



Introducing in-service English language teachers to data-driven learning for academic writing

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ABSTRACT

Corpora are widely used in the creation of language learning and teaching materials, such as dictionaries, grammar books, textbooks, and vocabulary lists. Little work, however, has focused on how the DDL approach might be introduced successfully into a teacher training program. In this paper, we describe the background, implementation, and results of a DDL-focused teacher training workshop that is designed to introduce a corpus-assisted academic writing pedagogy to in-service English language educators in Hong Kong. To evaluate the success of the workshop and gain further insights on factors that might lead to instructors accepting or rejecting the approach, we administered a questionnaire to participants after the workshop and carried out a statistical analysis of the responses. Results revealed that participants generally had a positive experience of the training. Based on correlation tests, the results also showed that factors such as prior knowledge of corpora, prior experience in using corpora, motivation for professional development, and teaching experience, correlated significantly with teachers' perceptions of the difficulties in using corpus tools and an inclination to integrate data-driven learning in their future teaching. The findings may be related to broader research on teacher attitudes to the adoption of technology in the classroom.

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1. Introduction

There is now a consensus that language corpora have had a significant impact on language education (Flowerdew, 2008; Flowerdew & Forest, 2009; Boulton, 2011; Boulton & Pérez-Paredes, 2014; Cotos, 2014; Leech, 1997; Römer, 2011; Sinclair, 2004; Tono, Satake, & Miura, 2014; Yoon, 2011). Indirect applications of corpora, in particular, have played an important role in the creation of learner dictionaries, grammar books, textbooks, and vocabulary lists. The direct use of corpora in language teaching, known as Data-Driven Learning (DDL) (Johns, 1991), has also been given serious attention. Boulton and Cobb (2017) have carried out a meta-analysis of 88 papers that report on quantitative findings about DDL in the English language classroom and provided strong evidence that this approach can be effective and positively accepted by learners. Studies on the theory and practice of DDL have demonstrated that the approach provides students with better access to authentic language data, as the information found in corpora tends to be richer than that found in traditional resources

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(Lenko-Szymanska, 2015: 3). It has also been shown to improve the teaching and learning of lexicogrammatical items (Liu & Jiang, 2009) and to help learners develop error correction and proofreading skills (Mizumoto & Chujo, 2016). More generally, DDL has been shown to aid the development of cognitive and meta-cognitive abilities (O'Sullivan, 2007; Yoon & Jo, 2014).

Despite the many strengths offered by DDL, to date, its uptake has been somewhat limited. One of the commonly cited challenges with DDL is the need for learners to master the necessary technical skills and search and analysis techniques (Anthony, 2016a). Teachers can also find DDL to be time-consuming. In addition, both teachers and learners need to take on new roles. For DDL to be a truly data-driven learning experience, Johns (1991) has suggested that learners need to become detectives, exploring the language provided in corpora. At the same time, teachers need to take on the role of guide and facilitator rather than a more traditional role of instructor and informant. It follows that teacher preparation becomes an important component in the success of any DDL implementation. Surprisingly, however, this latter aspect of DDL has received relatively little attention to date (but see Ebrahimi & Faghih, 2016; Leńko-Szymańska, 2014b, 2017; Zareva, 2017).

In this paper, we describe the background, implementation, results, and wider implications of a teacher-training workshop designed to introduce a corpus-assisted academic writing pedagogy to in-service English language educators at universities in Hong Kong. The workshop was delivered in two separate sessions and was attended by over 60 in-service English teachers representing all the major institutions in the region. The study contributes to the literature in various ways. First, it is one of the first descriptions of in-service teacher training in the use of DDL; as such it can inform those seeking to design similar interventions in the future. Second, based as it is on a much larger number of participants than the limited numbers of participants in previous studies, the study is able to identify correlations between teachers' attitude towards DDL and a range of major variables, something not done before. These correlational results mean that the study is also able to contribute to the more general literature on teacher attitudes and the classroom application of technology.

Through the above-mentioned endeavours, we hope to provide more insights into in-service teachers' predisposition towards DDL regarding the following questions.

1. What were teachers' perceptions of the workshop and DDL more generally?
2. What statistical correlations can be found between teachers' personal traits (e.g. teaching experience, corpus literacy, prior use of corpora) and their attitudes towards DDL?
3. What are the implications for the successful running of DDL teacher education workshops, DDL teacher education, and the application of technology in the language classroom more generally?

1.1. Literature review

Various researchers have described applications of DDL with different learner groups (Chen & Flowerdew, 2018; Anthony, 2016a; Charles, 2011, 2012, 2015; Lee & Swales, 2006; Poole, 2016; Tono et al., 2014; Yoon & Jo, 2014). Much of this research is with learners of EAP at the tertiary level, the level at which the present investigation is directed. A seminal study focussing on DDL in the context of EAP is that of Lee and Swales (2006), who introduced the approach to PhD students. In a second study in this area, Flowerdew (2015) described a 13-week course for PhD students who undertook a writing workshop focused on the discussion section of the PhD thesis. Working with an experimental DDL group and a control group without corpus assistance, Cortes (2014) described how she introduced students to the different moves of the research article. Various studies by Charles (2007, 2011, 2012, 2014, 2015) have investigated how her PhD level students have engaged with corpus tools and self-compiled specialised corpora. Finally, Chen and Flowerdew (2018) have described the design, implementation and evaluation of a series of corpus-based research writing workshops for PhD students run across a group of universities.

Although limited, a range of studies have focused on teacher education for DDL. Among these studies, Farr (2008) introduced a variety of English language corpora and corpus software to 28 MA students in an English language teaching programme. A post-course survey revealed participants' positive reception of corpora on the grounds that they provide real-language examples and promote a spirit of enquiry and research. However, the participants also complained about some of the constraints of corpora, such as time and lack of expertise in technical terms. In another study, Breyer (2009) introduced a home-built corpus of EFL textbooks and different English L1 corpora to 18 future secondary-school teachers in Germany. She found that the value of corpora in teacher training may go beyond corpus literacy and assist teachers in the evaluation of classroom materials. On the other hand, the pre-service teachers in her study had reservations about using corpora in their future teaching, due to difficulties they envisaged in classroom management, the complexity of working with corpus tools, and time constraints. In a similar study with pre-service ESL teachers in corpus-based activities, Heather and Helt (2012) offered a semester-long grammar course in a U.S state university, which also fostered critical thinking regarding published English language teaching resources. The six case-study students focussed on in this course had similar reservations to those of Breyer (2009), such as issues with the technical side of corpus work, time constraints, and concerns about applying corpora in their teaching. Bunting (2013) worked closely with three very experienced in-service English native teachers in the United States, all with more than 20 years' teaching experience. Under his guidance, the teachers designed activities for ESL courses using corpora and used them in their classes. Classroom observations and post-lesson reflections showed how teacher beliefs, their prior knowledge about and experience of corpus applications, and their teaching aims jointly affected their decision-making process, the teaching outcome, and their motivation of continuing to use corpora in future teaching. While all

three participants were positive overall about the use of corpora, a number of problematic issues were raised, including the time taken to develop appropriate corpus-based materials and class time taken up due to technical issues. In a further study, [Lin and Lee \(2015\)](#) followed six early-career, in-service teachers in the classroom. They found that the teachers were positive with regard to DDL for the teaching of grammar, especially liking its potential for active learning and plenty of classroom discussion. On the other hand, they had reservations about the extra workload required for developing the activities and technical difficulties with materials design and classroom practice.

Other recent empirical studies have been carried out by [Leńko-Szymańska \(2014a, 2014b, 2017\)](#), [Ebrahimi and Faghih \(2016\)](#) and [Zareva \(2017\)](#), respectively. [Leńko-Szymańska \(2014a, 2014b, 2017\)](#) offered semester-long corpus literacy training to pre-service English language teachers in Poland; [Ebrahimi and Faghih \(2016\)](#) introduced free online corpus resources to Iranian MA students of TEFL in a seven-week online course; while [Zareva \(2017\)](#) integrated 6 h' corpus training into a grammar course with 21 American student teachers. These studies all yielded very positive feedback from participants. They found the approach beneficial for learners, as corpora provide authentic examples and motivate students, yet in common with the studies already reviewed, they also highlighted negative aspects of DDL that have been reiterated in the literature, such as frustrations with the technology and time constraints.

The above-mentioned teacher education studies have revealed the intricacies involved in the process of promoting the direct use of corpora in teaching among English language educators. In all of the studies, the participants could immediately see the affordances of corpora in English language teaching (e.g., providing genuine language examples and promoting learner autonomy). However, their enthusiasm towards this new approach was often tempered by factors such as time constraints and a lack of confidence in their understanding of corpora and mastery of the technical aspects of the approach. It is also worth noting that, except for the studies by [Bunting \(2013\)](#) and [Lin and Lee \(2015\)](#), these studies mainly involved participants who were pre-service teachers with little or no teaching practice. While pre-service teachers are undoubtedly an ideal target for introducing the DDL approach, given the relative newness of the approach, in-service interventions are equally important. Furthermore, experienced in-service teachers are likely to have different perceptions regarding the use of corpora as compared to pre-service teachers, given that they will generally be older and thus tend to perceive and use digital technology differently to those of a younger generation. On the other hand, given their classroom experience, in-service teachers may be better able to judge how DDL is likely to work with students.

As well as the (limited) previous studies of teacher education initiatives in DDL, also relevant to our study is the literature on attitudes to classroom application of technology on the part of teachers. This is because our study will highlight some of these factors as they relate specifically to DDL. As [Gilakjani and Leong \(2012: 130\)](#) have noted, teachers' attitudes towards computers, whether positive or negative, affect how they respond to their use in the classroom. Indeed, various empirical studies with regard to the classroom adoption of technology have shown the importance of teacher attitudes as an important variable. Studies conducted by both [Khine \(2001\)](#), with 184 pre-service teachers, and [Yuen and Ma \(2002\)](#), with 216 secondary teachers (in Hong Kong), for example, have shown significant relationships between teacher attitudes towards technology and its uptake in the classroom. Clearly, if a technological innovation introduced to teachers is not perceived by them to meet their or their students' needs, then they are not likely to take it up ([Teo, 2008: 414](#)). Various factors may affect teachers' attitudes towards technological innovation. For example, in a survey of pre-service teachers in an online forum, [Sime and Priestley \(2005\)](#), found that adoption of a technological innovation may be influenced by how easy or difficult it is to use, the age or gender of the user, the level of familiarity with technology of the user, opportunities for training and support, time constraints, and individual teachers' skills, confidence, and attitudes. Such factors will be investigated in the present study specifically in relation to DDL, but with broader implications for teacher adoption of classroom technology.

2. The workshop

2.1. The workshop and the participants

The 3-h workshop was designed and delivered collaboratively by the authors of this paper, who are experienced corpus linguists and language educators. All three members of the team have rich experience in teaching English academic writing using corpora. The workshop was run twice and attended by 63 in-service teachers from at least ten different institutes mainly at a tertiary level. The teachers attended the workshop voluntarily. Before the workshop, an invitation email was first sent to 328 teachers and academic staff members in the English language centres, departments of English, and English divisions of the faculty of education at the eight government-funded universities in Hong Kong. The invitation was then circulated among approximately 120 members of the Hong Kong Association of Applied Linguistics (HAAL) with the help of the association secretary. Altogether, 71 teachers from seven government-funded universities, three private tertiary institutes, and two secondary schools signed up for the workshop. Of these, 63 attended the workshop (attendance rate: 84%), including four secondary school teachers. Given that there is a considerable overlap between the 328 teachers and the 120 odd members of HAAL, we would estimate that the 59 participants (excluding the four secondary-school teachers) account for at least one seventh of the whole English language educator population at tertiary level in Hong Kong.

Table 1a
Participants' teaching experience.

Years of teaching	No.	%
1 year	2	3.7%
2–3 years	7	13%
4–5 years	5	9.3%
6–10 years	11	20.4%
11–15 years	15	27.8%
16–20 years	5	9.3%
21 years or more	9	16.7%
Total	54	100%

The workshop lasted 3 h and consisted of four parts. In the first part (20 min), participants were introduced to basic concepts about corpora and corpus linguistics and were given a brief overview of research on indirect and direct applications of corpora in English language teaching. In the second part (75 min), acting as language learners, participants were guided through two activities using the academic sub-corpus of BNCweb,¹ which showed them how to help students address lexicogrammatical problems in their writing. In this part of the workshop, participants learned how to create a sub-corpus out of the BNCweb corpus, carry out simple and complex searches using wildcards, use the sort, frequency breakdown, and collocation functions in BNCweb, and interpret results. After each guided activity, participants were given a real-world example of inappropriate student writing and required to work in groups to discover what searches should be carried out to find more appropriate phraseological patterns. In the third part (75 min), participants experienced hands-on corpus activities with AntConc (Anthony, 2016b) using discipline-specific corpora created by one of the workshop instructors. The activities addressed students' writing problems at lexical, section- and discourse-levels. In this section, participants were also shown how to build their own corpora using AntFileConverter (Anthony, 2016c). The workshop ended with a 15-minute Q&A session, during which participants could raise questions regarding the use of corpora in teaching English academic writing.

All the activities in the workshop were taken from actual writing courses and workshops that the three team members had given to students at different levels and in various disciplines (Anthony, 2016a; Chen & Flowerdew, 2018). It was thought that these examples could best demonstrate how corpora can be used in actual teaching (see Chen and Flowerdew (2018) for detailed descriptions of some activities). During the workshop, after participants had completed each task, the members of the team shared their observations of students' reactions when using the tasks in their previous teaching. This input was designed to help teachers predict the teaching outcome if they were to use similar activities in their own teaching. Throughout the workshop, a teaching assistant was present to provide timely support whenever any participants had difficulties following the teacher.

2.2. Data collection and analysis

After the workshop, the participant teachers were invited to complete a post-workshop questionnaire (Appendix 1), which investigated their prior experience, their evaluation of the workshop, and their perceptions of the direct use of corpora in English language teaching. Out of the 63 teachers who attended the workshop, 54 completed the questionnaire. The survey, which involves 18 Likert-scale questions and two open-ended questions, was developed based on the authors' reading of the literature and their extensive experience with DDL over many years, in particular their running of a series of workshops for PhD students employing DDL to teach research writing (e.g. Chen & Flowerdew, 2018), and piloting with two research assistants and academic friends and colleagues of the authors. To ensure the reliability and objectivity of the survey, we included both negative and positive statements when designing the Likert-scale questions about teachers' attitude towards DDL. This procedure helps avoid "acquiescence bias" (Dörnyei & Taguchi, 2010: 43).

In order to ascertain the relationship between personal variables and the participants' predispositions to the use of corpora in English language teaching, Spearman's rank-order correlation tests were run with SPSS 22 (for justification see Hauke & Kossowski, 2011) to explore the relations between 1) teachers' corpus literacy prior to the workshop [Q 1.1 in Table 2], 2) teachers' prior experience of using corpora [Q 1.2], 3) teachers' motivation for professional development [Q 2], and 4) teachers' work experience [Q 11] and 5) their evaluation of the workshop and perceptions of using corpora in English language teaching [Qs3-8]. The correlation coefficient (r) is measured on a scale that varies from -1 to $+1$ with an r value between -1 and 0 indicating a negative correlation, a value between 0 and 1 indicating a positive correlation, and a complete absence of correlation represented by 0 .² The correlation results are presented in Sections 3.2.

¹ The BNCweb corpus is available from <http://bncweb.lancs.ac.uk/bncwebSignup/user/login.php>, in an online interface created by Lancaster University.

² The absolute r values could be grouped to indicate five degrees of correlation (Swinscow, 1997): 1) $0.00 - 0.19 =$ very weak; 2) $0.20 - 0.39 =$ weak; 3) $0.40 - 0.59 =$ moderate; 4) $0.60 - 0.79 =$ strong; 5) $0.80 - 1.0 =$ very strong.

Table 1b
Participants' teaching level.

Levels	No.	%
Associate Degree	6	11.11%
Associate Degree; Bachelor's	4	7.41%
Bachelor's	30	55.56%
Bachelor's; Master's; MPhil or PhD	4	7.41%
Master's, MPhil or PhD	6	11.11%
Secondary	4	7.41%
Total	54	100%

3. Findings and discussion

3.1. Participants' feedback on the workshop

The results show that most of the teachers who attended the workshop and completed the questionnaire are highly experienced in terms of both years of teaching (Q11) and student levels taught (Q12) (see Table 1 A and 1 B respectively). Over half of them have more than 10 years' teaching experience and teachers with no less than six years of experience account for almost two thirds of the total. Only 3.7% of teachers have one year of teaching experience. Apart from the four secondary-school teachers, who were recruited through the HAAL email circulation, around half of the teachers are currently teaching undergraduate students while just over 10% are teaching three-year Associate Degree students. Around one quarter of the teachers are teaching students of two different levels or more.

Many teachers who attended the workshop had little prior knowledge of corpus linguistics (see Qs 1.1 & 1.2 in Table 2). However, they showed great interest in maintaining professional development (Mean = 4.26, SD = 1.14, with a value of 5 corresponding to "strongly agree" for Q 1.3). The workshop seems to have met their expectations, as they highly rated the workshop, indicating that it was very useful (Mean = 4.59, SD = 0.71, with a value of 5 corresponding to "very useful" for Q 3) and showing a strong inclination to use or continue to use corpora for both in-class and out-of-class activities in future teaching (Qs 4 & 5). It is also very likely that they would recommend the workshop to their colleagues (Q 8).

To ensure that the teachers' evaluation of the workshop included in-depth responses, two open-ended questions were included to further investigate aspects of the workshop that participants valued as most and least useful (Qs 9 and 10). Participants' answers further confirmed their high evaluation of the workshop. The majority of those who answered the question about the most useful part(s) of the workshop mentioned the two corpus tools introduced in the session. The majority who responded to the question about the least useful part(s) of the workshop wrote "None". The following are selected comments from the questionnaire:

Selected comments (from a total of 24): What are the most useful part(s) of the workshop?

- *Specific functions for AntConc.*
- *The use of BNC to search for the lexiogrammar knowledge.*
- *Searching for collocations; frequency of phrases.*
- *Hands-on activities with help from the staff.*
- *The actual demonstration.*
- *Examples; step by step instructions.*
- *The sharing of teaching techniques.*
- *Pedagogical application.*
- *Treating us as though we were the students, thereby keeping the instructions very simple.*

Selected comments (from a total of 12): What is/are the least useful part of the workshop?

- *None.*
- *All aspects were useful.*
- *Some of the links were done very quickly, so a little difficult to follow.*
- *Prof XXX's part is too fast.*

Many teachers (10 out of 24) directly mentioned BNCweb and AntConc as the most useful elements of the workshop suggests that they understood the value of different corpus resources in facilitating English academic writing. Some participants also found the corpora introduced in the workshop to be useful in revealing linguistic patterns that are not visible to the naked eye (2). Hands-on activities with step-by-step guidance and teacher demonstrations on the screen were considered as another very useful aspect of the workshop (7). Some participants also appreciated the teachers' sharing of their own experiences of using corpora in the academic writing classroom (2). As mentioned above, in this workshop, the instructors showed the participants how corpora were used in teaching by treating the participants as students. The participants' positive

Table 2
Participants' feedback on the workshop.

Questions (5-point Likert scale)	Mean	SD
Q1.1 Prior to the workshop, I knew nothing about corpora and I would like to find out what they are and how to use them. ^a	3.09	1.39
Q1.2 Prior to the workshop, I had already worked with corpora and I would like to find out more about how to use them. ^a	3.13	1.52
Q1.3 I am interested in language teaching and I would take courses related to it. ^a	4.26	1.14
Q2 To what extent were you familiar with corpora prior to this workshop?	2.63	1.14
Q3 How did you find the workshop? ^b	4.59	0.71
Q4 How likely are you (continue) to use corpora in in-class activities in the future? ^c	4.15	0.92
Q5 How likely are you (continue) to use corpora in out-of-class assignments in the future? ^c	4.07	1.03
Q6.1 Corpora provide "authentic" language materials. ^a	4.46	1.09
Q6.2 It is easy to prepare corpus-based materials. ^a	3.17	1.06
Q6.3 Corpus tools are more useful than other resources. ^a	3.80	0.94
Q6.4 Hands-on activities with promote in-class learning. ^a	4.44	0.95
Q6.5 Students would enjoy corpus-based activates more than traditional activities. ^a	3.56	0.90
Q7.1 Corpora do not seem to be more useful than other materials. ^a	2.24	0.82
Q7.2 It is time-consuming to prepare corpus-based materials. ^a	3.19	1.05
Q7.3 Corpus tools are difficult to use. ^a	3.09	1.01
Q7.4 It is time-consuming to have corpus activities in class. ^a	3.30	0.94
Q7.5 Students would prefer traditional classroom activities to those using corpora. ^a	2.89	1.16
Q8 How likely are you to recommend the workshop to your colleagues? ^c	4.50	0.69

² 1 = not familiar at all; 2 = not familiar; 3 = neutral; 4 = familiar; 5 = very familiar.

^a 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree.

^b 1 = of little use; 2 = not useful; 3 = neutral; 4 = useful; 5 = very useful.

^c 1 = very unlikely; 2 = unlikely; 3 = neutral; 4 = likely; 5 = very likely.

comments about the tools, the hands-on activities and demonstration, and the teaching tips show that they could see the value of the DDL approach and envisage their own application of it in the classroom.

In response to the second open-ended question regarding what they valued least about the workshop, many participants wrote down "None" or "All are useful" (10 out of 12). The only negative comment was about the pace of teaching (2). It was very challenging for the three team members to both ensure enough time for both practice and reflection for each activity and manage to finish the workshop within 3 h. Clearly, attending a workshop of such intensity was a great challenge for participants to stay focused throughout the session.

As for teachers' perceptions of DDL after attending the workshop, they highly valued the use of corpora in providing learners with genuine language examples and promoting discovery learning (Mean = 4.46, SD = 1.09 for Q 6.1; Mean = 4.44, SD = 0.95 for Q 6.4 in Table 2). They also believed that corpus tools could be more useful than other teaching resources (Mean = 3.8, SD = 0.94 for Q 6.3; Mean = 2.24, SD = 0.82 for Q7.1) and predicted that students would enjoy corpus-based activities greatly (Mean = 3.56, SD = 0.9 for Q 6.5). However, in line with findings from previous studies, teachers who attended the workshop also had reservations about using corpora in their teaching, given the difficulty of preparing/ implementing corpus-based actives (Mean = 3.17, SD = 1.06 for Q 6.2; Mean = 3.09, SD = 1.01 for Q 7.3) and the time to be invested (Mean = 3.19, SD = 1.05 for Q 7.2; Mean = 3.3, SD = 0.94 for Q 7.4).

The results so far indicate that the workshop participants could easily see the benefits of using corpora in English language teaching, but they also had concerns about the time and potential difficulties involved in adopting a DDL approach. These views seem to align closely with those of teachers discussed in other studies in the literature.

3.2. Correlations between teachers' personal traits and their perceptions of corpus application in teaching

Given the above views and the fact that no studies to date have tried to pinpoint the factors that contribute to this amalgam of enthusiasm and fear, we took a step further to investigate the relationship between certain teachers' personal variables and their predispositions to corpus-based pedagogy. Complete tables of the correlations that were run are shown in Appendix 2. Out of a total of 42 correlations, nine were significant. These are now discussed with an understanding that some may be spurious in nature due to the high number of correlation measures undertaken overall.

3.2.1. Correlation between teachers' corpus literacy and their post-workshop evaluation

As mentioned in Section 3.2, participants had limited prior knowledge of corpus linguistics in general (see Table 2). Results of Spearman's correlation tests show that the corpus linguistics training that teachers had received prior to the workshop does not seem to affect their evaluation of the workshop and reception of corpus-assisted pedagogy greatly, except for their prediction about the complexity of corpus tools (Appendix 2; Table 3). As shown in Appendix 2, Table 3, for the statement "Corpus tools are difficult to use", the results indicate that participants' answers to Q 1.1 (i.e. "I knew nothing about corpora"; 5 = strongly agree, 1 = strongly disagree) show a weak positive correlation ($\rho = 0.355$, $p < .01$). As might be expected, it seems that teachers with less prior knowledge about corpora are more likely to be fearful of the approach, and those with more previous contacts with corpus resources will be more confident in adopting it.

3.2.2. Correlation between teachers' prior experience of using corpora and their post-workshop evaluation

Similar correlations were found between teachers' prior experience of using corpora and their post-workshop evaluation. As can be seen from [Appendix 2, Table 4](#), first, there is a weak negative correlation between teachers' answers to Q 1.2 (i.e. "I had already worked with corpora prior to the workshop", 5 = strongly agree, 1 = strongly disagree) and their rating of the statement "Corpora tools are difficult to use" ($\rho = -0.289$, $p < .05$). Again, this indicates that teachers with more prior experience of using corpora are less likely to find corpus tools difficult to use and vice versa. Moreover, there exists a moderate positive correlation between teachers' responses to Q 1.2 and their inclination to use or continue to use corpora in in-class activities (Q4: $\rho = 0.4$, $p < .01$), while a weak positive correlation exists between teachers' experience of corpus use and out-of-class activities/exercises (Q5: $\rho = 0.313$, $p < .05$). In other words, the more experienced the teachers are in using corpora, the more likely they are to adopt DDL in teaching over the long term.

3.2.3. Correlation between teacher motivation and post-workshop evaluation

Significant correlations were also found between the teachers' interest in language teaching (i.e. "I am interested in language teaching and I would take courses related to it", 5 = strongly agree, 1 = strongly disagree) and their perceptions of certain benefits of corpora (see [Appendix 2; Table 5](#)). Weak positive correlations exist between teachers' interest in teaching and willingness to take courses related to it and their rating of the following two statements: "Hands-on activities with corpora promote in-class learning" ($\rho = 0.286$, $p < .015$) and "Students would enjoy corpus-based activities more than traditional activities" ($\rho = 0.278$, $p < .01$). Teachers with a greater interest in teaching and a willingness to take courses related to it seem to more appreciate the value of corpora in promoting discovery learning and better learner engagement. Teachers with a greater interest in language teaching and motivation for maintaining professional development are also more likely to adopt the corpus-based approach in in-class as well as out-of-class activities/assignments over the long term ($\rho = 0.399$, $p < .01$; $\rho = 0.416$, $p < .01$ respectively).

3.2.4. Correlation between teacher experience and their post-workshop evaluation

The teachers' work experience (number of years teaching) seems to have some impact on their predictions about the impact of corpora on the teaching outcome. [Appendix 2, Table 6](#) shows that there is a weak negative correlation between the teachers' work experience and their rating of the statement "Corpus tools are more useful than other resources" ($\rho = -0.291$, $p < .05$). In other words, teachers with more years of teaching experience seem to be more sceptical of the benefits of corpora. To be more specific, teachers who disagreed with the statement "Corpus tools are more useful than other resources" were mostly those who had taught English for at least 11 years. In contrast, teachers with five years of experience or less tended to agree or strongly agree with the same statement. As for those who have 6–10 years' experience, nearly half of them took a neutral stance while the other half agreed with the statement.

3.2.5. Summary of significant correlations

To summarise, in the correlational study, significant associations were identified between four different personal variables and teachers' dispositions to the use of corpora in English language teaching. Teachers with more prior knowledge of corpora and experience of using corpora appear to be less frustrated with the difficulties of acquiring corpus skills. Richer experience in using corpora better motivates teachers to use or continue to use corpora in teaching. This indicates that English language teachers' reluctance at the thought of employing corpus techniques can be overcome by more guided practice. Moreover, teachers' interest in language teaching also helps motivate them to adopt or continue adopting the corpus-assisted approach in their future teaching. Teachers with more intrinsic motivation for maintaining professional development tend to appreciate more the value of corpora in promoting discovery learning among students and better learner engagement. A third observation is that teachers with more years of teaching are more sceptical of the affordances of corpora in English language teaching than their less experienced peers. A final observation worth mentioning is that three of the four teacher variables (i.e. corpus literacy, prior experience of using corpora, and interest in teaching) have also shown significant correlations with teachers' responses to the statement "Corpus tools are difficult to use" but not with those to the statement "It is easy to prepare corpus-based materials". One possible explanation would be that the teachers were introduced to two types of DDL at the beginning of the workshop, the "soft" type, which involves paper-printed concordance examples pre-selected by the teacher, without the need for a corpus tool, and the "hard" type, which requires students to use corpus tools on a computer. It is possible that the teachers had both types in mind when responding to the statement "It is easy to prepare corpus-based materials", hence showing no significant correlation. Although many of the findings reported in this section are perhaps not surprising, they nevertheless provide empirical confirmation of common-sense intuitions and may suggest certain implications, which we will set out in the next section.

3.3. Discussion of the findings

Results from the post-workshop question show that after the teachers really got to know how DDL works, they did show a very positive attitude towards its affordances in English language teaching and are willing to try this new approach. The teachers' reaction to DDL shows that it is highly possible to spread DDL through training in-service teachers with suitable

training sessions. These teachers did show some concerns when asked to predict the difficulty of applying DDL to teaching. Possible solutions for eliminating or reducing their fear are given in the conclusion.

Regarding the correlation analysis, only nine out of a total of 42 correlations were found to be significant. Although this is a disappointing finding from a research point of view, it can be considered a positive finding from a pedagogic viewpoint. The many non-significant correlations in the study suggest that DDL workshops in the teaching of academic writing such as the one reported in this study can appeal to a wide range of teachers. This implication is further confirmed by the overall positive reception of the workshop, as indicated by the participants evaluation of the workshop reported in section 3.1. Nevertheless, the significant correlations found in the study lead to some possible implications for future workshops and DDL teacher education in general. These will now be discussed.

3.3.1. *Teachers with less knowledge about corpora find corpus tools more difficult to use*

This finding suggests that more time needs to be given to total novices than to teachers with some familiarity with corpora. Total novices are likely to make slower progress, so a strong effort needs to be made to motivate them, for example, by showing them some positive learning outcomes of novice DDL learners. Furthermore, to reduce their fear, it would be valuable to encourage complete novices to develop some familiarity with corpus skills before coming to the workshop. It would also be helpful to provide them with some ready-made activities that they can easily adapt for their future teaching during or after the workshop. Alternatively, consideration might be given to running separate workshops for total beginners and those with some familiarity with corpora. Where there are heterogenous groups of total novices and experienced teachers, it may be advantageous to pair members from each group. In this way, those with prior knowledge can help the novices and give them encouragement. This may also help the novices overcome any initial fear or reluctance.

3.3.2. *Teachers with more knowledge about corpora find corpus tools not so difficult to use*

This is the corollary of the previous finding and the same implications apply. We might also add a further implication that, given the greater facility that comes with experience, longer training is likely to be beneficial and increase the chances of teachers taking up DDL; the longer the training the better.

3.3.3. *Teachers who are more interested in language teaching and motivated for maintaining professional development say they are more likely to use corpora in out-of-class assignments, think hands-on activities with corpora promote learning, and believe their students would enjoy corpus-based learning*

This finding is not surprising. Common sense would suggest that more professionally motivated teachers are more likely to be interested in applying innovative methodologies such as DDL. However, it needs to be borne in mind that all participants self-selected to attend the workshop and there was no compulsion. All participants were therefore intrinsically motivated to find out about DDL, but among them there was variation in overall professional motivation. This suggests that DDL workshops may not appeal to relatively less professionally motivated teachers, even if, after attending the workshop, they are less likely to take it up. The ideal participant for future workshops is thus someone who is well motivated professionally. Less professionally motivated participants, even if interested to learn about DDL, are less likely to apply the approach after attending a DDL workshop. This presents something of a dilemma for the organizers of future workshops. Do they focus on more highly professionally motivated participants (overall) or put in extra effort to convince the less professionally motivated? One way of resolving this issue might be to pair up more and less professionally motivated participants in the hope that the enthusiasm of the more motivated participants rubs off onto the less motivated.

3.3.4. *Teachers with more years of experience are more sceptical of corpus-based learning*

This finding may be explained, perhaps, by the fact that more experienced participants will have had the opportunity to try various different approaches to language pedagogy and therefore be familiar with more approaches with which to compare the DDL approach. Alternatively, it could be a sign that they are more jaded. However, this interpretation is less likely given that all participants in the study self-selected to attend the workshop. This finding does suggest, though, that different strategies might be appropriate for the more and less experienced teachers, with more experienced teachers requiring more convincing of the merits of the approach. One way this might be achieved is by showing them more positive learning outcomes from DDL.

Even though the nine correlations interpreted in the subsections above were statistically significant, with a relatively small sample size, it is worthwhile to explain and justify why we feel that the weak correlations, in particular, can be meaningfully interpreted. Our results are meaningful because we have looked at different teacher variables and their correlation with teachers' reception of DDL (i.e., teachers' corpus literacy, teachers' prior experience of using corpora, teachers' motivation, teachers' work experience). Although many correlations were not significant, this might be partly due to the fact that the participants' rating of the workshop is very high, showing not much difference between teachers of different backgrounds. Moreover, we can already see how the four variables weigh differently in teachers' perception of DDL. Among the four variables, teachers' motivation and their prior experience of using corpora show more significant correlations with their responses to the DDL questions (see tables in [Appendix 2](#)) than the other two variables (i.e. teachers' corpus literacy and teaching experience). This difference between the four variables has implications for promoting DDL among both pre-service

and in-service teachers. 1) DDL can appeal to a wide variety of teachers as motivation appears to be a more important factor than teaching experience; 2) Once teachers have overcome their fear of DDL and used corpus tools by themselves, it is easier for them to see the value of DDL, as prior use of corpora appears to be a more important factor than corpus literacy.

4. Conclusion and implications for teacher education in data-driven learning and classroom technology more generally

In this study, we have demonstrated how a half-day workshop can be organised to introduce the DDL approach to a relatively large number of in-service teachers. The positive post-workshop feedback given by English language teachers in this study has shown the value of such a training session. Although this is not a perfect solution, we propose that this type of workshop can be taken as a starting point for further integrating a direct use of corpora in English language teaching.

More broadly, this study has added to the limited literature on teacher education for DDL. We believe it is the first such study to be conducted in Hong Kong and only the third to focus specifically on in-service teachers. Although there is a qualitative difference between our study and those reviewed earlier in this paper with pre-service teachers, certain commonalities can be discerned, for example, overall interest and positive feelings towards the approach, on the one hand, and concerns with technical issues, time constraints, and classroom application, on the other. The only other studies with in-service teachers, those of [Bunting \(2013\)](#) and of [Lin and Lee \(2015\)](#), were very different to our study insofar as they were both qualitative case studies involving small numbers of teachers, with participants teaching with corpus-based materials, not attending a workshop. They did not involve questionnaire data after a workshop or course, which was the case with our study. It is hoped that the description of the workshop, the results of the questionnaire-based survey, and the correlational analysis of factors affecting attitudes to data-driven learning can inform future course designers on how to introduce the DDL approach to teachers as well as feeding in to further research into corpus-based pedagogy.

One of the original contributions of this study is the correlations that we have identified between teachers' attitude towards DDL and four different major variables: familiarity and experience with corpora; interest in language teaching; intrinsic motivation for maintaining professional development; and length of experience in teaching. These findings can tie in with research on the classroom application of technology more generally; research which has shown that teachers' attitudes towards computers are a critical factor that affects technology use and integration in teaching and learning. As stated by [Gilakjani and Leong \(2012: 130\)](#), understanding of teachers' attitudes towards computers can provide useful insights into the classroom integration and acceptance of technology. Similarly, as argued by [Huang and Liaw \(2005\)](#), however sophisticated a technological tool may be, the extent of its application depends on the positive attitude of the teacher.

Two specific implications for future pre- and in-service teacher training are the following. First, the correlation between teachers' prior knowledge of and experience in corpus-based pedagogy and their perceptions of the complexities of corpus tools points to the importance of teacher educators providing long-term training or support in order to disseminate the corpus-assisted teaching approach more effectively. Although teachers in this study highly rated the 3-h workshop and found the guided hands-on activities very useful, a single 3-h workshop might not be able to alleviate all possible difficulties and frustrations teachers may encounter in the future use of corpora in teaching. Follow-up support or sharing sessions could be provided to help teachers integrate this approach into their teaching gradually.

The second implication is that providing more training or support raises the issue of time constraints on the part of those wishing to employ data-driven learning in their teaching. This is a major obstacle that has been frequently discussed in the literature. One way to alleviate the problem, of course, is to provide more thorough training and more practice. Also, software tools now exist that allow teachers and learners to automatically build large-scale discipline-specific corpora (e.g., [Anthony, 2017](#)) which can thus alleviate much of the time-consuming work of building corpora in certain settings. In the medium and longer term, the problem might also become less of an issue if more textbook materials and online ready-made online data-driven learning lessons become available along the lines of [Thurston and Candlin's \(1997\)](#) ground-breaking textbook or the corpus-based activities in [Swales and Feak \(2012\)](#).

One limitation of our study is that we have only used a questionnaire research design and have not employed other more qualitative research tools. One of the major purposes of the workshop was to introduce DDL to language teachers in an effective and cost- and time-efficient way. Given that most teachers who participated in this workshop had little knowledge about DDL or experience in using it in teaching, we wanted to document their first encounter with the innovative approach. Given the heavy workload language teachers have, it would have been difficult to ask them to commit more of their time to this. Further research is planned to follow up on these teachers to see whether and how they have used DDL in their teaching since the workshop and what kind of difficulties they have encountered.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.system.2019.102148>.

Appendix

Table 3
Correlation between participants' corpus literacy and their perceptions of DDL

	rho	p
Q3 How did you find the workshop?	-0.024	0.866
Q4 How likely are you (continue to) use corpora in in-class activities in the future?	-0.153	0.269
Q5 How likely are you (continue to) use corpora in out-of-class assignments in the future?	-0.036	0.796
Q6.1 Corpora provide "authentic" language materials.	-0.099	0.478
Q6.2 It is easy to prepare corpus-based materials.	-0.176	0.203
Q6.3 Corpus tools are more useful than other resources.	-0.052	0.708
Q6.4 Hands-on activities with corpora promote in-class learning	0.002	0.99
Q6.5 Students would enjoy corpus-based activates more than traditional activities.	-0.118	0.396
Q7.1 Corpora do not seem to be more useful than other materials.	0.037	0.791
Q7.2 It is time-consuming to prepare corpus-based materials.	-0.122	0.381
Q7.3 Corpus tools are difficult to use.	0.355	0.008
Q7.4 It is time-consuming to have corpus activities in class.	-0.187	0.177
Q7.5 Students would prefer traditional classroom activities to those using corpora	-0.019	0.889
Q8 How likely are you to recommend the workshop to your colleagues?	0.162	0.243

Table 4
Correlation between participants' experience of corpus use and their perceptions of DDL

	rho	p
Q3 How did you find the workshop?	0.077	0.579
Q4 How likely are you (continue) to use corpora in in-class activities in the future?	0.4	0.003
Q5 How likely are you (continue) to use corpora in out-of-class assignments in the future?	0.313	0.021
Q6.1 Corpora provide "authentic" language materials.	-0.008	0.954
Q6.2 It is easy to prepare corpus-based materials.	0.12	0.933
Q6.3 Corpus tools are more useful than other resources.	0.126	0.366
Q6.4 Hands-on activities with promote in-class learning.	0.122	0.38
Q6.5 Students would enjoy corpus-based activates more than traditional activities. ¹	0.11	0.428
Q7.1 Corpora do not seem to be more useful than other materials.	-0.159	0.251
Q7.2 It is time-consuming to prepare corpus-based materials.	0.08	0.563
Q7.3 Corpus tools are difficult to use.	-0.289	0.034
Q7.4 It is time-consuming to have corpus activities in class.	0.124	0.373
Q7.5 Students would prefer traditional classroom activities to those using corpora.	-0.056	0.688
Q8 How likely are you to recommend the workshop to your colleagues?	-0.044	0.752

Table 5
Correlation between participants' interest in teaching and their perceptions of DDL

	rho	p
Q3 How did you find the workshop?	0.146	0.292
Q4 How likely are you (continue) to use corpora in in-class activities in the future?	0.399	0.003
Q5 How likely are you (continue) to use corpora in out-of-class assignments in the future?	0.416	0.002
Q6.1 Corpora provide "authentic" language materials.	0.16	0.248
Q6.2 It is easy to prepare corpus-based materials.	0.104	0.456
Q6.3 Corpus tools are more useful than other resources.	0.14	0.313
Q6.4 Hands-on activities with corpora promote in-class learning.	0.286	0.036
Q6.5 Students would enjoy corpus-based activates more than traditional activities. ¹	0.278	0.042
Q7.1 Corpora do not seem to be more useful than other materials.	-0.233	0.09
Q7.2 It is time-consuming to prepare corpus-based materials.	-0.044	0.754
Q7.3 Corpus tools are difficult to use.	0.073	0.6
Q7.4 It is time-consuming to have corpus activities in class.	-0.009	0.949
Q7.5 Students would prefer traditional classroom activities to those using corpora.	0.095	0.493
Q8 How likely are you to recommend the workshop to your colleagues?	0.25	0.068

Table 6
Correlation between participants' teaching experience and their perceptions of DDL

	r_s	p
Q3 How did you find the workshop?	-0.105	0.451
Q4 How likely are you (continue) to use corpora in in-class activities in the future?	-0.135	0.331
Q5 How likely are you (continue) to use corpora in out-of-class assignments in the future?	-0.075	0.588
Q6.1 Corpora provide "authentic" language materials.	-0.071	0.611
Q6.2 It is easy to prepare corpus-based materials.	-0.195	0.157
Q6.3 Corpus tools are more useful than other resources.	-0.291	0.033
Q6.4 Hands-on activities with corpora promote in-class learning.	-0.049	0.726
Q6.5 Students would enjoy corpus-based activities more than traditional activities.	-0.196	0.156
Q7.1 Corpora do not seem to be more useful than other materials.	0.225	0.102
Q7.2 It is time-consuming to prepare corpus-based materials.	0.069	0.618
Q7.3 Corpus tools are difficult to use.	0.198	0.152
Q7.4 It is time-consuming to have corpus activities in class.	0.192	0.165
Q7.5 Students would prefer traditional classroom activities to those using corpora.	-0.179	0.196
Q8 How likely are you to recommend the workshop to your colleagues?	-0.167	0.228

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