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Perceptions of supervisors and their doctoral students regarding the problems in writing the doctoral dissertation results section

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ABSTRACT

In the past, whereas much attention has been paid to exploring doctoral dissertation writing as a whole or the move analysis of results section, there is a dearth of studies examining how the problems keep posing for doctoral EFL students in writing such a section. The current study focused on students' problems when they write the results section of their dissertations in the fields of education and chemistry, and investigated the degree to which students' understanding was in line with that of their supervisors through semi-structured interviews with ten pairs of supervisors and students. The results showed that (1) disciplinary differences played an important role in writing the results section; (2) supervisors and students in the same discipline understood the purposes of writing the results section to a certain extent, but the overall result varied in different disciplines; (3) there was a lack of agreement between supervisors and students regarding the reasons for the students' problems, especially in the field of chemistry; and (4) students, regardless of discipline, tended to attribute their problems to limited language proficiency while their supervisors provided reasons other than that. In light of the findings, the pedagogical implications for writing instruction are discussed.

1. Introduction

Students write a doctoral dissertation once in a life time (most commonly), and it is usually viewed as a product of the learning process. Notwithstanding the fact that dissertation writing is an important part for students in higher education around the globe, they often encounter writing problems in various sections of the dissertation (Swales & Feak, 2012). Writing problems faced by EFL students at the postgraduate level have been the topic of on-going research in the past few decades (e.g., Kamler & Thomson, 2014; Komba, 2016; Lin & Morrison, 2021; Liu & Buckingham, 2018; Paltridge & Starfield, 2020; Rafi & Moghees, 2022; Shen et al., 2019). Researchers have noted that in writing the results section, students may struggle due to a lack of prior writing expertise (Basturkmen, 2009; Lim, 2010). They have to decide what is key information to present to their readers in the results section, which often makes up the largest section of the dissertation (Basturkmen, 2009; Lim, 2010). Moreover, writing the results section necessitates incorporating data into the main text as well as making a point and building an argument based on data (Swales, 2004; Swales & Feak, 2012).

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Nevertheless, there is a lack of research in previous literature in terms of the specific concentration on the results section of dissertation and the inclusion of both supervisors' and doctoral students' perceptions in an EFL context. Most of the literature focuses on the overall problems encountered by students in dissertation writing in general (e.g., Peng, 2018; Rafi & Moghees, 2022; Shen et al., 2019), rather than inquiring into the specific section. Even if studies conducted move analysis of the results section, they were mostly restricted to research articles (e.g., Brett, 1994; Bruce, 2009; Chen & Kuo, 2012; Lim, 2010; Williams, 1999; Yang & Allison, 2003). In other words, while it is crucial for doctoral students to write the results section in the dissertation, there is a paucity of empirical research regarding the difficulties that they might encounter.

In light of this, the current study seeks to occupy such niche to explore supervisors' and their doctoral students' perceptions of the problems in writing the doctoral dissertation results section in English in the fields of chemistry and education in Taiwan. The reasons why these two different disciplines, chemistry and education were chosen were due to the consideration that first, they reflect different epistemologies, one from natural science while the other from social science. Second, the ways how the results section is approached could be different owing to the different nature of these two disciplines.

In this study, the section with the heading 'Results' that comes directly after the methods section is referred to as the results section. Other names like 'Results and Discussion', 'Results and Conclusion', and 'Results and Summary' were excluded, since these sections may serve different communicative purposes (Kwan & Chan, 2014).

Against this backdrop, past literature regarding the nature of the problems in dissertation writing is reviewed first, including problems in understanding the requirements in dissertation writing, communicative purposes of the results section in dissertation writing, and context of Taiwan in dissertation writing. Then, the research design such as data collection and analysis are illustrated. Next, results related to the purposes of writing the results section, problems of doctoral students when they write the results section, students' perceptions of writing problems in comparison with those of their supervisors are reported and discussed. Finally, the paper ends with conclusion and pedagogical implications.

1.1. Problems in understanding the requirements in dissertation writing

Numerous studies have specifically highlighted the need to understand the requirements of the dissertation genre in addition to common writing problems at the sentence and paragraph levels, such as vocabulary and grammar use (Cooley & Lewkowicz, 1997; Dong, 1998; Kamler & Thomson, 2014; Komba, 2016; Liu & Buckingham, 2018; Rafi & Moghees, 2022; Swales & Feak, 2012). They particularly indicated that students have problems about what content is appropriate for different sections, and are unsure about how it should be organized. According to Kamler and Thomson (2014), these problems are most likely the result of a lack of clear understanding of text logic. However, as Swales and Feak (2012) noted, they are probably the result of a poor understanding of the genre function.

Another major problem reported by supervisors in dissertation writing is constructing arguments in the context of the body of prior research. Students could, for example, exaggerate or underestimate the significance of their findings in relation to earlier studies. Several supervisors have noted that this problem may arise from the inappropriate use of modal or reporting verbs in arguments (Cooley & Lewkowicz, 1997; Kamler & Thomson, 2014; Parry, 1998). Other supervisors noted that students may struggle with argumentation when they are unsure who their readers are or what expectations that differing academic communities have (Belcher & Hirvela, 2005; Komba, 2016). Several studies (Bitchener, 2017; Dong, 1998; Knight, 1999), for instance, focused specifically on Chinese graduate students and revealed that they struggle with critical thinking and sound judgment, as well as with providing precise and detailed facts and examples to support their arguments. These problems are likely due to the fact that they were asked to show respect and not to be against their supervisors' opinions.

There exist multiple potential explanations for students' lack of awareness regarding the function and organization of the dissertation. First of all, research has shown that supervisors in their own disciplines are likely to be implicitly aware of the features and characteristics of the dissertation (Lillis & Curry, 2010). Nonetheless, it may not be assumed that this implicit understanding of the dissertation's features and characteristics will be explicitly articulated to the students. Second, prior to completing their dissertations, students have opportunities to write short research papers in a research method course. However, this does not guarantee that they will be able to effectively apply what they have learned in dissertation writing (Casanave & Li, 2008). Third, students are usually expected to read many research articles in their fields of study prior to beginning their dissertations. Nevertheless, they may not be all aware of the differences of the features and characteristics in various sections of articles within and across disciplines and journals. Fourth, it is possible that only few students have read earlier studies that have highlighted significant features and characteristics in the results section, as those published in by Basturkmen (2009), Yang and Allison (2003), Chen and Kuo (2012), Bruce (2009), Lim (2010), and Brett (1994). Finally, after being accepted into doctoral programs, students are generally required to read a guide in dissertation writing. However, according to Paltridge and Starfield (2020), the guide often lacks detailed information concerning particular dissertation sections.

1.2. Communicative purposes of the results section in dissertation writing

Swales and Feak (2012) state that communicative purposes in the dissertation results section can include introducing results, reporting results and commenting on results. Their work offers a basic framework and a useful guide in writing the dissertation results section. In particular, at the very beginning the results section prepares for the presentation of the

findings. This is accomplished by reporting specific results as a means of positioning the research to demonstrate why more research on a given topic is required. Second, results are crucial in terms of writing a dissertation. Here, researchers present their research and offer their interpretations. The former particularly in the case of quantitative dissertations might have numerous numbers and statistics displayed in the form of figures, tables, graphs, and charts. As a result, these figures and data have to be described in the results section in order to demonstrate how they advance our understanding of the field (Basturkmen, 2009). Furthermore, due to the necessity of expanding on the present state of knowledge, results are discussed and evaluated while researchers defend and emphasize the significance of the research in a competitive research environment. New knowledge claims cannot be made and the numbers may stay useless without the comment and interpretation (Chen & Kuo, 2012; Yang & Allison, 2003).

Over the past decades, research related to the Swales' move analysis model has largely centered on cross-disciplinary variations regarding the nature and range of the rhetorical moves (e.g., Basturkmen, 2009; Brett, 1994; Bruce, 2009; Chen & Kuo, 2012; Kanoksilapatham, 2005; Lim, 2010; Williams, 1999; Yang & Allison, 2003). Despite the fact that much attention has been paid from researchers to previous studies on move analysis of the results section in different disciplines, the issue of writing the results section in the doctoral dissertation from supervisors' and their doctoral students' perspectives still remains very much an open question. In other words, there is a lack of research showing how teachers or students view communicative purposes and problems in writing the results section.

1.3. Context of Taiwan in academic writing

University students in EFL contexts are often confronted with low academic writing proficiency in English. In Taiwan, despite the fact that many universities aim to be globalized, only few of them have inaugurated English writing centers to provide academic writing services to students. Moreover, even though the majority of universities offer 'Freshman English' and/or 'Sophomore English' courses, they adopt textbooks targeted for English for general purposes rather than for academic purposes. Students' academic writing skills remain weak as a result of these limitations and their test-driven learning method. Taiwanese students are therefore usually described as getting high scores on exams yet being unable to compose satisfactory English writing.

At the graduate level, although writing a dissertation in English has increasingly been mandatory for students at more and more universities in Taiwan, it usually comes with an extra load for them because they have not had much practice writing in academic English. Especially for students enrolled in Taiwan's top universities, the majority of course assignments and dissertations often have to be completed in English. However, despite being requested to write research papers and reports in English on a regular basis, their academic writing abilities remain limited (Huang, 2010, 2014, 2017). One of the main causes could be inadequate academic English writing courses offered and the overall lack of requirement for academic English writing courses at the undergraduate level before graduate study. Apart from some credit-bearing courses like 'Thesis Writing' and 'Advanced English Writing', students pursuing doctoral programs generally do not need to enroll in any additional writing or English courses.

1.4. Gap in the research

In view of previous research, graduate EFL students may have several problems in writing at sentence and paragraph levels, as well as in having a good grasp of the requirements of the dissertation genre. Because a dissertation consists of different sections with different purposes, it is important to explore supervisors' and students' understanding the purposes of writing a particular section in the doctoral dissertation. Second, previous research revealed how supervisors and students perceived the overall difficulties that EFL students had when writing their dissertations, such as inability to evaluate literature critically, inability to integrate, generalize and systematize the existing literature of several sources well, inability to construct a conceptual framework based on a wide range of existing literature, inability to see the interrelatedness between the previous research and their own research, inability to separate clearly between discussion and results in the discussion section, inability to make an expected knowledge claim in the discussion, and inability to further advance an argument (Peng, 2018; Shen et al., 2019). However, it did not particularly address any problems that students might have had when writing the results section. Supervisors and students may find certain problems distinct or more pronounced in a particular section. Lastly, earlier research revealed issues that supervisors or students perceived (Casanave & Hubbard, 1995; Yeh, 2010). It did not, however, look into how the supervisor and student interacted with each other about the problems. The present study aims to address the following three research questions:

1. What do supervisors and doctoral students think the purposes are of the dissertation results section?
2. What problems do supervisors and doctoral students perceive in the writing of the dissertation results section?
3. How do students consider their writing problems in comparison with students' writing problems perceived by their supervisors?

2. Research method

Individual in-depth semi-structured interviews were used to assess how supervisors and their doctoral students evaluated the purposes and problems when the results section was written. Interview data were co-constructed by the interviewer and the interviewee interactively (Gubrium & Holstein, 2002). In the present study, I (one of the researchers) acted in the role of a facilitator to let supervisors and their doctoral students lead the interview process. My experiences as a university teacher provided me with an insider perspective which combined with my outsider role as an independent researcher, featuring an important methodological strength of this study. This insider/outsider perspective enabled me to establish a strong rapport with them throughout the data collection phase (Silverman, 2002). My standing of being an insider (teaching writing at the university and therefore giving a sense of collegiality) and an outsider (not knowing each supervisor's and student's perceptions regarding the problems in writing the doctoral dissertation results section) provided frank and open expression of viewpoints on the part of the supervisors and students.

The study included ten pairs of supervisor-doctoral students from Taiwan (chemistry pairs 1–5; education pairs 6–10). The reason for not limiting the study to one discipline was that it would be interesting to observe if their thinking about the purposes and problems when students wrote the results section was shared by different disciplines. Doctoral students were limited to L2 learners from Taiwan. The current study's participants were all anonymous and assigned codes (supervisors: A1–A10; doctoral students: D1–D10). Supervisors and their students participated in the interviews between 2021 winter and 2022 spring, with each participant interviewing for one to two hours. Since they were from different schools, the location of the interviews differed. The study was conducted at universities in Taiwan and was approved by the university ethics committee.

Table 1
Supervisory experiences of chemistry supervisors.

Supervisors	Rank/Discipline	Age	Years of teaching experience	Number of academic journal articles	Number of academic book chapters	Past two years' supervised students	Current supervised students
A1	Associate Professor, Chemistry	42	9	21	5	3	3
A2	Professor, Chemistry	50	15	32	8	3	2
A3	Associate Professor, Chemistry	44	10	26	7	5	2
A4	Professor, Chemistry	56	21	46	9	5	2
A5	Professor, Chemistry	53	17	37	11	6	4

Table 2
Academic experiences of chemistry doctoral students.

Doctoral students	Discipline/Year	Attended academic conferences	Academic journal articles	Academic book chapters
D1	Chemistry, 4th year	4	2	0
D2	Chemistry, 4th year	7	3	0
D3	Chemistry, 3rd year	2	2	0
D4	Chemistry, 3rd year	2	3	0
D5	Chemistry, 5th year	4	6	0

2.1. Chemistry group

Tables 1 and 2 show the basic information of supervisors and their students from chemistry (Pairs 1–5). Supervisors' information is provided in Table 1, such as discipline, ages, years of teaching experience, and students supervised currently and in the past two years. Their ages ranged from 42 to 56 years old, and years of teaching experience were from 9 to 21 years. All five supervisors were professors or associate professors in chemistry. Their backgrounds in research methods ranged from quasi-experimental designs, theoretical and computational approaches, to chemometric methods. These methods were utilized in different instrumental techniques, including vibrational spectroscopy, electrochemistry, and hyphenated mass spectrometry techniques. The number of journal articles published by these five supervisors varied, ranging from 21 to 46. The number of book chapters ranged from 5 to 11. Among the five supervisors, A5 had the highest number of supervised doctoral students, with four doctoral students currently and six doctoral students in the past two years.

Like Table 1, Table 2 offers a basic information on doctoral students, including their subjects of the study and academic achievements. It is noticeable that D2 had the most experience of attending international conferences. D5 had most journal publication experience during the time of interview. None of the doctoral interviewees had published book chapters. It is noted that they were not required to take research methods or academic English writing courses during their doctoral study. They were supposed to learn how to research and write up their findings on their own under the course of independent study with individualized guidance from supervisors. Therefore, supervisors played an important role in shaping students' development of research skills, academic writing and their own sense of themselves as research writers.

Table 3
Supervisory experiences of education supervisors.

Supervisors	Rank/Discipline	Age	Years of teaching experience	Number of academic journal articles	Number of academic book chapters	Past two years' supervised students	Current supervised students
A6	Professor, Education	49	13	15	12	3	1
A7	Associate Professor, Education	43	8	9	4	5	5
A8	Professor, Education	55	22	23	14	4	2
A9	Professor, Education	51	18	20	10	2	2
A10	Associate Professor, Education	45	10	11	5	3	2

Table 4
Academic experiences of education doctoral students.

Doctoral students	Discipline/Year	Attended academic conferences	Academic journal articles	Academic book chapters
D6	Education, 4th year	5	2	2
D7	Education, 5th year	6	3	0
D8	Education, 3rd year	4	1	0
D9	Education, 5th year	6	4	0
D10	Education, 3rd year	4	1	0

2.2. Education group

Tables 3 and 4 reveal the experiences of education participants in a total of five supervisor-doctoral student pairs (Pairs 6–10). In Table 3, all five supervisors were professors or associate professors in education, specifically in the field of education. Their ages ranged from 43 to 55 years old, and years of teaching experience were from 8 to 22 years. Their backgrounds in research methods ranged from interviews, observations, surveys, to questionnaires. Depending on the nature of the study, the research approaches included quantitative research, qualitative research, and mixed methods research. The number of journal articles published by these five supervisors varied, ranging from 9 to 23. The number of book chapters ranged from 4 to 14. Regarding the number of doctoral students supervised in the last two years or presently supervised, A7 was the highest among the five supervisors.

As shown in Table 4, regarding their academic achievements, all of the doctoral students had published journal articles and attended conferences. D9 had most journal publication experience during the time of interview. Only D6 had published two book chapters co-working with her supervisor. It is noted that unlike chemistry doctoral students, they were required to take research methods during their doctoral study, such as quantitative research methodology and qualitative research methodology. However, as was the case for chemistry doctoral students, academic English writing courses were not required.

2.3. Data collection

Participation in the current study was requested from doctoral students. I would then extend an invitation to their supervisors to participate in the study to those who had agreed to take part. Ten pairs of supervisors and their students ultimately took part in the study. The text-based interviews were conducted while the students were at the stage of writing their dissertations. In particular, their supervisors had previously provided feedback on the results section drafts that they had submitted. The student drafts of the results section were brought to the interviews by the supervisors and students for reference. In other words, the interviews were conducted in the presence of dissertation drafts. Supervisors and students were interviewed separately at universities where they were affiliated.

Open-ended questions were intended to encourage reflection on dissertation writing, especially in the results section for students and supervisors. For example, the supervisors' interview questions were structured into two stages. During the initial stage, supervisors were asked to discuss their experiences in helping their students write dissertation results section. They were asked regarding the number of doctoral students under supervision as well as their viewpoints regarding the students' results section's strengths and weaknesses. Additionally, there were a number of possible writing problems in different areas, including understanding the purposes of the results section, choosing and arranging content, and demonstrating appropriate word choice, grammar, and stance. During the second stage, supervisors were asked to discuss the causes of these problems, how to help students prevent them, and how to help them write a successful results section. The interview questions for the supervisors were modified for use in the student interviews. As a result, opinions from supervisors and students could be compared and contrasted. The interviews were conducted in their first language, audio recorded, and thoroughly transcribed by me. The data analysis was done on the first language. Only the excerpts that I used were translated by me, and they were checked against an experienced EFL educator. Possible errors were discussed to ensure that the intended meaning was conveyed in the translation and corrected as appropriate.

2.4. Data analysis

Grounded theory (Strauss & Corbin, 1998) was used to analyze qualitative interviews in an effort to understand how doctoral students and their supervisors view the problems involved in writing the results section of their dissertations. To be more precise, the first stage involved carefully reading and rereading each piece of data. As a result, it was possible to get to know the data and start classifying the information. All of the data were coded, with open coding, to determine the concepts line by line and their potential categories. The next stage was to eliminate uncoded content from related categories and reduce overlap. Finally, the categories remained refined. As more data were coded, the ideas were contrasted and compared at the same time, consolidated into new concepts, and ultimately refined, renamed, and sharpened (Kelle, 2005).

Two researchers checked the coding consistency of the study in order to lend it credibility. Collaborative qualitative coding was intended for two main purposes: (1) to provide a sound interpretation of data in response to the challenge of the subjectivity of qualitative data, and (2) to infer reliability from the observed agreement between independent researchers. For instance, following the individual coding of data by each of us, we collaborated to determine the most relevant categories and defended the data in accordance with those codes. Data were coded mainly by key semantic equivalents. There was debate and justification for various coded data and categorization. The coded data in each category were verified by us after we had reviewed and identified the joint categories. When inter-coder reliability was examined, 97.8% of those involved agreed.

Disagreement on categorized data was discussed and resolved by us. At each instance, we discussed the rationale behind the code until we reached a consensus about which code best suited the instance. Specifically, we chose to resolve all instances of disagreement. They took notice of which codes were used by others for a particular instance and listened to each other's rationale for using a code before making a decision. In addition, as noted by Hammer and Berland (2014), the coding examples should show the complexity of applying the codes, including instances in which the independent researchers disagreed and explaining how agreement was reached. For instance, in the present study, when referring to purposes of writing the results section, one of us categorized the statement "the results section is a part that not just introduces results section and presents the key results, but also summarizes data and compares different data sets" as introducing results section, presenting key results, and summarizing data, while the other researcher categorized it as introducing results section, presenting key results, summarizing data, and comparing and contrasting different data sets. This example shows that comparing and contrasting different data sets is also one of the potential codes.

Following the coding steps suggested by Strauss and Corbin (1998), the coding process in the interviews revealed three main themes: (1) the purposes of doctoral students' writing in the dissertation results section, (2) the problems of doctoral students' writing in the dissertation results section, and (3) students' consideration of their writing problems in comparison with students' writing problems perceived by their supervisors. Groups of different concepts led to the establishment of categories, such as lack of selecting and presenting key results, lack of logical organization, difficulty of presenting the information in an objective and scientific way, and insufficient English proficiency. These categories helped to decide the issues that the students faced in writing the doctoral dissertation results section. Table 5 provides the themes, coding categories, and few examples of coded data.

Table 5
Themes, coding categories, and examples of coded data.

Theme	Coding Category		Example
The purposes of doctoral students' writing in the dissertation results section	*Chemistry Group (Supervisors)* Introducing results section Presenting key results Summarizing data Comparing and contrasting different data sets *Education Group (Supervisors)* Illustrating and elaborating the results Providing possible answers for research questions Making a connection between data and literature Showing the significance of the research Demonstrating the originality and innovation of the research	*Chemistry Group (Students)* Announcing results Introducing results section Summarizing data Commenting on results *Education Group (Students)* Showing the results of the research Presenting the results of the research faithfully Convincing the researchers that the research meets their expectation Strengthening the researcher's perspective Organizing the general results of the research	1. "The results section is a part that not just introduces results section and presents the key results, but also summarizes data and compares different data sets." (A1) (To introduce results section; To present key results; To summarize data; To compare and contrast different data sets) 2. "I think the purposes of the results section are about the need to show the results of the research and present the results of the research faithfully." (D7) (To show the results of the research; To present the results of the research faithfully)
The problems of doctoral students' writing in the dissertation results section	*Chemistry Group (Supervisors)* Lack of selecting and presenting key results	*Chemistry Group (Students)* Insufficient English proficiency (vocabulary/grammar)	1. "My student could not properly organize the results section. He wrote too much about the

(*continued on next page*)

Table 5 (*continued*)

Theme	Coding Category		Example
	Difficulty of presenting the information in an objective and scientific way	Lack of selecting and presenting key results	secondary points, and the readers might lose their
	Insufficient English proficiency (vocabulary/grammar)	Difficulty of presenting the information in an objective and scientific way	patience." (A3) (Lack of selecting and presenting key results)
	Not knowing how to present the selling points	Lack of strict structure	2. "An interview study, unlike scientific
	Not motivating the readers to keep reading		experiment, tends to
	Failing to present the research contributions		compile up a large amount
	Education Group (Supervisors)	*Education Group (Students)*	of information. I have a
	Insufficient English proficiency (vocabulary/grammar)	Insufficient English proficiency (vocabulary/grammar)	hard time organizing
	Inability to present the findings with the right tone (Inappropriate strength of claim)	Lack of logical organization (chronological or from most to least important)	different data sets logically and have made a great effort to polish my writing
	Lack of logical organization (chronological or from most to least important)	Difficulty of deciding what results should be included or excluded	and struggled to present the results in a structured manner. Probably I should
	Repetition in words what the data have expressed	Convoluted writing with arguments/details insufficiently given and justified	select only the information that is most relevant to the questions I want to answer, so that I am able to let
	Difficulty in making decisions about which results to include or exclude		readers know that I have carefully considered all the data relevant to research questions." (D10) (Lack of logical organization)
Students' consideration of their writing problems in comparison with students' writing problems perceived by their supervisors	Lack of selecting and presenting key results Repetition in words what the data have expressed Inappropriate strength of claim		"He did not select information carefully and present only key results. From time to time, the information just came up suddenly." (A2) (Lack of selecting and presenting key results)

3. Results

3.1. Q1. What do supervisors and doctoral students think the purposes are of the dissertation results section?

Table 6
Purposes of writing the results section considered by supervisors.

	A1	A2	A3	A4	A5
Introducing results section	+	+	+	+	+
Presenting key results	+	+	+	+	+
Summarizing data	+	+	+	+	+
Comparing and contrasting different data sets	+	+	+	+	+

Table 7
Purposes of writing the results section considered by doctoral students.

	D1	D2	D3	D4	D5
Announcing results	+	+	+	+	+
Introducing results section	+			+	+
Summarizing data		+	+	+	
Commenting on results		+	+		+

3.1.1. Chemistry group

Tables 6 and 7 show the purposes of writing the results section perceived by chemistry supervisors and doctoral students respectively. As can be seen, Table 6 shows that supervisors have similar perspectives. All indicated that the results section should introduce results section, present key results, summarize data, and compare and contrast different data sets. In other words, the results section should give an overview and orient readers of the results section, show key information to readers, present a summary of data in an informative manner, and reveal similarities and differences across data sets. It should be noted that during the interviews, the supervisors considered these purposes to be interweaved. For example, A1 regarded that "the results section is a part that not just introduces results section and presents the key results, but also summarizes data and compares different data sets."

Table 7 shows that shared understanding among the students is limited. Although all students considered the purpose of the results section to be about the need to announce results, nonetheless, they had different viewpoints concerning preparing background information, summarizing data and commenting on results. All students tended to have a limited understanding of the purposes of the results section when compared with their supervisors. They regarded it as having only two or three purposes (i.e. announcing results, introducing results section, summarizing data, or commenting on results).

It is noted that although all students addressed the need to announce results, the supervisors particularly commented on the role of the results section in presenting key results and carefully selecting only the information that is most relevant to research questions in order to show that all the data are related to research. In addition, the supervisors emphasize the importance of presenting results rather than commenting on results, which in turn denotes that the information should be illustrated objectively rather than interpreted subjectively. For example, A3 stated as follows.

> In a chemistry paper, if a researcher is writing a results section alone, then a researcher should show, not interpret, results. For instance, a sentence like, 'The UV-Vis spectrum of the complex showed the highest at 302 nm', is a fact and appropriate for the results section. However, a sentence like, 'The highest at 302 nm indicates that the complex drastically changed conformation', is interpretive and should be in the discussion section.

Table 8
Purposes of writing the results section considered by supervisors.

	A6	A7	A8	A9	A10
Illustrating and elaborating the results	+	+	+	+	+
Providing possible answers for research questions	+	+	+	+	+
Making a connection between data and literature	+	+	+	+	+
Showing the significance of the research	+	+	+		
Demonstrating the originality and innovation of the research	+	+	+		

Table 9
Purposes of writing the results section considered by doctoral students.

	D6	D7	D8	D9	D10
Showing the results of the research	+	+	+	+	+
Presenting the results of the research faithfully		+		+	
Convincing the researchers that the research meets their expectation			+		
Strengthening the researcher's perspective					+
Organizing the general results of the research	+				

3.1.2. Education group

Table 8 lists the purposes of writing the results section perceived by education supervisors. It is noted that three purposes including illustrating and elaborating the results, providing possible answers for research questions and making a connection between data and literature were indicated by all supervisors, while A9 and A10 did not specifically point out the importance of showing the significance of the research and demonstrating the originality and innovation of the research.

Table 9 shows the purposes of writing the results section considered by education doctoral students. A total of five purposes were addressed by the students. All students indicated the importance of showing the results of the research. The remaining problems varied for them, including presenting the results of the research faithfully, convincing the researchers that the research meets their expectation, strengthening the researcher's perspective, and organizing the general results of the research.

From the comparison of the above tables, both supervisors and students within the same discipline were to some extent consistent. Whether in the chemistry group or the education group, all of the supervisors and doctoral students tended to consider the importance of presenting key results in the results section. Overall, from chemistry supervisors' perspective, all of them considered that introducing results section, presenting key results, summarizing data, and comparing and contrasting different data sets to be the problems. They particularly indicated some problems, such as summarizing data and comparing and contrasting different data. In contrast, all of the education supervisors considered that illustrating and elaborating the results, providing possible answers for research questions, and making a connection between data and literature. Two other problems were especially emphasized, such as showing the significance of the research and demonstrating the originality and innovation of the research.

For students, the situation was similar, in which some purposes pointed out by them overlapped, and some were individually identified by each group. All students from chemistry and education conceded to show the results of the research to be the purpose. Students from chemistry particularly indicated the purpose of commenting on results. As for students from education, they raised four other purposes, including presenting the results of the research faithfully, convincing the researchers that the research meets their expectation, strengthening the researcher's perspective, and organizing the general results of the research.

3.2. Q2. What problems do supervisors and doctoral students perceive in the writing of the dissertation results section?

Table 10
Problems of writing the results section considered by supervisors.

	A1	A2	A3	A4	A5
Lack of selecting and presenting key results	+	+	+	+	+
Difficulty of presenting the information in an objective and scientific way		+	+	+	
Insufficient English proficiency (vocabulary/grammar)	+		+		
Not knowing how to present the selling points	+				+
Not motivating the readers to keep reading		+			
Failing to present the research contributions					+

Table 11
Problems of writing the results section considered by students.

	D1	D2	D3	D4	D5
Insufficient English proficiency (vocabulary/grammar)	+	+	+	+	
Lack of selecting and presenting key results		+		+	+
Difficulty of presenting the information in an objective and scientific way		+	+	+	
Lack of strict structure	+				+

3.2.1. Chemistry group

Tables 10 and 11 show the problems encountered during writing perceived by chemistry supervisors and doctoral students respectively. Among all the problems perceived by the supervisors, all of them brought out the issue of lack of selecting and presenting key results among the doctoral students. A representative example given by A3 reads that "my student could not properly organize the results section. He wrote too much about the secondary points, and the readers might lose their patience." Interestingly, A3 further suggested that "to solve this problem, it is better to imitate and refer to the template particularly for beginning learners. This being the case, students are able to understand ways of describing numbers such as statistical average and standard deviation."

Another major problem indicated by three supervisors was the difficulty in presenting the information in an objective and scientific way. For example, A2 stated as follows.

> The results section should truly show the research findings. However, sometimes my student tended to add personal opinions. It is important to present the results without adding personal comments. Compared with the discussion section, the results section should be more objective.

A2 further indicated that "the opinions should instead be left in the discussion section." Other problems include not knowing how to present the selling points, failing to mend the gap between what the writers aim to convey and what the readers perceive, not motivating the readers to keep reading, and failing to present the research contributions.

As for doctoral students, most of them indicated the problem of lacking English proficiency. For example, D1 confessed that "the biggest problem is that sometimes I found my writing redundant." D1 further stated that it was difficult for him to write like native English speakers with the precision in word use. Two other major problems indicated by three students are lack of selecting and presenting key results, and difficulty in presenting the information in an objective and scientific way. The remaining problem concerned the structure of the results section.

Table 12
Problems of writing the results section considered by supervisors.

	A6	A7	A8	A9	A10
Insufficient English proficiency (vocabulary/grammar)	+	+	+		+
Inability to present the findings with the right tone (Inappropriate strength of claim)	+	+			
Lack of logical organization (chronological or from most to least important)				+	+
Repetition in words what the data have expressed		+		+	
Difficulty in making decisions about which results to include or exclude		+			

Table 13
Problems of writing the results section considered by students.

	D6	D7	D8	D9	D10
Insufficient English proficiency (vocabulary/grammar)	+	+	+		+
Lack of logical organization (chronological or from most to least important)				+	+
Difficulty of deciding what results should be included or excluded		+			
Convoluted writing with arguments/details insufficiently given and justified	+				

3.2.2. Education group

Table 12 lists problems encountered during writing perceived by education supervisors. Most of the supervisors indicated doctoral students' problem of insufficient English proficiency. A representative example comes from A8. "The problem of choosing appropriate words might be a common problem shared by most students. In academic English writing, it is crucial to use precise words that convey sufficient information."

Other problems were singled out by some individual supervisors. A6 and A7 especially emphasized the importance of presenting the findings with the right tone. For instance, A6 said "sometimes students have to use 'might' or 'could', which is a more uncertain tone, whereas sometimes students need to use verbs that show absolute certainty if you have to express 100% support for the idea." On the other hand, A9 particularly pointed out that students might find it hard to organize information in a logical order. For example, A9 indicated that D9's dissertation focused on the cultural aspects of junior high and senior high textbooks. D9 first organized the research by using categories of 'English-speaking' and 'Non-English speaking'. However, A9 stated that this way of classification might be "too general to be of much use. It is important to find patterns within the research results and center on the main points."

In addition to the problem of being unable to present the findings with the right tone and lack of logical organization, another major problem was repetition in words what the data have expressed. For instance, A7 indicated:

> My student simply repeated in words what the data expressed in non-verbal form. He repeated the data already included in figures, tables and charts, and attempted to cover all the information and repeated all the details in words. Results should complement the graphical information and vice versa.

The remaining problem identified by A7 was difficulty in deciding what results should be included or excluded.

Table 13 shows education doctoral students' perceptions on problems encountered during their writing. The problem indicated by most students resonates with those indicated by their supervisors, which is insufficient English proficiency, especially problems with English academic word and grammar use. A representative example comes from D6, stating that "the choice of vocabulary and sentence patterns show potential obstacles to writing," and she later "collected the revision and further made a corpus of her own academic writing." The process, according to D7, took quite some time but she found it crucial for her training as a doctoral student.

On the other hand, the difficulty in presenting the information in a logical way in the result section was especially pointed out by D9 and D10. For instance, D10's research was a longitudinal qualitative study on senior high school English teachers. She indicated:

> An interview study, unlike scientific experiment, tends to compile up a large amount of information. I have a hard time organizing different data sets logically and have made a great effort to polish my writing and struggled to present the results in a structured manner. Probably I should select only the information that is most relevant to the questions I want to answer, so that I am able to let readers know that I have carefully considered all the data relevant to research questions.

Lastly, other problems such as the difficulty of deciding what results should be included or excluded and details insufficiently given and justified varied for each doctoral student.

Finally, comparison of problems encountered during writing the results section was made between the chemistry group and the education group. Supervisors and doctoral students from both groups generally regarded insufficient English proficiency as the major reason. In spite of this, they to some extent held quite different perspectives. In sum, all of the chemistry supervisors considered students' lack of ability to select and present key results to be the problem. They particularly pointed out some problems, including inability to present the information in an objective and scientific way, not knowing how to present the selling points, not motivating the readers to keep reading, and failing to present the research contributions. In contrast, from education supervisors' perspective, all of them considered students' insufficient English language proficiency to be the problem. Four other problems were emphasized, such as inability to present the findings with the right tone, lack of logical organization, repetition in words what the data have expressed, and difficulty in deciding what results should be included or excluded.

On the students' side, some problems overlapped between the chemistry group and the education group. There were also some other problems especially singled out by each group. All students from these two groups regarded insufficient English proficiency as the problem. Students from chemistry particularly indicated problems such as lack of selecting and presenting key results, difficulty in presenting the information in an objective and scientific way, and lack of strict structure. As for students from education, they raised three other problems, including lack of logical organization, difficulty of deciding what results should be included or excluded, and details insufficiently given and justified. This shows that students from the chemistry group tended to have problems related to content selection and genre as well as how write objectively and scientifically in the results section, while students from the education group were likely to have problems related to argumentation.

3.3. Q3. How do students consider their writing problems in comparison with students' writing problems perceived by their supervisors?

In the interviews, although all supervisors indicated their students' strengths in writing the results section, nonetheless, the major focus of this study was on problems. Three supervisors' perceptions of their students' major problems were compared with those perceived by the students. In addition to insufficient English language generally found in different sections in dissertation writing, three major problems peculiar to the results section pointed out by supervisors from either chemistry or education are reported as follows.

3.3.1. Pair A: Lack of selecting and presenting key results

A2 found that D2 had to select and present key results for his research in the results section. In other words, D2 sometimes showed too much about secondary results rather than primary results for his research in the results section. When writing in English D2 tended to avoid selecting and presenting key results, which required him to narrow down. For example, A2 indicated that "my student was unable to narrow down the results section because he had a tendency to pile up a bulk of different information. He did not select information carefully and present only key results. From time to time, the information just came up suddenly."

D2 was aware that he was supposed to capture the essence of his data and highlight only the information that was most relevant to the questions he wanted to answer rather than include all his data and describe everything, so as to let readers know that he carefully considered the data relevant to his research questions. However, as D2 observed, sometimes it was not easy to put into practice.

3.3.2. Pair B: Repetition in words what the data have expressed

A7 regarded that D7's written text in the results section repeated the data that she included in figures and tables. As A7 pointed out, "the results should complement the data in figures and tables and vice versa. My student did include data in the results section, but he merely repeated in words what the data expressed, which may lead to a negative evaluation of her dissertation." A7 further commented that "a result is a message than can give readers a sense of whether one value is higher or lower than another or some data differ from other data in some significant way." In light of this, it can be inferred that the results section should compare and integrate different findings based on data in order to have major and coherent arguments rather than simply report findings by repeating wording in figures or tables.

On the other hand, D7 admitted that she "delved into a number of details in data rather than break down the data into sentences and compare results with different data sets that show their significance to the research questions." Sometimes she had difficulty in organizing, comparing and explaining the differences among different results. As stated by A7, D7 expressed ideas weakly because she focused too much on details and did not present the core findings of her study and organize the results section in a coherent fashion.

3.3.3. Pair C: Inappropriate strength of claim

A6 considered D6's major problem was that her writing lacked sufficient data to support her claim and was not fully justified with the use of an appropriate tone. In other words, her argument was not well supported by data. There was an urgent need, as A6 said, for D6 "to give enough data, explain and justify the rationale behind them, and show how they were connected and developed." The art of the results section particularly in data commentary is "to find the right strength of claim in discussing data and then to arrange statements in some appropriate way, such as in the order to relevance or importance."

D6 regarded that the problem occurred due to the fact that she sometimes drew conclusions without adequate data support. In addition, it was also associated with her lack of English language proficiency. D6 pointed out that she did not have a good grasp of English language; therefore, there was a problem for her to disentangle the complicated concepts that she wanted to express, and thus she usually wrote down her ideas with a few sentences without fully developing her own ideas. To make matters worse, sometimes she did not justify why she wrote in a particular way. In the past, she compensated for her lack of English proficiency by writing first in Chinese and then translating, since she considered it would be easier for her to fully deliver her intended meaning.

4. Discussion

Academic writing is discipline-specific (Ezza & Drid, 2020; Qiu et al., 2024). Overall, the interview results suggest that supervisors generally want to see their students write in disciplinary approved ways as a means of demonstrating their acculturation into the respective field and that supervisors' responses about student's writing problems are reflected by these understandings. For students, writing is an important tool for them to participate in their disciplines and to show their learning to readers in their disciplines.

In response to the first research question, due to disciplinary difference, supervisors in different disciplines had different understandings of the purposes of the results section in view of their experience in doing research and writing different papers and in supervising many doctoral students. On the other hand, there was also little similarity in perspectives among the students across different disciplines. As shown in the interview data, supervisors and students all articulated the importance of showing the results of the research. Nevertheless, differences did exist between chemistry and education

participants. The results indicate that students from chemistry regarded it necessary to comment on results. However, their supervisors did not think so since the results had to be scientific factual reporting and written in an objective way despite the fact that as suggested by Thompson (1993) and Kanoksilapatham (2005), the results section in biochemistry is also the place where new findings are commented upon. In addition, the purposes of the results section tended to show greater variety in the education group than in the chemistry group. Students from education particularly emphasized the validity and sought to convince researchers the value of their own research. Although their supervisors approached from different angles, it was clear that they intended the results to be tightly connected with literature and make a contribution to the existing research. As suggested by Swales and Feak (2012), in the results section, it is important for writers to engage in reasonable speculation in terms of the meaning of their findings related to prior research and explain their reasoning process leading to the conclusions.

The second research question explored supervisor and student perceptions of the problems of students in writing the results section. Not surprisingly, there was similarity between the chemistry group and the education group, particularly in students' problem with limited English language proficiency as a default mode of explanation of their difficulties. The result is in line with some of the previous findings of supervisors and students in response to the problems that students face at sentence and paragraph levels (Komba, 2016; Liu & Buckingham, 2018; Rafi & Moghees, 2022). However, some supervisors offered explanations other than second language proficiency. In addition, there were differences between these two groups. Such differences could be considered evidence that students from chemistry need to learn content selection and genre as well as how write objectively and scientifically in the results section. On the other hand, students from education need to learn augmentation skills. In other words, the results should be reported and structured logically with concrete and specific details to support the argument (Wolfe, 2011).

Moreover, regarding the third research question about what students consider their writing problems in comparison with students' writing problems perceived by their supervisors, the results showed some differences between supervisor and student perceptions of what posed major problems for students in writing the results section. In view of lack of previous research on supervisor-student paired perceptions, the present study adds to our understanding of these problems and the reasons for incongruences. For instance, they might be due to communication problems between supervisors and students (Bastola, 2022; Basturkmen, 2014; González-Ocampo & Castelló, 2018; Yang, 2023). In addition, they may take place if students do not solidly learn from their supervisors' instruction (Kamler & Thomson, 2014). It was apparent in the interview data that when compared with students, supervisors were more aware of the underlying reasons for students' writing problems. This in turn indicates that supervisors plays a key role in supporting their students to recognize the fundamental problems in writing the results section.

Finally, this has been a small scale study of supervisors' and their doctoral students' perceptions of the problems in writing the doctoral dissertation results section in the fields of chemistry and education. Therefore, it is difficult to generalize too far from these supervisors' and students' perceptions. However, because most prior research focused on studying writing problems in dissertation writing in general (e.g., Peng, 2018; Rafi & Moghees, 2022; Shen et al., 2019) or analyzing moves in the results section of research articles (e.g., Brett, 1994; Bruce, 2009; Chen & Kuo, 2012; Lim, 2010; Williams, 1999; Yang & Allison, 2003), one of the major contributions of the present study is to reveal the problems that students might encounter in fulfilling the need to write the doctoral dissertation results section in different disciplines. Supervisors and students all indicated students' lack of understanding of the purposes of writing the results section. More importantly, it showed understandably that supervisors had had a more wide-ranging and thorough coverage of these problems when compared with their students. Another important contribution is that the current finding reveals supervisors' and their students' lack of mutual understanding concerning the major problem the students had in writing the results section and the reason for the problem. The students mainly attributed their problem to inadequate language proficiency while the supervisors gave explanations other than English language proficiency. Lastly and most importantly, the present study helps push forward our understanding of the communicative demands between supervisors and students as well as problems that students may have in disciplinary writing. In particular, focusing on supervisors' perspectives shifts attention to the importance of the reader in writing (Hyland, 2011) and the need for student writers to understand and incorporate an audience for their dissertation writing, addressing those who will judge the learning that has occurred.

The findings therefore have relevance for both the research on writing problems and for the writing-to-learn dimension of writing. For the former, it highlights the importance of not only the texts produced for supervisors in the dissertation writing but also an understanding of supervisors' expectations aside from their concerns with students' limited language proficiency. For the latter it enhances our understanding of the dissertations and expectations which surround students' attempts to advance their expertise and identify their problems by writing themselves into their disciplines. This study therefore further contributes to learning in addition to writing itself, and relates to the acquisition of academic competence in both disciplinary conventions and the ability to communicate and thus write dissertations appropriately. A better understanding of students' problems in dissertation writing along with teachers' perceptions can provide insights into the demands that disciplinary writing makes on students, and inform supervisors' teaching and designers of ESP writing textbooks as well as publishers.

5. Conclusion

In conclusion, this study intends to contribute to the perceptions of supervisor-doctoral student pairs of the problems encountered when students write the results section, an area that is often overlooked in spite of its significance in the positioning between supervisor and student. This study has also offered a deeper understanding of the similarities and

differences by exploring the interplay in the disciplines between chemistry and education. Accordingly, the present study potentially enriches the pedagogy of doctoral dissertation writing, because it not only enhances our understanding of the problems in students' dissertation results writing but also relates to the disciplinary acculturation that teachers and students negotiate in different disciplinary standards. As suggested by Hyland (2013), "a key aspect of disciplinary acculturation involves the gradual acquisition of both the socially recognized conventions of writing and the established practices of knowledge construction" (p. 243). Since students are writing to learn and familiarize themselves with disciplinary appropriate conventions, norms, and expectations, the writing-to-learn connection should be taught and spelled out explicitly.

To illustrate, the study shows that there are similarities as well as differences regarding the responses given from supervisors' and doctoral students' end in different disciplines, and supervisors tend to have more awareness of their students' writing problems compared with students' themselves. First, the purposes given by supervisors and doctoral students in chemistry or education are to some extent consistent, revealing the explanation of research results to the readers to be the most fundamental purpose. On the other hand, supervisors and doctoral students also have different understandings of the various functions and content parameters of the results section in different disciplines. It is also noted that although other responses from each group are different, they also somehow target the similar aspect, such as for the chemistry group to announce or show the results of the research and for the education group to illustrate and elaborate the results.

Second, in terms of problems, when compared within the same group, in chemistry, the most common problem among the supervisors is that doctoral students lack the ability to select and present key results. However, students from chemistry generally perceive lack of English proficiency as the major stumbling block to their writing. On the other hand, in education, the most common problem is insufficient English proficiency, which is elaborated in terms of word choice and grammar. Both supervisors and doctoral students consider the lack of English proficiency to be a major hindrance in writing.

Despite exploratory findings in the present study, it should be cautioned that the sampling of this study only constitutes participants in chemistry in natural science and education in social science. Also, it should be noted that the study does not aim to generalize the findings due its sample size, but to look at the perceptions of supervisor-doctoral student pairs of the problems encountered when students write the results section between these two different disciplines. For the future research, focus can be put on including and comparing different sub-disciplines, such as mathematics and physics in natural sciences and economics and political science in social sciences, since there could be variety even within natural sciences and within social sciences.

Finally, some pedagogical suggestions in writing can be made. At the micro-level, if supervisors can pinpoint the problems that their doctoral students are facing and are cognizant of the causes of these problems, they could be resolved during supervision. Therefore, to foster conversations of varied viewpoints while writing dissertations, supervisors and doctoral students may need to work together to establish mutual understanding and an engaged supervisory relationship (Casanave, 2020). At the meso-level, universities may have to consider disciplinary expectations and norms, and provide a wealth of opportunities including conferences and symposiums for doctoral students to engage with different members of the academic community. Beyond the supervisor-student dyad, more coordinated and programmatic methods for dissertation writing support, such as discipline-specific graduate writing courses, are also required. Last, at the macro-level, it is important for the academic community to embrace the concept of open-mindedness across disciplines and make concerted efforts to assist students during the dissertation writing process.

CRediT authorship contribution statement

Shih-Chieh Chien: Writing – original draft, Methodology, Formal analysis, Conceptualization, Funding acquisition, Writing – review & editing. **Wei-Yan Li:** Data curation, Validation, Writing – review & editing, Investigation, Methodology.

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