English for Specific Purposes 63 (2021) 59–70

Contents lists available at ScienceDirect

English for Specific Purposes

journal homepage: http://ees.elsevier.com/esp/default.asp

Challenges in academic writing: Perspectives of Engineering faculty and L2 postgraduate research students

Linda H.F. Lin*, Bruce Morrison

English Language Centre, Hong Kong Polytechnic University, Hung Hom, Hong Kong

ARTICLE INFO

Article history:
Available online 10 April 2021

Keywords:
Academic writing
Challenges
Postgraduates
Language strategies
Engineering students

ABSTRACT

This paper investigates the academic writing challenges encountered by L2 postgraduate students in Engineering and the strategies they developed (or, from the perspective of faculty, should develop) to address these issues. Drawing on both quantitative and qualitative data gathered from 82 graduate students and 24 faculty in Engineering in three universities in Hong Kong, the study revealed similarities and differences related to topics previously identified in the literature. The study identified major differences between students and faculty regarding academic writing challenges. The primary concern of most L2 graduate students was challenges at the sentence level (i.e. local language features), whereas that of most faculty was challenges at the discourse level (i.e. global language features). The study also revealed that some student strategies for managing academic writing challenges (e.g. employing Google Translate) do not fully meet faculty expectations. These findings have significant pedagogical implications, for example, the need for providing appropriate writing models and writing interventions for L2 graduate students in Engineering.

1. Introduction

English academic writing presents a challenge for almost all writers and particularly for English as a second language (L2) and English as foreign language (EFL) students. This challenge has stimulated extensive research which has subsequently prompted writing interventions in higher education. The principal source of difficulty for undergraduates has been found generally to be vocabulary, which is compounded by another two essential elements of academic writing, register (tone and style) and organisation (cohesion and coherence) (Evans & Morrison, 2018; Hinkel, 2011).

L2 students at the graduate level can find academic writing even more taxing. Three interrelated factors can explain this. First, many L2 students have not received formal training in academic writing before entering their programmes (Hyland, 2016). This is amplified by insufficient attention to testing candidates' academic literacy prior to programme entry. Although the medium of instruction of these programmes is English, achieving a certain IELTS (International English Language Testing System) or TOEFL (Test of English as a Foreign Language) score is often the only entry language requirement (Wang, Andre & Greenwood, 2015). Both IELTS and TOEFL are university entry tests and very limited academic writing competence is needed to achieve an acceptable score (Lax, 2014). Second, academic writing is not integrated into the postgraduate curriculum in many parts of the world (Odena & Burgess, 2017). This is of major concern when considering that

* Corresponding author.
E-mail address: eclindal@polyu.edu.hk (L.H.F. Lin).

https://doi.org/10.1016/j.esp.2021.03.004
0889-4906/

there is no significant correlation between students' writing skills and the length of their study period in higher education (Reinhold, Batstone, González, Troian & Yu, 2017), i.e. writing competence may not improve along with the intellectual and cognitive development that normally accompanies students' progression to a higher academic level. The last and perhaps the most important factor is that postgraduates, in particular doctoral students, need to manage more specific and complex writing tasks, such as writing journal articles, grant proposals and theses. These tasks require writers' conscious efforts in not only developing an authorial voice but also showing an awareness of audience needs and are thus more demanding in terms of critical thinking as well as writing skills than those required in the undergraduate experience. When these demands are compounded with L2 learners' language limitations, writing can become an arduous and demanding process.

Despite the formidable hindrances outlined above, there has been a dearth of research into the challenges faced by L2 graduate students in their academic writing. The scholarship that has been undertaken in relation to the learning experiences of graduate students in higher education has mainly focused on student learning journeys (e.g. Cotterall, 2013; McAlpine & McKinnon, 2013; Odena & Burgess, 2017), supervisor-student communications (e.g. Starfield, 2010; Howells, Stafford, Guijt & Breadmore, 2017; Mason & Hickman, 2019) and strategies for 'choreographing' academic papers, funding proposals and theses (Flowerdew, 2016; Odena, 2013; Paltridge & Woodrow, 2012). An example of a study of graduate students' learning journeys is Odena and Burgess (2017). It identified three factors that are important for the success of most doctoral students, timely and constructive supervisor feedback, longstanding student commitment and a supportive network. An example of research on 'choreographing' academic texts is Flowerdew's (2016) study, which analysed a research grant proposal writing module provided for L2 graduate students by adopting a genre-based and lexico-grammatical approach.

Of the limited research that has investigated problems encountered by graduate students in their academic writing, three studies are particularly worth noting. The first one discussed the challenges from the student's perspectives (Hyland, 2016). Through a questionnaire survey delivered to over 150 students in Hong Kong and multiple interviews (four times in two years) with eight L2 students, this longitudinal study explored the writing challenges faced by doctoral students in Hong Kong and the strategies formulated by these students to tackle their difficulties. Reflecting results from other research (e.g. Dong, 1996), this study found that most students approached their academic writing by "probing in the dark and learning from mistakes" (p. 453). To manage the situation, many students resorted to the use of "model" academic papers. Notwithstanding the concerns expressed by some academics about students' textual appropriation (borrowing), which often leads to plagiarism (in the form, for example, of patch writing), some students successfully used these "textual resources" as their "textual mentors" (p. 167). They also leveraged peer support networks, their chosen academic discourse communities, when seeking assistance in their academic writing.

The second study, Huang (2010), explored voices from both students and faculty. This study reported on the findings of a large-scale questionnaire survey with 432 L2 students and 93 instructors at a university in British Columbia, Canada. Of the students, 95 were graduate students. Despite the small number of graduate participants, the study derived a number of intriguing findings relating to the commonalities and differences between the views of undergraduates, postgraduates and their instructors regarding the challenges of academic writing. The views shared by the two groups of students showed two different perspectives. First, both groups regarded academic writing as the greatest challenge in their studies. Second, both showed higher confidence than their instructors in their writing abilities, i.e. they perceived a higher competency level in their academic writing skills than their instructors assessed them to have. The major divergence in perspective between the two groups was that the undergraduates expressed more concerns about their language at the surface or local level while the postgraduates were more concerned about the discourse or global level. Language problems at the global level are also referred to as discourse-level errors, such as text organisation, idea development and awareness of audience needs, while those at the local level refer to surface-level errors, such as vocabulary, tense use and sentence structures.

The third investigation into academic writing problems encountered by graduate students is Casanave and Hubbard (1992), a milestone study although conducted 30 years ago. It examined the issue from the faculty perspectives. By gathering data from a survey of 85 faculty of graduate programmes in 28 departments at Stanford University, the study investigated three main areas: the writing required of its predominantly native English speaker doctoral students, the criteria employed to assess student writing, and the similarities and differences between the views of two groups of faculty, those in humanities and social sciences (HSS) and those in science and technology (ST). The study found that both groups of faculty, regardless of their different disciplines and specialisms, rated the importance of the global features of writing higher than the local features. Both faculty groups also agreed on the increasing significance of writing skills over time, i.e. as graduate students progress with their studies, their writing abilities become more important for their success. This importance is perceived as particularly pronounced when students start writing their theses. The view that differentiated these two groups of faculty was that HSS faculty rated "appropriateness of vocabulary use" as their major concern about their graduate students' writing whereas the ST faculty did not perceive this to be the main problem, indicating a possible discrepancy in the focus of academic writing skills required of ST and HSS graduate students (local vis-à-vis global language features).

The studies discussed above carry three key implications. First, Casanave and Hubbard (1992) identify discrepancies in faculty' views of the centrality of "appropriateness of vocabulary use" in the writing of HSS students and ST students. This suggests a need for independent data to be gathered from both students and faculty in either the HSS or the ST stream. This need also applies to Huang (2010) which indicates a seeming over-estimation by students of their language abilities. The respondents in her study also included students in both HSS and ST streams. Second, Huang's (2010) findings resonate with Casanave and Hubbard (1992) on the importance of the global language features in graduate students' writing. However, the former study gathered data twelve years ago and was based on L2 students while the latter collected data thirty years ago and

the participating faculty relied primarily on their observations of students with L1 (English as the first language) backgrounds. These two types of data are not directly comparable, which points to the need for more commensurate data from students with a similar language background. Third, Hyland's (2016) study reports on strategies L2 doctoral students operationalised in attempts to tackle their writing problems, but little information is revealed about the extent to which these solutions met the expectations of faculty.

Motivated by these considerations, the current study sets out to examine the writing challenges faced by Engineering postgraduate students, particularly those at the doctoral level, by comparing the perspectives of faculty and students. Engineering students form a large proportion of the ST graduate students in most countries around the world (Yoder, 2016) and thus provide a significant sample from which to draw inferences related to the language skills of ST graduate students. These students often enter graduate programmes with "stellar technical skills". They attend to "facts and the implications of those facts" (Lax, 2014, P.24), but often find constructing cogent academic arguments unduly testing (North, 2005). This situation is more serious with L2 Engineering students, many of whom enter their graduate studies unfamiliar with and unprepared for academic writing (Lax, 2014). Studying the challenges in academic writing encountered by this group of students can shed valuable insight into the writing challenges encountered by ST students with a L2 background. This study aims to answer three research questions:

1. How do views on students' academic writing challenges compare between L2 Engineering graduates and faculty?
2. How do perceptions of importance of global and local language skills compare between L2 Engineering graduates and faculty?
3. What are the prevailing practices of L2 Engineering postgraduate students in managing the challenges they encounter in their academic writing? Do these practices meet faculty expectations?

This paper commences by providing the institutional context of the study, and then proceeds to explain the questionnaire survey and semi-structured interviews which were used to explore answers to the above three questions. Research results and implications of the findings are then discussed.

2. The study

2.1. Institutional context

The current study was undertaken in three major universities in Hong Kong. The medium of instruction in these universities is English. The universities offer English courses and/or related workshops for postgraduate research students (e.g. Thesis Writing for Research Students, Academic Presentation Skills for Research Students). These are generic courses/workshops focusing on research writing genres and academic speaking skills, which are mandatory unless students can pass an exemption test. Although the universities require that students take these courses/workshops any time before their commencement of thesis writing, most students complete them in the first two years of their graduate studies. Research students in these institutions comprise mainly Doctor of Philosophy (PhD) students with a small number of Master of Philosophy (MPhil) students. These students need to achieve a minimum IELTS score of 6 (or equivalent test score) prior to commencement of their studies.

2.2. Participants

A total of 86 research students and 24 faculty from the three universities participated in the questionnaire survey. Of these respondents, the survey results of 82 students (77 PhD and 5 MPhil; 56 males and 26 females) and all 24 faculty (21 males and 3 females) met the data collection criteria and thus included in the data analysis. The respondents were from various Engineering streams, such as Electronic Engineering, Mechanical Engineering and Civil Engineering. Information regarding years of study and number of years of teaching experience for students and faculty respectively can be seen in Tables 1 and 2. The student respondents had all taken a course or workshops on research writing skills.

Table 1
Year of study - student participants (N = 82).

Year of study	Number (and percentage) of students
1	38 (46.3%)
2	24 (29.3%)
3	11 (13.4%)
4	8 (9.8%)
5 or above	1 (1.2%)
Total	**82 (100%)**

Table 2
Years of teaching experience - faculty participants (N = 24).

Year of teaching experience	Number (and percentage) of faculty
1–5	8 (33.3%)
6–10	5 (20.8%)
16–20	2 (8.3%)
20 or above	9 (37.6%)
Total	**24 (100%)**

These tables reveal two main features of the respondents. First, a large percentage of the student respondents (76%) were in the first or second years of their graduate studies (38% and 24% respectively). Second, most of the faculty respondents were experienced teaching staff (with more than five years of teaching experience). Another important feature is that the mother tongue of the majority of the participants in both groups was Chinese. More than three quarters of the participants in the student group (78%) were Chinese speakers (50 Putonghua speakers and 14 Cantonese speakers). The rest were native speakers of Southeast Asian (9.7%), European (8.7%) or African languages (3.6%). The faculty group also consisted mostly of Chinese speakers (75%, ten Cantonese speakers and eight Putonghua speakers), and the rest were native speakers of English (20.8%) and one native speaker of an Indian language (4.2%).

All the respondents were invited to a semi-structured interview after participating in the questionnaire survey which was administrated during the courses/workshops. However, only nine PhD students and eleven faculty, who were all PhD student supervisors, volunteered to participate in this part of the research.

2.3. Data collection

Both qualitative and quantitative information was gathered for this study. The quantitative data were derived from two 7-point numerical rating scale questionnaire surveys, one delivered to students (n = 82) and the other to faculty (n = 24). The questionnaire was administered in person, during student courses/workshops and at faculty meetings/workshops. The survey was promoted at these events, but participation was entirely voluntary and all responses anonymous. To further help ensure anonymity, the researcher at each event only approached those who requested clarification of points in the questionnaire. Informed consent was obtained from all participants.

The questionnaire was designed according to the instruments employed in Evans and Morrison (2018) and Hyland (2016). Both studies investigated the writing challenges of L2 tertiary students in Hong Kong, with the former focused on undergraduates and the latter on doctoral students. The surveyed items in the former covered fundamental academic writing skills while those in the latter focused on writing skills required of doctoral students. Triangulating items in the two studies and also considering the general principles for academic writing discussed in Bennett (2009), the current study identified eight items to be included in the survey referring to planning an academic paper, organising and supporting arguments, maintaining academic style, citing sources, connecting sentences and using technical vocabulary (see Tables 3 and 4 for further details). In order to minimise any possible confusion, these items were phrased by employing the terms used and concepts discussed in the writing courses/workshops that the respondents had taken.

The respondents were asked to circle a number indicating the level of challenge for each item along a continuum from most challenging (1) to least challenging (7). An example was provided to participants to illustrate how to indicate their responses. The survey was piloted with seven graduate students and five faculty and was subsequently revised based on the pilot results. The analysis only included results from students who had studied at the university for a minimum of nine months so that they had taken either an academic writing course or related workshops. This filtering process was implemented to ensure that the participants could fully comprehend references to the skills each item requires.

Despite the relative representativeness of the collected quantitative information, which offered a broad-brush landscape of the writing challenges encountered by L2 Engineering graduate students in Hong Kong, two sets of qualitative data were also elicited, one via comments in the open-ended section of the survey and the other via semi-conducted interviews. The former was to identify respondents' writing challenges beyond those already specified in the 7-point scale questionnaire and their strategies for managing the challenges. The latter was to gather more specific information such as reasons for and examples of the reported challenges/strategies. In other words, the interview data was used to supplement and verify information collected from the survey. Triangulating these three sets of data helped to provide deeper insight into the problems perceived by the respondents.

The interviews were conducted in English and were also mainly focused on the same two investigated domains, challenges in academic writing and strategies for addressing the challenges. Although the interviews followed a predetermined overall structure, i.e. based on four guiding questions (see Appendix), probing questions were asked for interviewees to clarify and expand upon comments, perceptions and any other interesting issues that arose during the interviews. The interviews lasted 30–50 min and were audio recorded and subsequently transcribed for detailed analysis.

2.4. Data analysis

Analyses of the percentages and means of the 7-scale Likert questionnaire results were performed via a t-test in order to compare the academic writing challenges perceived by the two groups of respondents, students and faculty. Before administration of the t-test, the data were checked for normality and homoscedasticity residues, and the results revealed that the residuals were normal and their variance homoscedastic ($p > .05$, ranging from .28 to .68).

Specialist software for thematic data analysis, NVivo, was deployed to help analyse responses gathered from the open-ended section of the questionnaire and the semi-structured interviews. The analysis involved first reading and annotating the transcriptions, and then categorising and sub-categorising the recurring themes.

The categorisation process followed Odena (2013) and involved repeatedly reading, comparing and cross-checking participants' remarks until all relevant text was grouped. An experienced independent researcher was then invited to validate the categorisation of remarks in the open-ended section of the questionnaire survey, i.e. to review the collated comments (132 from students and 34 from faculty) and check whether he would categorise them differently from the three main themes and eight sub-themes identified by the researchers. The validation result was that the independent researcher agreed with all the original groupings except for two items in the sub-themes, which were subsequently re-categorised by the researchers after detailed discussion with the independent researcher.

3. Findings and discussion

The findings are presented and discussed according to the sequence of the three research questions.

3.1. Estimation of writing challenges (students vis-à-vis faculty)

The first research question explores the challenges in terms of academic writing perceived by both sets of respondents, students and faculty. The results from the two questionnaire surveys (one delivered to students and the other to faculty) were compared (see Tables 3 and 4 for details).

Table 3
Mean challenge level ratings for academic writing skills - students vis-à-vis faculty (7-point Likert scale; 1 = most challenging, 7 = least challenging).

	Academic Skill	Mean (SD) (Students = 82)	Mean (SD) (Faculty = 24)	Sig. (2-tailed)
1	Planning long written texts	3.56 (1.45)	3.00 (1.38)	.095
2	Elaborating and supporting ideas	3.84 (1.32)	2.79 (1.25)	.001[a]
3	Organising ideas clearly and logically	3.88 (1.36)	3.00 (1.33)	.002[a]
4	Linking sentences smoothly	3.92 (1.43)	3.00 (1.32)	.005[a]
5	Using technical vocabulary appropriately	3.99 (1.35)	3.83 (1.17)	.612
6	Summarising & paraphrasing academic sources	4.20 (1.09)	3.71 (1.56)	.086
7	Using appropriate academic style	4.26 (1.40)	4.08 (1.35)	.592
8	Citing academic sources	5.09 (1.49)	4.67 (1.55)	.234

[a] Significant at .05.

Table 4
Perceived challenges in academic writing skills - students vis-à-vis faculty (7-point Likert scale; 1 = most challenging, 7 = least challenging).

	Academic skill		Response percentage on 7-point Likert scale						
			1	2	3	4	5	6	7
1	Planning long written texts	Students	9	17	22	22	20	10	0
		Teachers	17	21	25	25	8	4	0
2	Elaborating and supporting ideas	Students	1	15	28	23	28	5	0
		Teachers	8	43	29	8	8	4	0
3	Organising ideas clearly and logically	Students	2	9	24	25	30	10	0
		Teachers	8	25	29	25	9	4	0
4	Linking sentences smoothly	Students	1	15	28	21	21	14	0
		Teachers	17	17	29	29	4	4	0
5	Using technical vocabulary appropriately	Students	4	9	26	26	21	13	1
		Teachers	4	0	38	33	21	0	4
6	Summarising & paraphrasing academic sources	Students	0	5	16	29	33	17	0
		Teachers	4	21	13	29	13	20	0
7	Using appropriate academic style	Students	4	6	17	31	22	15	5
		Teachers	4	4	21	41	13	13	4
8	Citing academic sources	Students	1	1	12	25	17	25	19
		Teachers	4	4	13	25	17	29	8

Table 3 shows the mean and standard deviation (SD) of the two group of participants. To provide a fuller picture of the survey, the response percentages were also calculated (see Table 4). Careful examination of both sets of data led to three interesting observations. The overall trend is that the challenge levels of the eight academic writing skills were rated lower by the students than the faculty, although only three of these differences were found statistically significant. These three skills were all at the discourse level: elaborating and supporting ideas ($p \leq 0.01$), organising ideas clearly and logically ($p \leq 0.02$) and linking sentences smoothly ($p \leq 0.05$).

Second, students found academic writing skills at the discourse level, i.e. organisation (cohesion and coherence), clarity and logicality, most challenging whilst those pertaining to academic conventions (citing sources, summarising and paraphrasing skills, and adopting appropriate academic style), which require skills both at the sentence level and the discourse level, less challenging. Third, neither students nor faculty considered the proper use of technical vocabulary a major challenge in academic writing.

These results corroborate those of Huang (2010) which revealed that graduate students were more concerned about their language skills at the discourse level, which explains why global language features appeared at the top of the most challenging list in the current study. However, Huang's finding that the graduate students "self-assessed at a much higher perceived competency level than instructors assessed them in almost all cases" (p. 533), has not been confirmed by this study. Of the eight surveyed academic skills, only three of the student self-assessed skills were statistically higher than the faculty's perceptions.

Another interesting result pertains to the proper use of technical vocabulary – very few students and the faculty regarded this as very challenging (ref. Tables 3 and 4). This finding echoes Casanave and Hubbard (1992) who discovered that ST faculty did not perceive appropriate use of vocabulary as a major concern of their graduate students' academic writing. However, numerous other studies (e.g. Evans & Morrison, 2018; Hinkel, 2011; Wang et al., 2015) have suggested lexical use is one of the major obstacles encountered by L2 undergraduate academic writers. The student respondents of the present study were at the postgraduate level and from Engineering, a discipline in which people often convey meanings via "a combination of words, images, diagrams, and mathematical/graphical signs" in academic writing (Fang, 2005, p. 336). Whether this profile was a factor in the perceived challenges requires further investigation.

3.2. Writing skills at the local and global levels

To gain further insight into respondents' perceptions of challenges pertaining to vocabulary use, data collected from the open-ended section of the survey were examined. The objective of including the open-ended section was to allow the participants to comment on challenges beyond the eight items in the 7-point scale survey, and to explore the strategies they deployed (or, from the faculty perspectives, should deploy) to manage the problems. This section was included in both the student and faculty surveys.

Most respondents (80 students and 23 faculty) participated in this section. Their remarks varied in length (as short as a two-word phrase and as long as a whole paragraph) and complexity (with some focusing on one issue and others covering multiple points). The remarks were collated and then thematically analysed. The process yielded 132 related remarks from the graduate students and 34 from the faculty. Three main themes and eight sub-themes emerged from the analysis of the remarks. The three main themes pertain to the level of skills required for each sub-theme:

- Theme 1: skills at the sentence level
  sub-themes: vocabulary, grammar
- Theme 2: skills at the discourse level
  sub-themes: sentence connection, text organisation, intertextuality
- Theme 3: skills at both the sentence and the discourse levels
  sub-themes: academic writing conventions, clarity, conciseness

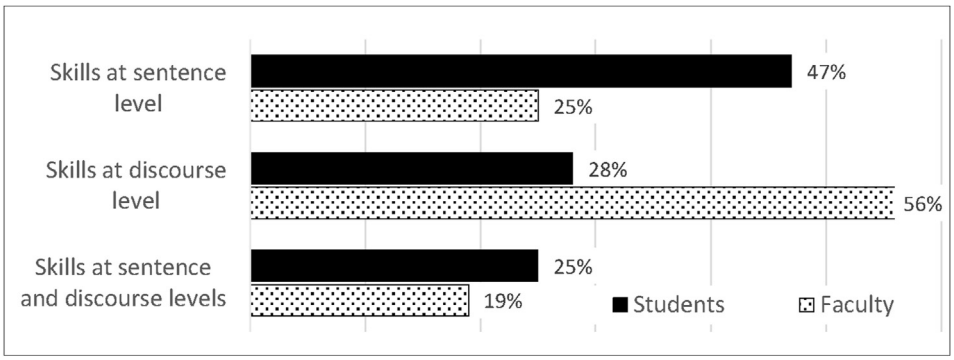

Figure 1. Percentage of comments provided by students and faculty on perceived writing challenges that fall into the three main analytical themes.

Figure 1 presents the percentage of comments focusing on challenges in academic writing as perceived by students and faculty. It shows that almost half of the challenges the students commented on were related to surface level skills (47%). The top concern was their ability to use vocabulary appropriately (35%), which was followed by correct use of grammar (12%). This finding is supported by qualitative data gathered from the interviews with the students, during which many lamented the difficulties in lexical use, either in general lexical use, see Comment 1(C1), or more specifically in using synonyms (see C2).

C1

I'm not happy … I use some words or phrases not understandable … My supervisor is confused about what I am writing. So he sometimes ask(s) me, "What's the meaning of this sentence?". This is the major challenge in my writing … I cannot fully express my idea(s).

C2

In my undergraduate study, I use(d) the thesaurus a lot, … try not to repeat the same word. But now I realise they don't really mean the same thing. So that's another challenge. Sometimes there are subtle differences between words … illustrate, demonstrate, show and exemplify… actually they are all different. And you shouldn't just replace one with another.

A number of remarks about using correct grammar were also found in the student interviews (see C3 for an example).

C3

The grammar seems to be the biggest difficulty in academic writing. Even (though) you know the rules, (you) just don't know when to use which rules or tenses. For example, I don't know when to use corresponding or corresponded.

These findings indicate that the respondents were fully aware of sentence level challenges. They still considered grammar and particularly lexical use as major challenges in academic writing. The main reason for the discrepancy between the first part (7-point scale questionnaire) and the second part (open-ended comments) of the survey was that the former focused on technical vocabulary while the latter on general lexical use. Disciplinary lexis can pose a major challenge to undergraduates who have newly entered university, specifically those who are from non-EMI (English as a Medium of Instruction) secondary schools. These students could find themselves overwhelmed by "a deluge of unfamiliar vocabulary" (Evans & Morrison, 2018, p. 1024) at the beginning stage of their academic studies. However, technical vocabulary is "more 'universal' in English" (Casanave & Hubbard, 1992, p. 43). After sufficient exposure to topics pertaining to their discipline, many students no longer find disciplinary lexis a major barrier to their studies (Zhang, 2013). Expanding students' repertoire of general lexical use, on the other hand, requires a much wider spectrum of language skills, and is consequently more difficult for students. This barrier may not be a major problem for L1 ST graduate student as indicated in Casanave and Hubbard (1992), but it is a prime concern for many L2 graduate students as evinced by the current study. The fact that the students were at the graduate level and in the Engineering disciplines had not alleviated the concern.

Another intriguing finding was the differences in the respondents' perceptions about skills at the surface and global levels. The percentage of student concerns about surface level skills (47%) was significantly higher than those of faculty (25%). In contrast, the percentage of faculty concerns about student writing problems at the global level (56%) was much higher than those of the students (28%). This indicates that the students were more worried about local language features whilst the faculty evinced less confidence in students' global language features.

The remarks on discourse level skills in the open-ended section include sentence connection, textual organisation, logicality and intertextuality. Similar to the results from the 7-point scale survey, where faculty showed significantly more concerns about students' challenges in smooth connection between sentences, textual organisation and logicality, the percentage of faculty who lamented students' lack of these skills was also much higher than that of students' answers in the open-ended questions.

One more factor that added to faculty concerns about students' global language features in the open-ended comments was intertextuality, which refers to writers' ability to effectively deploy existing sources to underscore the academic contribution of a new study (Badenhorst, 2019). This skill is essential for writing an effective Introduction and Literature Review of an academic text. A significant percentage of faculty comments was related to students' lack of academic intertextuality (25%), while the percentage of student remarks on this item was lower (19%).

The above finding is strongly supported by the qualitative data gathered from the interviews with faculty, where most faculty discussed the relationship between the skills at the two levels (global vis-à-vis surface). A telling illustration can be seen in C4.

C4

Vocabulary is not that important because basically in technical writing we often use similar vocabulary. …the logic, how it actually forms arguments, is more important.

The centrality of the global language features is further supported by the remarks of another faculty participant in the interview data (see C5).

C5

If you just want to fix language problems, you can simply send your paper to an editing service. But the service cannot fix the logic problems in your writing. Although most of the services are provided by native speakers [of English] … and they can fix every language problem in the paper, [if your logic problems remain], your paper still won't make sense.

It is also worth noting that although there is a similar percentage of comments from students and faculty on skills required at both the local and global levels (16.9% and 18.8% respectively), one sub-theme, conciseness, a factor that is regarded by many scholars as an essence of academic writing style (Bennett, 2009), appeared in the faculty comments a number of times, but was not mentioned by a single student in the survey. This finding agrees with that of Dixon (2004) which found sentences written by students are "too long more often than they are too short" (p. 149). This view was even more pronounced in the faculty interviews, where they underlined the importance of conciseness at the sentence level as well as at the discourse level (see C6).

C6
[Students] may repeat the same idea multiple times in different parts of the paper, so I keep telling them that writing a technical paper is different from writing a novel. You need to be concise and to the point. If you can say it in seven words, you should not say it in eight words.

3.3. Strategies for managing writing challenges

The third research question elicits respondents' strategies (or recommended strategies from the faculty perspective) for managing graduate students' writing challenges. The comments were gathered from 80 students and 23 faculty in the open-ended section of the survey. Totally, 123 strategies were reported by the students and 32 were recommended by the faculty. Figure 2 identifies the top five strategies reported by the student respondents, compared with faculty's recommended strategies in these five areas. The figure shows both groups believed that reading and following exemplary academic papers was the most effective strategy. This self-initiated strategy seems to have been particularly important for the students, and over two fifths (42%) reported having used it. The two groups also agreed on the importance of careful planning for an academic text and of seeking external assistance when necessary. The reported/recommended external help to which they referred mainly includes peer support within student networks, faculty feedback and writing courses. These findings reflect those of Hyland (2016), who found reading and peer support to be crucial for improving the academic writing of graduate students. The present study also reported a common study practice of Chinese learners of English - taking notes of useful phrases and memorising exemplary models, which was also noted in Hyland (2016). An example can be seen from a student participant of the present study who reported that "*I will choose some really beautiful articles and try* to *remember [memorise] them*".

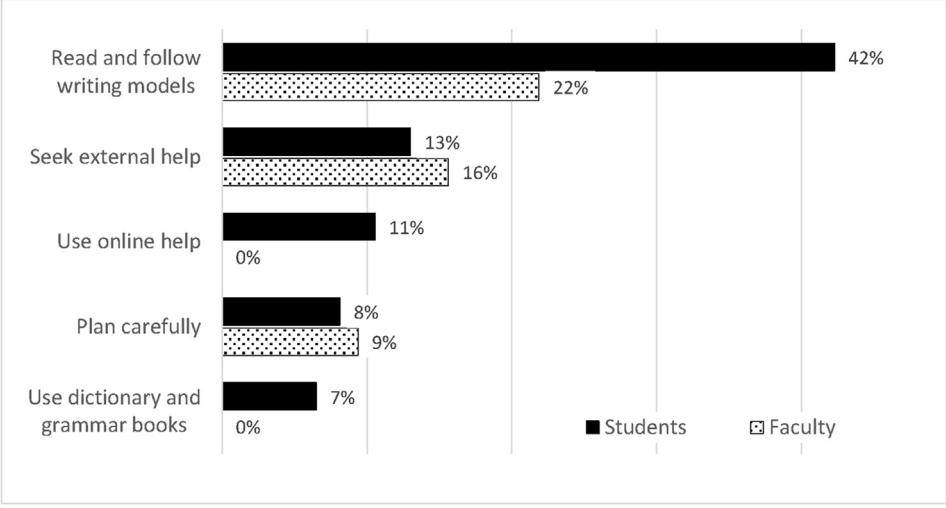

Figure 2. Percentage of comments on top five student strategies for managing writing challenges (compared with faculty views on these strategies).

There are two major differences between the two groups. The first one pertains to the use of dictionaries and grammar books. Nearly ten percent of the students (7%) reported using these resources, but no teacher respondent made remarks in this connection. One possible explanation for this is that the faculty were mainly concerned about global language features and thus did not feel the need for recommending strategies to improve skills at the surface level. The second discrepancy lies in the use of online resources. Over ten percent of the student respondents (11%) articulated their use of this strategy but it was not identified as a useful strategy in the faculty comments. One reported tactic of using online resources was to deploy *Google Translate* for academic writing. This approach to using modern technology for academic writing, although a practice that can cause many undesirable consequences (Groves & Mundt, 2015; Singh, 2017), was not rare amongst L2 graduate

students. This can be seen in the remarks from a number of interviews with the student participants. A telling example is as follows:

C7
Some colleagues even construct sentences in Chinese first and try to work them back into English. And that's vastly different [from our practice]. Especially I have seen so many colleagues … from mainland [China]. What they do is to write in Chinese … and then Google translate. I see so many guys there [doing that].

4. Conclusions, pedagogical implications, and future research

4.1. Conclusions

This study has examined some of the challenges in academic writing encountered by L2 graduate students in Engineering. It compared the perspectives of L2 graduate students with those of faculty. Participants' views were elicited via a questionnaire survey and semi-structured interviews with both parties. The comparison revealed similarities as well as differences related to topics previously identified in the literature.

First, the views of L2 Engineering graduate students and the faculty about academic writing challenges are rather different in some areas. The results from the analysis of the 7-point scale questionnaire data indicated that the student perception of their writing challenges was significantly lower than that of the faculty in skills at the discourse level (e.g. sentence connection, text organization and argument elaboration). The open-ended comments in the questionnaire, however, suggested that the student perception of their writing challenges at the sentence level, specifically in general lexical use, was higher than that of the faculty. These findings, although not in line with Huang (2010), who found that the graduate students in her study rated almost all their writing skills at a much higher level than that assessed by their instructors, have confirmed the results of many other studies concerning L2 students' awareness of the challenges of local language features (e.g. Evans & Morrison, 2018; Hinkel, 2011; Hyland, 2016).

Second, the perceptions of L2 Engineering postgraduate students and their faculty on the relative importance of global and local level of language skills in academic writing were also diversified, with the students more concerned about writing skills at the sentence level while the faculty more at the discourse level. This result is in line with that of Casanave and Hubbard (1992) in which all surveyed faculty, both in HSS and ST, rated the importance of the global features of writing higher than the local features. The result has also expanded on Casanave and Hubbard's study by identifying the primary concerns of L2 graduate students regarding their writing skills. Another related conclusion derived from the current study is that although L2 graduate students and their faculty may not perceive technical vocabulary as a major barrier in academic writing, they were fully aware of the demanding nature of general lexical use. This points to the need to differentiate students' competence in the use of technical vocabulary from that of their use of general lexis, which is a significant pedagogical factor to consider in the writing interventions for postgraduate students in Engineering.

Finally, the most prevailing strategies of L2 Engineering postgraduate students in overcoming their writing challenges were reading published academic papers and using them as models. However, with the advance of modern technology, some students adopt machine translation (MT), in particular *Google Translate,* for their academic writing. This MT tool, despite its ability to "produce stretches of clear and accurate English" (Groves & Mundt, 2015, p. 117), can only achieve a limited level of accuracy. The translation produced by this tool was often "patchy, and at times led to a breakdown of clarity" (p. 117). A more important consideration is that this tool was unable to manage issues "beyond the sentence" (p. 118), i.e. not able to help students with language skills at the discourse level, issues with which many faculty believed the graduate students needed assistance the most.

4.2. Pedagogical implications

These conclusions have very significant pedagogical implications. They point to the paramount importance of two types of support that should be offered to graduate students: providing appropriate writing examples, and delivering timely and subject-specific writing interventions. Using published academic papers as models, despite concerns about its potential risk of leading to plagiarism (Abasi & Graves, 2008), is a "legitimate" learning strategy for students (Jones & Freeman, 2003, p. 168), and is also understandably the most immediate and practical measure for novice writers to take when managing their writing challenges. Problems in relation to this practice are very likely to arise when students "use inappropriate models" or "when appropriate models are used inappropriately" (p. 168). To ensure that graduate students follow appropriate examples, articles that are highly regarded in their own discipline both in content and academic writing style should be provided. However, this is an area in which many graduate students were "probing in the dark and learning from mistakes" a decade ago (Dong, 1996, p.453); and the situation has not improved much since (Pelger & Sigrell, 2016).

This situation points to an urgent need to provide research students, in particular those who have recently entered university, appropriate writing models including ones that have been annotated (e.g. annotated academic articles and theses). Appropriate models are "textual resources" and can play the role of "textural mentors" for students (Hyland, 2016, p. 166). These textual mentors are valuable in developing students' skills at the sentence level (e.g. lexical use) and are even more instrumental in improving students' much needed skills at the discourse level (e.g. cohesion and coherence). Providing

appropriate writing models requires close interdisciplinary collaboration between faculty in language teaching units and those in the content departments. Such collaboration, which is at the core of a Writing Across the Curriculum approach to academic writing enhancement, is a growing trend in higher education (Vrchota, 2015) despite challenges encountered in the process. These challenges range from a paucity of administrators' long-term financial commitment (Cox & Galin, 2020) to a lack of faculty support, which is often manifested in "pseudo-compliance" or even "explicit rejection" (Davison, 2006, p. 466). Despite such difficulties, many institutions have successfully established interdisciplinary collaboration (Adler-Kassner, 2019). A noteworthy example was a joint initiative in which language professionals and the faculty in a content department co-developed an e-learning tool and a discipline-specific corpus for graduate students to explore language use in the research articles in the discipline (Lin et al., 2017). Outcomes from such collaborations provide "optimal conditions" for students to "learn the important language or rhetorical norms of their field" (Gilmore & Millar, 2018, p. 6).

The second significant implication of this study is the need for writing interventions for L2 graduate students. Effective writing classes can help scaffold student learning by analysing the primary moves in each main section of an academic paper; for example, the three moves in an effective Introduction of an academic text (Swales & Feak, 2012), a model which has been widely adopted by academic writers. Conducting such an analysis is important for improving students' ability in ensuring intertextuality, which is a pre-requisite skill for writers to produce an effective literature review (Badenhorst, 2019). This instructional discourse analysis may also help prevent students from using appropriate models inappropriately, the second risk discussed in Jones and Freeman (2003). A more important objective for providing writing interventions is to highlight the centrality of language features at the discourse level, as highlighted by the faculty. By facilitating an analysis of "model" academic texts, writing classes will enable students to better understand the logicality of academic texts, and to effectively leverage cohesive devices to connect sections and subsections of an academic text. This instructional scaffolding is particularly useful for students who intend to deploy *Google Translate* for academic writing, a practice which, although not always encouraged, is very likely a growing trend in student writing (Escartín, O'Brien, Goulet & Simard, 2017). Instead of making ineffective attempts to stop students from using this MT tool, language teachers can teach them how to take effective advantage of it in the writing process, particularly in managing surface language features.

Writing interventions can also play a crucial role in shifting students' focus from merely "learning-to-write" to "writing-to-learn", a strategy of using writing as a means of gaining fuller understanding of what one is learning, including the writing conventions in one's discipline (Pelger & Sigrell, 2016). This objective can be achieved by heightening students' understanding of the importance of two strategies: 1) maintaining conciseness in academic writing, and 2) learning vocabulary in context. Conciseness is an essential factor in creating an effective academic text (Bennett, 2009), but graduate students' awareness of this seems very low, which is evident in the findings of the current study.

Learning vocabulary in context is another area that requires writing interventions. Due to an unconducive English learning environment, many L2 students learn words by merely matching the form of a word with its meaning. As a result, they have little knowledge about how to use words appropriately in context (Zhao, 2016). This partially explains why many respondents in the present study considered general lexical use the most challenging factor in academic writing. Addressing this situation requires explicit writing interventions to heighten students' awareness of other important aspects of lexical knowledge, for example, collocation, colligation and semantic prosody (Qian & Lin, 2020). One of the effective approaches to achieving this objective is to adopt a corpus-based pedagogy. Such an approach allows students to understand the different lexical properties in student writing and published research articles (Crossley, 2020). It also empowers students to leverage corpus-based tools, such as the *Research Writing Tutor* (Cotos, 2016), the *Academic Phrasebank* (Morley, 2017) and the *Compleat Lexical Tutor* (Cobb, 2020), to learn the lexico-grammatical features of academic writing (Gilmore & Millar, 2018).

Academic writing poses significant challenges to L2 graduate students in Engineering. Helping them overcome these challenges requires balanced consideration of these graduate students' "wants", their self-perception of the language skills they lack, and their "needs", the observation of "specialist informants" (e.g., thesis supervisors) about the language skills they should enhance (Flowerdew, 2018, p. 2). Acknowledging their "wants" is to ensure that students' major concerns (e.g. vocabulary and grammar) are addressed, while addressing their "needs" is to heighten their awareness of the writing skills expected by faculty (e.g. text organization, intertextuality and conciseness). In order to effectively managing these issues, pedagogical assistance, i.e. provision of appropriate writing models and writing interventions, should be offered at the commencement of students' graduate programmes even though the demand for writing skills in their first year may not be as high as in subsequent years (Casanave & Hubbard, 1992). Early provision of such support can empower graduate students to leverage appropriate sources at an early stage of their PhD/MPhil life and thus avoid unnecessary detours on their learning journey. It can be instrumental in developing and enhancing academic literacy of L2 graduate students in Engineering and should also be important for L2 graduate students in other ST streams. Institutions which cannot provide such discipline-specific formal writing classes can consider the provision of writing workshops or even developing WAC initiatives to assist L2 graduate students with their academic writing.

4.3. Recommended future research

Future research could usefully focus on two areas. The first would be to ascertain if graduates in Engineering or in ST in general underestimate the challenges of academic writing skills at the discourse level. This suggestion derives from the first finding of the current study. It revealed that the postgraduates self-rated their writing skills at the discourse level significantly higher than the faculty assessed them. To test this possibility, future studies might triangulate faculty's comments on student

writing challenges with those of independent faculty assessors. Future studies could also consider performing detailed analysis on student writing to compare their perceptions and their written production.

The second area, which is closely related to the first, could be to identify if the awareness of global language features of graduate students in Engineering or in ST in general improves in line with their year of study. Casanave and Hubbard's (1992) study indicates that the demand on academic writing skills increases as graduate students progress with their studies. In other words, as these students gather more experience of academic writing, their awareness of global language features may increase over time. To test this possibility, future studies need to achieve a balanced ratio between student respondents in their first two years of studies and those in subsequent years.

Acknowledgement

The work described in this article was substantially supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. PolyU 89GV).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.esp.2021.03.004.

References

Abasi, A. R., & Graves, B. (2008). Academic literacy and plagiarism: Conversations with international graduate students and disciplinary professors. *Journal of English for Academic Purposes, 7*(4), 221-233.
Adler-Kassner, L. (2019). Designing for "more": Writing's knowledge and epistemologically inclusive teaching. *The WAC Journal, 30*, 35-63.
Badenhorst, C. M. (2019). Literature reviews, citations and intertextuality in graduate student writing. *Journal of Further and Higher Education, 43*(2), 263-275.
Bennett, K. (2009). English academic style manuals: A survey. *Journal of English for Academic Purposes, 8*(1), 43-54.
Casanave, C. P., & Hubbard, P. (1992). The writing assignments and writing problems of doctoral students: Faculty perceptions, pedagogical issues, and needed research. *English for Specific Purposes, 11*(1), 33-49.
Cobb, T. (2020). *Compleat lexical tutor.* Retrieved from https://www.lextutor.ca/.
Cotos, E. (2016). Computer-assisted research writing in the disciplines. In S. A. Crossley, & D. S. McNamara (Eds.), *Adaptive educational technologies for literacy instruction* (pp. 225-242). Routledge.
Cotterall, S. (2013). More than just a brain: Emotions and the doctoral experience. *Higher Education Research and Development, 32*(2), 174-187.
Cox, M., & Galin, J. R. (2020). Tracking the sustainable development of WAC programs using sustainability indicators: Limitations and possibilities. *Across the Disciplines, 16*(4), 38-60.
Crossley, S. (2020). Linguistic features in writing quality and development: An overview. *Journal of Writing Research, 11*(3), 415-443.
Davison, C. (2006). Collaboration between ESL and content teachers: How do we know when we are doing it right? *International Journal of Bilingual Education and Bilingualism, 9*(4), 454-475.
Dixon, T. (2004). *How to get a first: The essential guide to academic success*. Routledge.
Dong, Y. R. (1996). Learning how to use citations for knowledge transformation: Non-native doctoral students' dissertation writing in science. *Research in the Teaching of English, 30*, 428-457.
Escartín, P. C., O'Brien, S., Goulet, M. J., & Simard, M. (2017). Machine translation as an academic writing aid for medical practitioners. In S. Kurohashi, & P. Fung (Eds.), *Proceedings of MT summit* (pp. 254-267). Asia-Pacific Association for Machine Translation.
Evans, S., & Morrison, B. (2018). Adjusting to higher education in Hong Kong: The influence of school medium of instruction. *International Journal of Bilingual Education and Bilingualism, 21*(8), 1016-1029.
Fang, Z. (2005). Scientific literacy: A systemic functional linguistics perspective. *Science Education, 89*(2), 335-347.
Flowerdew, L. (2016). A genre-inspired and lexico-grammatical approach for helping postgraduate students craft research grant proposals. *English for Specific Purposes, 42*, 1-12.
Flowerdew, L. (2018). Needs analysis for the second language writing classroom. In J. I. Liontas (Ed.), *The TESOL encyclopedia of English language teaching* (pp. 1-6). John Wiley & Sons, Inc.
Gilmore, A., & Millar, N. (2018). the language of civil engineering research articles: A corpus-based approach. *English for Specific Purposes, 51*, 1-17.
Groves, M., & Mundt, K. (2015). Friend or foe? Google translate in language for academic purposes. *English for Specific Purposes, 37*, 112-121.
Hinkel, E. (2011). What research on second language writing tells us and what it doesn't. In E. Hinkel (Ed.), *Handbook of research in second language teaching and learning* (vol. 2, pp. 523-538)Routledge.
Howells, K., Stafford, K., Guijt, R., & Breadmore, M. (2017). The role of gratitude in enhancing the relationship between doctoral research students and their supervisors. *Teaching in Higher Education, 22*(6), 621-638.
Huang, L. S. (2010). Seeing eye to eye? The academic writing needs of graduate and undergraduate students from students' and instructors' perspectives. *Language Teaching Research, 14*(4), 517-539.
Hyland, F. (2016). Challenges faced by second language doctoral student writers in Hong Kong and their writing strategies. *Australian Review of Applied Linguistics, 39*(2), 158-180.
Jones, A. A., & Freeman, T. E. (2003). Imitation, copying, and the use of models: Report writing in an introductory physics course. *IEEE Transactions on Professional Communication, 46*(3), 168-184.
Lax, J. (2014, October). Laying a foundation for academic writing in Engineering: Helping international graduate students write in English. In *2014 IEEE international professional communication conference (IPCC)* (pp. 1-4). IEEE.
Lin, C. C., Liu, G. Z., & Wang, T. I. (2017). Development and usability test of an e-learning tool for engineering graduates to develop academic writing in English: A case study. *Journal of Educational Technology & Society, 20*(4), 148-161.
Mason, A., & Hickman, J. (2019). Students supporting students on the PhD journey: An evaluation of a mentoring scheme for international doctoral students. *Innovations in Education & Teaching International, 56*(1), 88-98.
McAlpine, L., & McKinnon, M. (2013). Supervision–the most variable of variables: Student perspectives. *Studies in Continuing Education, 35*(3), 265-280.
Morley, J. (2017). *The academic phrasebank: An academic writing resource for students and researchers*. The University of Manchester.
North, S. (2005). Different values, different skills? A comparison of essay writing by students from arts and science backgrounds. *Studies in Higher Education, 30*(5), 517-533.
Odena, O. (2013). Using software to tell a trustworthy, convincing and useful story. *International Journal of Social Research Methodology, 16*(5), 355-372.

Odena, O., & Burgess, H. (2017). How doctoral students and graduates describe facilitating experiences and strategies for their thesis writing learning process: A qualitative approach. *Studies in Higher Education, 42*(3), 572-590.
Paltridge, B., & Woodrow, L. (2012). Thesis and dissertation writing: Moving beyond the text. In R. Tang (Ed.), *Academic writing in a second or foreign language* (pp. 88-104). Continuum.
Pelger, S., & Sigrell, A. (2016). Rhetorical meta-language to promote the development of students' writing skills and subject matter understanding. *Research in Science & Technological Education, 34*(1), 25-42.
Qian, D. D., & Lin, L. H. F. (2020). The relationship between vocabulary knowledge and language proficiency. In S. Webb (Ed.), *The Routledge Handbook of vocabulary studies*. Oxford, UK: Taylor & Francis.
Reinhold, I., Batstone, K., González, I. G., Troian, A., & Yu, R. (2017). Quality of academic writing for engineering students at lund university. *Industrial Engineering and Management (I), 14*(1), 15.
Singh, M. K. M. (2017). International EFL/ESL master students' adaptation strategies for academic writing practices at tertiary level. *Journal of International Students, 7*(3), 620-643.
Starfield, S. (2010). Fortunate travellers: Learning from the multiliterate lives of doctoral students. *The routledge doctoral supervisor's companion* (pp. 138-146). London: Routledge.
Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasks and skills* (3rd ed.). University of Michigan Press.
Vrchota, D. A. (2015). Cross-curricular consulting: How WAC experts can practice adult learning theory to build relationships with disciplinary faculty. *The WAC Journal, 26*, 56-75.
Wang, C. C., Andre, K., & Greenwood, K. M. (2015). Chinese students studying at Australian universities with specific reference to nursing students: A narrative literature review. *Nurse Education Today, 35*(4), 609-619.
Yoder, B. L. (2016). *Engineering by the numbers*. https://www.asee.org/documents/papers-and-publications/publications/college-profiles/16Profile-Front-Section.pdf.
Zhang, M. (2013). A corpus-based comparative study of semi-technical and technical vocabulary. *The Asian ESP Journal, 9*(2), 148-172.
Zhao, J. (2016). The reform of the National Matriculation English Test and its impact on the future of English in China: Will English lose its predominance in the Chinese foreign language landscape? *English Today, 32*(2), 38-44.

Linda Lin holds a PhD in applied linguistics. She works for the English Language Centre of the Hong Kong Polytechnic University. She has extensive experience in L2 language learning and teaching, L2 language writing analysis and pedagogic development. Her research interests include academic writing, vocabulary learning, corpus analysis and applications of concordancing in teaching and learning.

Bruce Morrison is Director of the English Language Centre at Hong Kong Polytechnic University. He has extensive experience in language teaching, curriculum development, teacher education, educational research and pedagogic administration. His research interests include the non-native speaker tertiary learning experience, independent and self-access language learning, and technology enhanced language learning.