, must	Should, need to, must
Directive	-	see
Asides (N)		( ), —

Table 12: Frequent engagement markers in student assignments and expert N&V articles

Example 28

This suggests that peptidergic signalling is probably mediated by neuropeptide diffusion through tissues and not by synaptic wiring **typical** of bilaterian nervous systems. [Expert BSNV36]

5.6. Comparing frequency of stance and engagement features in N&V with frequencies in other genres

In Sections 5.1-5.5, we compared use of stance and engagement features of student N&V assignments and expert N&V articles. In this section we consider how both of these genres compare with other genres: research articles (Hyland, 2005b, p. 187), academic blogs (Zou & Hyland, 2019, p. 720) and postgraduate theses in biology (Hyland, 2004a, p. 144) (Figure 1). Figure 1 clearly shows that in terms of frequency of stance features, student N&V assignments and expert N&V texts are situated below academic blogs and above both research articles and postgraduate theses in biology. The exception is that both student N&V assignments and expert N&V articles research articles have a lower frequency of self-mention than either research articles or postgraduate theses in biology.
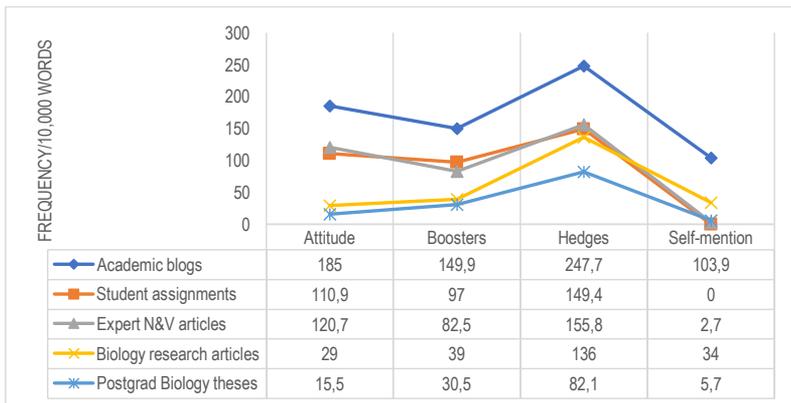
	Attitude	Boosters	Hedges	Self-mention
Academic blogs	185	149,9	247,7	103,9
Student assignments	110,9	97	149,4	0
Expert N&V articles	120,7	82,5	155,8	2,7
Biology research articles	29	39	136	34
Postgrad Biology theses	15,5	30,5	82,1	5,7

Figure 1. Stance features in student and expert N&V compared with research articles, blogs, and postgraduate biology theses.

Figure 2 compares our findings for engagement features in student N&V assignments and expert N&V articles with biology research articles Hyland (2005b, p. 187) and academic blogs (Zou & Hyland, 2019, p. 720)[4]. Again, the general trend is for the frequency of engagement features for student N&V assignments and expert N&V texts to be less than academic blogs and higher than research articles. The exception to this trend is that research articles use more directives than the N&V genres.

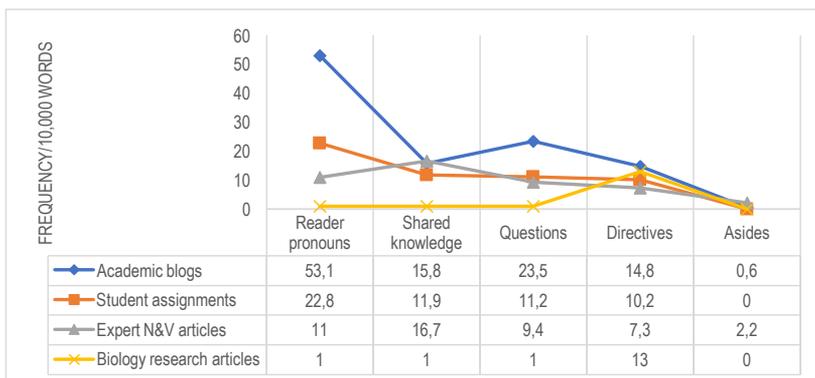|	Reader pronouns	Shared knowledge	Questions	Directives	Asides
Academic blogs	53,1	15,8	23,5	14,8	0,6
Student assignments	22,8	11,9	11,2	10,2	0
Expert N&V articles	11	16,7	9,4	7,3	2,2
Biology research articles	1	1	1	13	0

Figure 2. Engagement features in student and expert N&V compared with research articles and blogs.

Figures 1 and 2 indicate how the N&V genre, whether written by experts or students, compares with research articles, biology theses and blogs. Like blogs, the N&V genre recontextualises research originally written in the

more formal and restrained expression in research articles and theses. However, being intended for a disciplinary audience, it is more cautious in expression than academic blogs and does not share the level of engagement of blogs, whose intended audience is more general than N&V articles.

6. Projecting an authoritative identity and constructing a relationship with readers in expert N&V articles and student assignments

In the previous section we compared use of stance and engagement resources in expert and student writing. This section builds on this to address our second research question by discussing use of stance and engagement resources (a) to enable writers to project an authoritative identity and (b) to construct a relationship with readers.

6.1. Stance differences: Projecting an authoritative identity

We begin this section by summarising and discussing the stance features in student compared with expert N&V writing, and what this implies for the values and identities being projected (Berkenkotter & Huckin, 1993; Duff, 2008). We then move on to consider how the roles and identities of N&V writers, whether student or expert, differ from those expressed when scientists write other genres.

Expression of stance in the two data sets suggested that experts used a variety of stance features that reflect their identity as experts and demonstrate their greater insight and knowledge than the student writers. Understandably, student writers were more likely to use stance features suggesting limited knowledge.

As shown in Figure 1, Zou and Hyland (2019) found that academic blogs, aimed at a general audience, have significantly more attitude markers, than research articles which tend toward reticence. Between these two frequency extremes is the frequency of attitude markers in both N&V genres in our study (Figure 1), reflecting an audience of disciplinary insiders rather than a more general audience as in blogs. Comparing the attitude markers used by the two groups in our study, those signalling assessment and emotion supported the impression of greater knowledgeability of the experts. Both groups frequently commented on novelty and interestingness (Table 4).

However, *successfully* (Example 13) was only frequent in student writing while *powerful* (Example 1) was only frequent in expert writing. *Successfully* shows student writers commenting favourably that the researchers achieved their goals, while experts assessed how well the researchers achieved their goals. This difference could be interpreted as reflecting experts' greater ability to judge the level of achievement of the research.

Their use of attitude markers also showed experts' deeper perspective on the field. An example is students' frequent use of *unknown* in talking about limitations of the study being reviewed compared with experts' frequent use of *unclear* combined with a specific suggestion for future research (Table 4, Example 14, and Example 15). This demonstrates how stance features show an experts' identity as an experienced, knowledgeable researcher who can situate a study within past and future research. In contrast, student writers understandably don't share this depth of perspective of the field.

Also suggesting experts' knowledge is students' and experts' different use of attitude markers signalling emotion. Students' most frequent marker was *surprising*, possibly suggesting inexperience. Experts' most frequent marker was *impressive*, suggesting that experts' experience enabled them to make this assessment of where the research finding sits on a range from impressive to less impressive, just as they are able to judge a study as *powerful* or less *powerful*. These expressions of emotion in both N&V genres in our study could nevertheless be regarded as restrained and academic when compared with those (e.g. *impressed, happy, guilty, excited*) found in a study of blogs by Luzón (2013).

An expert identity was also expressed via boosters. Student writers used significantly more boosters overall than experts, as well as significantly more certainty boosters. Student writers chose to convince readers by stressing how certain they were; this high frequency of boosters corresponds with Zou and Hyland's (2019) findings for blogs. Experts used more extremity boosters, such as *most* and *best,* significantly more frequently, showing their greater ability compared with student writers to make judgements concerning the expected range (Example 5, Example 17). This agrees with experts' use of assessment markers (e.g. *powerful* and *impressive*) which also show experts' ability to judge the range of research.

In contrast, students frequently used some certainty boosters which were avoided by experts including *prove* and *obviously* (also found to be very common in blogs by Zou and Hyland, 2019). These project an overly certain tone, reflecting limitation in student writers' expression. Experts by

comparison had greater control of the academic scientific register and their significantly wider range of attitude markers and hedges as resources for expressing stance are part of their more nuanced control of this register.

Another stance resource that contributed to expert's expression of a knowledgeable identity was their use of significantly more rounders, hedges that provide an assessment of approximation (see Table 9, Example 8). Meanings implying typicality were used particularly frequently by the experts but not by the student writers. Knowledge of what is typical requires a broader knowledge of the field, which the expert writers have.

Self-mention was also important in enacting an expert identity. As Mur-Dueñas (2007) found, in research articles authors use self-mention to stress the novel contribution of their research. The use of self-mention is somewhat different in N&V articles where it is used to stress that authors are expressing their own opinion and making their own assessment. Experts used exclusive *we, one, our* or *I* to take responsibility for what they said. The expert writers were clearly confident stressing their own role in the ideas being expressed. In stark contrast, there was absence of use of these resources by students, which agrees with a finding by Hyland (2004a) that biology postgraduate students used the lowest frequency of self-mention of the six disciplines in that study. Hyland and Jiang (2016) note that these resources denote authority; they also guide the reader through the argument. In contrast, students' lack of exclusive *we, one, our* or *I* shows hesitation in enacting an expert identity. Another consideration is that students may be orienting to the academic context; through the period of their academic studies, it is likely that they have been discouraged from using these resources. This finding of students avoiding self-mention corresponds to that of Hyland (2004a), who found that the more experienced PhD writers in his study used self-mention far more than master's students, who said in interviews that they avoid doing so.

Our findings in this study emphasise how linguistic features express the values and identities of a genre (Duff, 2008). Although authors of N&V articles and authors of research articles belong to the same community, they play a different role in writing the two genres. Our findings show how N&V writers shift the linguistic features of their writing to express an identity that is less circumspect than that required when writing a research article. The greater frequency of attitude markers and boosters in N&V writing compared with research articles shows that the authors shift to be more

evaluative and more committed to their opinions in that their role as a N&V author is to place the research in a broader perspective for readers and consider the future possibilities of the research field. Comparing the student N&V writing with the expert N&V writing it is clear that the experts express a far more expert identity. However, comparing both N&V genres with research articles and blogs (Fig 1), we see that the students have been successful in shifting their stance to be more evaluative and less detached than a research article or thesis. This suggests the value of the N&V genre as a means of developing critical evaluation.

6.2. Reader engagement: Constructing a relationship with readers

In contrast to Hyland's (2004b) finding that final-year undergraduate projects in Hong Kong used only half as many instances of the reader engagement strategies of research articles, students in this study used about the same amount as experts. Compared with the undergraduates described by Hyland, the students in the current study, being master's students, were more advanced in their discipline, and were more likely to already identify as biologists. Importantly, the assignment task required them to view themselves as writing for fellow biologists. However, comparison with Hyland and Jiang's (2016) analysis of biology research articles shows that published N&V articles do far more to engage the reader than research articles. It is likely that the less specialised readership of the N&V article requires more emphasis on community and commonality.

Student writers in our study included the reader significantly more often than expert writers, using inclusive uses of *we*, *our* and *us* (Example 10, Example 22) although still not to the same extent as in blogs (Zou & Hyland, 2019). By this means, student writers constructed themselves as part of a community of biologists which includes both themselves and the readers. This is interesting when taken in conjunction with absence of self-mention by student writers and might suggest that students identify more with their own perspective as readers rather than as experts in the field. In contrast, as indicated by expert use of self-mention, the expert writers' perspective was firmly as a knowledgeable authority critiquing a new study in their field. This suggests the students were partially enacting a reader identity while the expert writers were enacting an identity as an authority.

Student writers also used *you* and *your*, which were absent from the expert writing. As discussed in relation to Example 23, use of these pronouns

sometimes suggested a textbook style, in which the writer is constructed as a "knower" compared with the reader. This impression was also promoted by translation of technical terms into lay language, suggesting a reader that is less knowledgeable than the writer. This misconstrues the readers' level of knowledge, whether the imagined reader is a biologist reading a N&V article, or the course instructor reading an assignment.

To address a community that includes the writer and readers, experts avoided *you* and *your*, instead using *us*, *our* and *we*, although less often than students. Experts also used *one* (Example 24), which is more formal than *us*, *our* and *we* and was unused by students. Thus, experts' use of reader pronouns showed more distance and formality than students.

Another feature in the expert writing suggesting greater formality and less reader engagement was use of questions. As Hyland (2002b) notes, questions, although an important strategy in engaging readers, are avoided in research articles, and indeed Hyland and Zou (2019) found far greater use of questions in blogs than in research articles. Students used more questions than experts and in this way were more engaging of readers than experts, Student writers also framed questions as interrogatives, using a question mark. In contrast, experts frequently framed questions as "a question that arises is…", which is more formal and arguably less engaging.

Appeals to shared knowledge were used by the expert writers more frequently than by the student writers. This may reflect expert writers more central membership of the biology research community and their greater awareness of the knowledge shared amongst readers.

Both shared knowledge and asides were used by experts more frequently than blog writers (Zou & Hyland, 2019) or research article writers (Hyland 2005b). In our study, asides were used by experts but not students. Experts used asides to share deeper insights as well as their own opinions and knowledge with readers. An aside treats the reader almost as a friend. Use of asides constructs expert writers as part of a community that shares the same values. It also shows greater confidence to share their own opinions and insights. As experts in their field, they are aware that their judgements will be acceptable to readers. This is not the case with the student writers who as relative novices have less knowledge and are as yet unknown in their field.

Although there were some differences in use of engagement features in the two corpora in our study, comparing both N&V genres with research articles and blogs (Fig 2), as Figure 2 shows, the students have been successful in

shifting their expression so that it falls between expression in blogs and in research articles to more or less the same extent as expert N&Vs. They have been successful recontextualising research for an audience that is broader than the audience of a research article, yet narrower that the audience of blogs.

7. Conclusion

In conclusion, and as might be expected, students were less skilled at enacting an expert identity than experts. Two important factors contributed to this, with the first being avoidance of personal pronouns that explicitly mention themselves and take responsibility for ideas being advanced. This avoidance reflects firstly their possible sense that they are not yet authorities in this field, secondly their inexperience of academic writing at this level, as well as their student identity. Another contributing factor was students' less expert use of stance resources, such as attitude markers that stressed their limited knowledge and use of certain boosters suggesting an overly certain tone.

In contrast, experts were skilled at enacting an expert identity through use of pronouns stressing their own responsibility for their ideas. Experts also signalled this by their use of attitude markers, hedges and boosters that made clear their experience and knowledge of the field and consequent ability to judge the worth of new research. This greater knowledge of the field meant they were better able to use hedges (rounders) to generalise and extremity boosters to compare the excellence of the study being discussed with others in their experience.

However, although less skilled at enacting an expert identity than experts, it is clear from our findings that students have been successful in appropriately shifting their stance from the more cautious expression found in research articles and theses in the direction of the more enthusiastic expression of popular science as reflected in blogs.

Students made good use of questions to engage readers. They also used more reader pronouns, although sometimes tended to be a bit patronizing, suggesting they had not quite judged the intended readers accurately. Again, their greater knowledge meant that experts were better able to include the reader through use of asides and appeals to shared knowledge.

7.1. Implications for teaching

Our findings have implications for teaching, either by biology professors introducing the N&V assignment to their postgraduate students or by ESP teachers involved in this teaching. These suggestions build on multiple prior studies which suggest the benefits of developing writer identity by guiding students' analysis of expert practices. For example, Hyland (2002a) suggests allowing students to analyse the use of personal pronouns in a typical research paper in the students' discipline. Swales and Lindemann (2002) discuss guiding graduate students to analyse research article abstracts before writing one themselves. Similarly, in teaching the N&V assignment, classroom discussion and analysis of an expert N&V article and identification of both stance and engagement features would be useful. Firstly, teaching should address with students the need for writers to include themselves in their texts to project an authoritative academic identity (Hyland 2002a). Real examples from professional N&V articles could be used to show how experts achieve this, and the contexts in which they use self-mention in their writing.

Attention could also be given to how experts use rounders and meanings of typicality (such as *generally, largely, typically, usually, often*) to make generalisations. In addition, experts' use of extremity boosters (such as *most* and *best)* in judging quality would be useful. Once again real examples from N&V articles could be used to demonstrate to students how experts achieve this.

Further classroom discussion should be given to who the intended readers of a N&V article are. The benefits of students' considering who their intended reader is have been discussed in many studies. For example, studies such as Forman and Rymer (1999), Gardner (2012), and Freedman et al. (1994) have found that students tend to address the instructor as audience rather than the 'imagined'/intended audience such as a client. Although the assignment prompt in this assignment stressed that intended readers were disciplinary insiders and that a textbook tone should be avoided, some students still produced writing that was a bit patronising. Discussion of how expert texts include readers through appeals to shared knowledge, humour and asides would be useful.

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NOTES

[1] Here and throughout the article, notations such as 'BSNV21' and 'NVSWS12' refer to texts from our expert and student corpora respectively.

[2] Links to task descriptions at these institutions may be found at: https://handbook.uts.edu.au/subjects/details/91817.html; https://programsandcourses.anu.edu.au/2019/course/biol8291/second%20semester/7680; http://www.umich.edu/~pwlab/Grading%20criteria.pdf; https://www3.nd.edu/~mpfrende/Evolutionary_Biology/Assignments%202017/Assignment%201%20-%20News_Views.pdf

[3] Ethical approval for the authors to collect student assignments and to interview instructor and students was granted by Australian National University (record number 12073)

[4] Hyland (2004a) did not report on frequency for each engagement feature.