

Elucidating Data Analysis Procedures in Research Reports on Language Education: An Inquiry into Writers' Communicative Resources

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Abstract—Helping learners acquire the skills in writing research methods constitutes an important component in various programmes in tertiary education. One of the challenges encountered by novice writers in language education has to do with the elucidation of data analysis procedures in experimental research reports. Adopting a genre-based approach, this study analyses the rhetorical strategies and linguistic resources used for recounting and justifying the steps taken in analyzing data. Employing the Statistical Package for Social Sciences (SPSS), the researcher conducted a quantitative analysis of the rhetorical steps used by experienced writers in 32 experimental research reports published in eight reputed international refereed journals. Attention was directed to the determination of the degree to which the frequencies of the steps under investigation-focused headings differ from those under procedure-focused headings. A detailed qualitative analysis of the writers' textual data was also conducted to identify the broad spectrum of language mechanisms employed in recounting and justifying the data analysis procedures. The findings have shed some light on what and how dissertation supervisors and instructors can possibly highlight while guiding second language writers to recount and justify data analysis procedures in experimental studies on language education.

Index Terms—Data analysis procedures, genre analysis, experimental research, writing research reports.

I. INTRODUCTION

Lecturers' experience in supervising postgraduate and undergraduate students in the writing of research reports and dissertations has revealed that students are often unsure about how they can systematically and convincingly present different kinds of information in the section or chapter on research methods. In this regard, books on educational research methods [1] [2] have highlighted the need to include specific components, comprising "subjects" or "sample", "materials" and/or "instrumentation", and "procedures" (i.e. 'data collection procedures') and data analysis (or 'data analysis procedures'). One of the components in which novice writers encounter difficulties has to do with the presentation of data analysis procedures. Students are uncertain as to (i) whether a brief mention of the data analysis package would be sufficient, and (ii) whether such descriptions of data analysis procedures need to be followed by related justifications.

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More importantly, student writers commit a large number of errors in the writing of data analysis procedures, thus prompting supervisors to ponder upon the need to come up with a framework that can assist novice researchers to present data analysis procedures using appropriate language resources. Motivated by such concerns, this study was conducted to (i) determine the prominence of data analysis procedures as a rhetorical move, and (ii) identify the communicative resources (i.e. rhetorical strategies and language mechanisms) needed to elucidate data analysis procedures. [A 'rhetorical move' in this context is defined as "a rhetorical unit that performs a coherent communicative function in a written or spoken discourse" [3], and it may be realized in the form of a clause, a sentence or several sentences.]

The rationale for conducting this study is based on two major observations of results reported in past studies. First, past research has shown that the frequencies of 'elucidating data analysis procedure/s' vary across disciplines, and we are uncertain with respect to the prominence of this important rhetorical move in some disciplines, such as language education. For instance, in Kanoksilapatham's [4] study, only 13.3% of the biochemistry research papers incorporated descriptions of data analysis procedures (i.e. statistical procedures). More interestingly, Li and Ge's [5] study of medical research reports has shown that there has been a significant increase in the prominence of 'elucidating data analysis procedures' in recent years. Their claim was grounded on the finding that the elucidation of data analysis procedures was found merely in 40% of the older medical experimental research reports (published during the period from 1985 to 1989), but its occurrences increased significantly to 96% in the corpus of recently published medical research reports (published during the period from 2000 to 2004). The prominence of data analysis procedures has been ascribed to the need to enhance the dependability, accuracy, and aptness of the findings to be reported subsequently in the Results section [5]. While the prominence of this rhetorical move in medical RAs in recent years is well demonstrated in their study, we are unsure as to whether the elucidation of data analysis procedure is also prominent in a social science discipline, such as language education, which bears the characteristics of two related disciplines, namely (i) linguistics which is a discipline in humanities, and (ii) education which is considered as a social science discipline.

Second, the need to conduct this study is based on our observation that past research [4] [5] has devoted less attention to the linguistic realizations of 'elucidating data analysis procedures'. For instance, Li and Ge [5] found that (i)

the simple past tense was more prevalent than the simple present tense and the present perfect tense in medical research articles, and (ii) the plural form of the first person pronouns was also more prominent in the medical corpus. Nonetheless, their findings on linguistic features were about research reports as a whole and not about this important rhetorical move on data analysis procedures in particular. As such, we are uncertain in regard to the salient linguistic features of 'elucidating data analysis procedures' which, according to our experience in supervision, appears to be a noteworthy portion in which novice writers have encountered problems in terms of both content and language. Analysing these segments will therefore provide us with adequate related instances that can be used in (i) pre-writing instructional sessions, and (ii) post-writing corrections and explanations.

In view of the need to enlighten novice researchers in their reading and writing of the Method section in experimental studies on language education, this genre-based study seeks to answer the following three research questions:

- 1) What are the communicative functions of 'elucidating data analysis procedures' in experimental research reports on language education?
- 2) Do the frequencies of the rhetorical steps in presenting data analysis procedures in these experimental reports largely hinge on the types of headings that the writers use?
- 3) What salient language mechanisms are used to present data analysis procedures in research reports on language education?

II. METHOD

To answer the aforementioned research questions, a total of 32 experimental research reports on language education were selected from eight different international refereed journals published from 2004 to 2008, including *Applied Linguistics*, *TESOL Quarterly*, *Studies in Second Language Acquisition*, *Language Teaching Research*, *Journal of English for Academic Purposes*, *International Review of Applied Linguistics in Language Teaching*, *System*, and *RELC Journal*. The sample was purposive in that four articles from each journal were chosen using the researcher's "experience and knowledge of the group to be sampled" [6] (p. 134). The selection criteria were such that the papers had to be (i) those published in reputed international refereed journals, and (ii) closely associated with experimental research on language education. The research procedures in some of these journals are presented in sections under investigation-focused headings, such as 'The Study' or 'The Experimental Study' rather than method-focused headings (such as 'Research Design' or Method/s'). Based on Lim's [8] and Pho's [8] classifications, they are considered as 'Method sections'. The findings obtained on the recounting and justification of data analysis procedures are therefore generalizable to the language education research articles exhibiting the aforementioned characteristics. Two specialist informants who had published experimental research articles in reputed international refereed journals on language education were then interviewed to (i) provide views on the rationale for elucidating data analysis procedures in the

discipline, and (ii) determine the degree of acceptability of the communicative functions involved in describing the procedures. Their spoken data in the face-to-face interviews were recorded digitally and analyzed to provide additional data for the textual analysis.

The generic organisation of the articles was analyzed before attention was focused on (i) the schematic structure of the sections containing data analysis procedures, and (ii) the salient language mechanisms used to realise each rhetorical move and constituent step. Swales' [3] [9] 'move-step analysis' was first used to examine the Method sections using a contextual procedure that focused on communicative functions. The researcher analyzed the genre with reference to distinct units in a hierarchically organized framework in which a section was divided into communicative moves that were then subdivided into rhetorical steps. Attempts were first made to ascertain whether it was possible to distinguish descriptions of data analysis procedures from other co-occurring rhetorical categories in the Method sections. The unit of analysis was a rhetorical step realized minimally as a T-unit, which is defined in this study as "an independent clause and all of its dependent clauses" [10] (p. 79). The occurrences of each step were marked in each RA so that its frequency could be determined. A segment identified as an occurrence of each step could comprise a main clause or even several sentences insofar as its occurrence was not interrupted by any other rhetorical step.

Attention was then directed to all segments which were semantically connected with descriptions of data analysis procedures (if any). The frequencies of the related rhetorical steps were subsequently counted with reference to the number of times each step appeared without being interrupted by any other step. The researcher then conducted the Mann-Whitney U-tests to determine the degree to which these frequencies were dependent on the major headings under which the segments appeared. Prominent linguistic features were then analyzed with reference to sentence structures, clause elements, categories of phrases, and word classes if they appeared as salient features of the rhetorical step. The analysis of salient linguistic choices was conducted using the (i) linguistic descriptions provided by Quirk, Greenbaum, Leech, and Svartvik [11] and Greenbaum and Quirk [12], and (ii) descriptions of research-related language illustrated by Thomas and Hawes [13] and Lim [7] [14] [15] [16] [17] for the research genre.

III. RESULTS AND DISCUSSION

Based on the research methods reported above, two rhetorical steps connected with the elucidation of data analysis procedures have been identified, and they are 'recounting data analysis procedures' and 'justifying data analysis procedures' (see Table I). Both specialist informants have acknowledged the frequent incorporation of these two distinctly separate rhetorical steps in their Method sections on experimental research reports on language education. With respect to justifications, specialist informant A (SIA) has considered the incorporations of justifications for data analysis procedures as optional and dependent on the writers' needs. The informants also highlighted the necessity to include justifications in cases where a procedure is "not really

mainstream”. This means that when data analysis procedures are deemed not readily accepted by the academic research community, related justifications would become essential, and this is usually done via citations of past researchers who used the procedures concerned.

‘Elucidating data analysis procedure/s’, as a communicative move, generally appears towards the end of the Method section but it may also be interspersed between segments pertaining to descriptions of research instruments and data collection procedures. Even though it is another form of procedure incorporated in the experimental research papers, it constitutes a different move related to how data were analyzed (rather than how data were collected). Despite the fact that it is possible for this move to occur before data collection procedure, it usually appears as a separate move after descriptions and justifications of data collection procedures. (Note: In some cases, data collected at one stage have to be analyzed first before subsequent data collection can proceed. The inclusion of data analysis procedures prior to a subsequent step in data collection can generally be ascribed to the need to measure the reliability of the instrument using the data collected in the preceding stage (involving a piloted study or pre-test) before the researcher

TABLE I: FREQUENCIES OF JUSTIFICATIONS OF DATA ANALYSIS PROCEDURES IN METHOD-RELATED SECTIONS

Article No.	Heading for the method-related section	Step 1	Step 2	Steps 1 & 2
M1	Method (Three Experiments)	0	0	0
M2	Methods	4	4	8
M3	Method	3	0	3
M4	Experiment 1 & Experiment 2	0	0	0
M5	Method	1	0	1
M6	Method	2	0	2
M7	Experiment 1 & Experiment 2	0	0	0
M8	Method	5	0	5
M9	Methodology	0	0	0
M10	Study 1 & Study 2	5	4	9
M11	The Current Study (2 Analyses)	6	1	7
M12	Method	4	2	6
M13	Method	2	0	2
M14	The Experiment	0	0	0
M15	Method	0	1	1
M16	The Study	2	1	3
M17	The Experimental Study	1	2	3
M18	The Experimental Study	1	1	2
M19	Design of the Study	1	0	1
M20	Method	1	2	3
M21	Experiment I & Experiment 2	0	0	0
M22	Experiment 1 & Experiment 2	3	1	4
M23	Experimental Design	4	2	6
M24	Method	0	0	0
M25	Research Method	1	0	1
M26	The Experiments	0	0	0
M27	Research Design	1	0	1
M28	Method	2	1	3
M29	Method	2	1	3
M30	Methodology	0	0	0
M31	An Experiment	3	2	5
M32	The Study	0	0	0
No. of reports containing the step/s		21	14	22
Frequency of the step/s under method-focused headings		33	13	46
Frequency of the step/s under investigation-focused headings		21	12	33
Total frequency of the step/s in all Method sections		54	25	79
Mean frequency		1.69	0.78	2.47
SD		1.768	1.128	2.590

can decide on whether further data collection can proceed using the same instrument designed beforehand.

Given the informants’ spoken data and the general features of ‘elucidating data analysis procedures’, we can now discuss the frequencies of these steps to provide an overview of their degrees of prevalence in Method sections 1 through 32 (i.e., M1 – M32). Table I illustrates that ‘recounting data analysis procedures’ appears in the majority (i.e. 65.6% or 21/32) of the experimental research reports on language education, with 1.69 occurrences per Method section. ‘Justifying the data analysis procedures’, however, occurs in less than half (i.e. 43.8% or 14/32) of the research reports, with 0.78 occurrence per Method section. Subsequently, Mann-Whitney U-tests were conducted to determine the inter-heading differences in the occurrences of both steps in the corpus. [The Mann-Whitney U-tests were used instead of independent samples t-tests because the occurrences were not normally distributed for all the constituent steps.] Table II shows the Mann-Whitney U-statistics and asymptotic values for each of these steps:

TABLE II: ASYMPTOTIC VALUES INDICATING INTER-HEADING DIFFERENCES WITH REFERENCE TO OCCURRENCES OF STEPS 1 AND 2

Rhetorical Category	Mann-Whitney U Statistic (U)	Asymptotic Value (2-tailed)
Step 1	108.500	0.554
Step 2	105.500	0.442
Steps 1 and 2	115.500	0.754

Given that the asymptotic values for the two steps in the Method sections are above the cut-off point of 0.05, there are no significant inter-heading differences in the occurrences of both steps 1 and 2. This means that occurrences of these steps exhibit no significant differences across papers with procedure-focused headings (e.g., ‘Method/s’, ‘Methodology’, ‘Research Design’, etc.) and investigation-focused headings (e.g., ‘The Study’, ‘The Experiment’, ‘The experimental Study’, etc.).

A. Step 1: Recounting Data Analysis Procedure/s

Step 1 involves a recount of the steps taken in analyzing the collected data. Although it may occasionally appear in the section on research design (as in M23), it normally appears in a separate subsection of the Method section, in which explanations are given on statistical tests, post-instructional scoring methods, and post-treatment assessment/s. Instances of step 1 are given as follows:

- 1) Based on the measures of learning, a detailed interlanguage profile was constructed for each learner. For plurals and past tense forms, increases in targetlike usage of the forms were coded, counting their suppliance of these targetlike forms in obligatory contexts... (M2: 418-419)
- 2) For example, the number of times each participant identified English /ð/ in the intervocalic context with French /d/ was tabulated as well as the number of times it was identified with each of the 10 other response alternatives... (M11: 425)
- 3) The resulting identification rates were compared against chance performance, namely choosing 1 out of 11 possible response alternatives (9%), which is equivalent to 1.4 out of a possible total of 15 responses... (M11: 426)
- 4) That is, all obligatory occasions for the use of ‘a’ (first mention) and ‘the’ (anaphoric reference) were identified. Each occasion was inspected to determine whether the correct article had been supplied... (M28: 361)

The examples above show that this step often consists of procedural verbs indicating how the data were processed,

treated and illustrated in analysis. These procedural verbs are generally process verbs which denote actions taking a period of time (e.g., ‘was constructed’, ‘was tabulated’, ‘was identified’, ‘were compared’, ‘was...inspected’, etc.) and are always expressed in the simple past tense.

A distinct feature of step 1 is the use of verbs denoting arithmetical calculations. These passive procedural verbs denoting arithmetical calculations (e.g., ‘were tallied’, ‘were combined and averaged’, ‘were computed’, ‘were subtracted’, ‘were calculated’, ‘were counted’, etc.) normally appear in the simple past tense as exemplified in Table III:

TABLE III: INSTANCES OF ‘RECOUNTING DATA ANALYSIS PROCEDURES’ USING ADDITIVE/TEMPORAL LINKERS AND PASSIVE PROCEDURAL VERBS IN STEP 1

Linguistic choice	Segment containing ‘recounting data analysis procedure’
Using additive linkers and passive procedural verbs in the simple past tense	Contexts for noticing of forms for each of the groups <u>were tallied</u> , <u>and</u> each report <u>considered</u> in that context since control group learners did not carry out stimulated recalls. (M2: 418) The 5 listeners’ average ratings <u>were combined and averaged</u> to obtain a measure of each speaker’s accent. The results (i.e., the accent scores for each of 16 speakers at two times) formed the <u>baseline measure</u> for accent. (M5: 447) All scores <u>were entered</u> into SPSS (2002) <u>and</u> a range of descriptive and inferential statistics <u>were computed</u> ... (M8: 269) Any T-units that were coded NA <u>were subtracted</u> from the total number of T-units <u>and were not included</u> in the analysis... (M10: 79)
Using temporal linkers and passive procedural verbs in the simple past tense	A total of the semantic units reported under each condition <u>was then calculated and expressed as a percentage</u> of all possible semantic units (35 x 10 for each condition). (M27: 89) An accuracy <u>score was then calculated</u> for each learner by <u>dividing</u> the total number of correctly supplied articles by the total number of obligatory occasions and expressed as proportions of 1. (M28: 361)
Using passive procedural verbs and mathematical equations to indicate the steps taken in analyzing data	In the interpretation task the raw scores <u>were calculated</u> as follows: incorrect response = 0 point; correct response = 1 point. (M13: 79) Articles <u>were first scored</u> for correct use in obligatory contexts. This score <u>then</u> became the <u>numerator of a ratio</u> whose <u>denominator</u> was the <u>sum</u> of the number of obligatory contexts in which articles were supplied inappropriately. The scoring formula is shown in the following equation: $\frac{n \text{ correct suppliance in contexts}}{n \text{ obligatory contexts} + n \text{ suppliance}} \times 100 = \text{percent accuracy in nonobligatory contexts}$ (M8: 266)

These passive verbs are generally preceded by noun phrases denoting dependent variables, such as the numbers of language structures, frequencies of errors, and performance scores in experimental research. Writers usually employ additive linkers or temporal linkers (e.g. ‘and’, ‘then’, etc.) and noun phrases denoting arithmetical calculations (e.g., ‘percentages’, ‘ratio’, ‘baseline measure’, etc.) to recount the data analysis procedures.

The use of passive verbs or phrasal verbs denoting conceptualization (e.g., ‘were considered to have’, ‘considered as’, ‘were treated as’, ‘were counted as’, ‘was accepted as’, ‘were ignored’, ‘was not considered’, etc.) also constitutes a salient feature of ‘recounting data analysis procedures’, as exemplified below:

- 1) If a learner reported noticing in at least two-thirds of the possible contexts, they were considered to have ‘high’ reports of noticing. (M2: 418)
- 2) Thus, considered in the final analyses were only those cross-language identification responses (and similarity ratings associated with them) that were at least two standard deviations above this chance identification rate (24%, or 3.6/15 responses)... (M11: 426)
- 3) Noun phrase calculation was based on the following rules: conjoined NPs were counted as single units; complex NPs (NPs with embedded NPs) were treated as single units and pronouns were ignored. (M31: 335)
- 4) Only fully correct forms were counted, and oversuppliance was not considered. (M2: 418-419)
- 5) Non-suppliance took the form of either omission of any article or of the use of the wrong article (e.g. ‘the’ instead of ‘a’) [Note 2]. In the case of contexts requiring the indefinite article, either ‘a’ or ‘an’ was accepted as correct irrespective of which form of the indefinite article the context required.... (M28: 361)

The passive verbs are used to indicate how the data collected could be conceptualized in the researchers’ attempt to record the values that would be analyzed subsequently.

A more prominent structure existing in step 1 is the subject-predicator-adverbial (SPA) structure as shown in Table IV.

TABLE IV: SPA STRUCTURES COMPRISING MEANS ADJUNCTS USED IN RECOUNTING DATA ANALYSIS PROCEDURES IN STEP 1

Subject	Predicator	Adverbial/s
[Noun phrase referring to data (obtained using the instrument), finding/s or decision/s]	(passive procedural verb in the simple past tense)	(<i>means adjunct</i> explaining how variable/s was analysed)
The similarity rating responses on the 11-point Likert scale	<u>were scored</u>	<u>by computing</u> the participant’s mean rating of the similarity between each English /ð/ token in a given context and each chosen response alternative. (M11: 425)
The FUMSQ	<u>was analyzed</u>	<u>by means of taking</u> frequency counts of each strategy in the pre- and post-test. (M20: 45)
The production score	<u>was derived</u>	<u>by averaging</u> the 10 listeners’ correct identification rates for each participant’s 18 words. (M22:238)
Normality of the data	<u>were achieved</u>	<u>by detecting</u> outliers for each variable <u>by means of</u> box plots and eliminating them from the count. (M23: 226)
The results (see Fig. 1)	<u>were obtained</u>	<u>by calculating</u> the number of semantic units from the materials that <u>were reported by students</u> in the written summary... (M27: 89)
The scores for the narrative writing tests	<u>were analyzed</u>	<u>by means of a repeated measures ANOVA</u> (3 groups x 3 times) <u>with post-hoc one-way ANOVAs</u> . (M28: 361)
The quantity and quality of pausal units	<u>was determined</u>	<u>by asking</u> eight university colleagues to assess pausal boundaries and importance levels. (M31: 335)
Agreement	<u>was reached</u>	<u>by totalling the choices</u> made by the raters. (M31: 335)

Segments in this step usually consist of predicators in the form of passive procedural verb phrases in the simple past tense, which are (i) preceded by sentence-subjects comprising noun phrases referring to phenomena, findings or characteristics of variables, and (ii) adverbials consisting of

means adjuncts explaining how variables are measured (e.g., ‘by computing how many times (out of 15) each participant identified English /ð/ tokens’, ‘by detecting outliers for each variable by means of box plots and eliminating them from the count’, ‘by applying the Bonferroni procedure’, ‘by asking eight university colleagues to assess pausal boundaries and importance levels’, ‘by totalling the choices made by the raters’, etc.). Most of the *means adjuncts* involve the use of the means-related or methodical preposition (i.e., ‘by’) followed by present participial phrases (e.g., ‘by detecting’, ‘by applying’, ‘by asking’, ‘by totalling’, etc.). (Note: *The Cambridge Advanced Learner’s Dictionary* considers ‘by’ as a preposition associated with ‘method’ [18].)

As data analysis revolves around the coding of data collected, step 1 is frequently associated with descriptions of conditions and situations in which the data should be coded in accordance with pre-determined criteria. This explains why temporal and conditional clauses are prominent in this step. Instances of these clauses are provided as follows:

- 1) Only suppliance/nonsuppliance in unambiguous contexts was coded (i.e., the contexts where the researchers could definitely determine that *a* or *the* was needed). This meant that some possible errors were ignored. Exceptions are noted in the points that follow.
 2. In the case of the word prompt *park*, both “in *the* park” or “in *a* park” were possible, so NPs containing this word were excluded from coding... (8: 266)
- 2) There were four possible codings in this system: (a) partially changed (PC), if at least one error from the original T-unit was changed in the direction of the feedback; (b) completely corrected (CC), if all of the errors from the original T-unit were corrected; (c) completely unchanged (UC); or (d) not applicable (NA), if there had been no errors in the original T-unit or if the T-unit had been added or deleted. We considered the PC and CC categories to show changes in accuracy, or at least some type of restructuring, whereas the UC category showed no evidence of this...(M10: 79)
- 3) When a student simply wrote a word or phrase that was associated with the semantic unit, the item was scored as being ‘understood’ even if grammatically inaccurate as this did not indicate a failure to comprehend the text... (M27: 89)

As shown above, *situational adjuncts* (e.g., ‘In the case of the word prompt *park*’) and temporal/conditional clauses (e.g., ‘When a student simply wrote a word or phrase that was associated with the semantic unit’, ‘if at least one error from the original T-unit was changed in the direction of the feedback’, etc.) are often used to indicate the context in which the data need to be coded in the analysis process.

The aforementioned temporal/conditional clauses may occur in two ways as shown in Table V. The first recurrent pattern involves the use of a subordinate temporal clause (indicating the situation encountered by the coders) before a matrix clause stating how the data were coded. The second prevalent structure requires the use of a matrix clause (stating the decision on the way in which the data were coded) prior to a subordinate conditional clause which depicts the situation in which data of certain values were obtained.

Given that ‘recounting data analysis’ frequently involves descriptions of situations in which coding was done, it is understandable that expressions indicating aspects that have been given the focus often constitute a salient characteristic of this step. Instances of aspectual indications are shown as follows:

TABLE V: INSTANCES OF ‘RECOUNTING DATA ANALYSIS PROCEDURES’ USING CONDITIONAL AND TEMPORAL CLAUSES IN STEP 1

Sentence Structure	Segment containing ‘recounting data analysis procedure’ with optional adverbials in some cases	
Subordinate temporal clause preceding matrix clause	<u>When it was not clear whether</u> a noun phrase (NP) constituted an obligatory context for <i>a</i> or <i>the</i> based on the student’s writing,	the NP <u>was not coded</u> . (8: 266)
	<u>However, when</u> neither article was present in the NP,	it <u>was coded as</u> nonsuppliance. (8: 266)
Matrix clause preceding subordinate conditional clause	<u>As such</u> , the participant’s <u>accuracy</u> in a given context <u>is scored as 1</u> (consistently right)	<u>if</u> the mean accuracy rate in that context <u>is at least</u> 80% (i.e., no fewer than 8 out of 10 English /ð/ tokens on average marked as right). (M11: 416)
	The participant’s <u>accuracy</u> in a given context <u>is scored as 0</u> (consistently wrong)	<u>if</u> the mean accuracy in that context <u>is lower than</u> 20% (i.e., no more than 2 out of 10 English /ð/ tokens on average marked as right). (M11: 416)
	The learners’ responses <u>were deemed</u> “correct”	<u>if</u> they <u>marked the same response</u> to their speech as was marked by the English listeners in Experiment 1 (whether it was the intended word or not). (M22: 244)

- 1) The language analysis test was scored on a discrete item basis with 14 points being the perfect score. (M8: 268)
- 2) Again, all of the errors were coded separately by the researchers and tallied with regard to the number and type of errors that had occurred in each version. At this point, all of the participants’ writing, the corrections and reformulations, the error coding, and their verbalizations were put into a column format, an example of which can be seen in Appendix B. (M10: 78-79)
- 3) Not only did we count the number of Errors made by each student, but also classified the exercises according to the percentage of wrong answers chosen in order to see where the main focus of difficulty was... (M17: 169)
- 4) Scores were given to each subject according to their performance in the individual role-play task and the small-group interaction task. (M29: 348)
- 5) For the individual role-play task, each subject received two scores – one score (A1) from 0-7 for his/her performance on eliciting and reporting information with the two examiners; and one overall impression score (A2) from 0-7 on his/her general performance of conversational strategies, intelligibility, and fluency. For the small-group interaction task, each subject was awarded an overall impression score (B) from 0-7 based on his/her participation in the group discussion... (M29: 349)

The instances given above show that prepositions are often used before noun phrases denoting the aspects focused upon in data analysis (e.g., ‘on a discrete item basis’, ‘with regard to the number and type of errors’, ‘according to the a the percentage of wrong answers chosen’, ‘according to their performance in the individual role-play task and the small-group interaction task’, ‘based on his/her participation in the group discussion’, etc.). Aside from the procedural verbs denoting arithmetical calculations explained above, this sub-step is also characterized by past tense verbs indicating conferment/reception (e.g., ‘were given’, ‘received’, ‘was awarded’, etc.).

Aside from the verbs indicating conferment/reception which are often preceded by noun phrases referring to participants or data, verbs denoting execution also form a prominent feature of ‘recounting data analysis procedure’. These *execution verbs* (e.g., ‘were performed’, ‘was carried out’, ‘were carried out’, etc.) are used in the language contexts as shown below:

- 6) Then one-way ANOVAs with posthoc multiple comparison tests using Tukey, repeated measures ANOVAs, and ANCOVAs were performed, followed by Pearson product moment correlation. (M8: 269)
- 7) The transcription of the narratives was carried out by the researcher and two research assistants. (M23: 226)
- 8) Repeated measures analyses of variance (ANOVA) of the nine dependent variables were carried out to measure the effects of Task Complexity and the differences among task types... (M23: 222)

The instances above show that the *execution verbs* are always in the simple past tense and in the passive voice. These verbs generally collocate with sentence-subjects referring to analysis procedures instead of data or participants.

Apart from the aforementioned verbs denoting execution, a more prominent feature of step 1 is the recurrent appearance of verbs indicating usage. These usage verbs are exemplified below:

- 9) The second variable – variability score—is used in implicational scaling. (M11: 416)
- 10) Finally, SPSS (Statistical Package for Social Sciences) was used, in line with current research on different aspects of social sciences. Although SPSS allows us to make various statistical studies, only two of them will be used for this analysis: multiple regression and correlation analysis. (M17: 170)
- 11) To determine the differences between the groups in terms of their vocabulary knowledge at the end of the study, independent t-tests were applied to the vocabulary gain scores of the groups. (M20: 45)
- 12) One-way analyses of variance (ANOVA) are used to detect difference between different levels of proficiency. (M23: 222)
- 13) Cohen (1977) uses the following scale for the d values:
 d=0.2 (small effect size)
 d=0.5 (medium effect size)
 d=0.8 (large effect size) (M25: 355)

As shown above, these usage verbs generally occur in the passive voice and may appear in various tenses encompassing the simple present (e.g., ‘is used’, ‘uses’, ‘are used’, etc.), the simple past (e.g., ‘was used’, ‘were applied’, etc.) and the simple future (e.g., ‘will be used’).

The broader range of tenses indicates that writers’ statements of the purposes or functions of data analysis procedures are comparatively more flexible in terms of temporal references (compared to recounts of other aspects of data analysis procedures mentioned above). A vast majority of the aforementioned usage verbs, however, appear in the simple past tense in a subject-predicator-adverbial (SPA) structure as shown in Table VI.

These predicators are generally (i) preceded by sentence-subjects denoting methods of analysis, and (ii) ensued by infinitive phrases (e.g., ‘to measure learners’ knowledge of articles by taking overuse of the target form into consideration’, ‘to work out the results of the

experimental and control groups’, ‘to determine if there were differences in the mean scores of first year students on selected variables’, etc.).

TABLE VI: SPA STRUCTURES COMPRISING USAGE VERBS AND INFINITIVE CLAUSES IN STEP 1

Subject (noun phrase denoting method/s of analysis with an occasional optional adverbial)	Predicator (passive usage verb in the simple past tense)	Adverbial/s (infinitive phrase indicating purpose of using the analysis procedure)
The TLU analysis	<u>was used</u>	<u>to measure learners’ knowledge of articles by taking overuse of the target form into consideration</u> . (M8: 266)
The following analyses	<u>were used</u>	<u>to answer</u> the three research questions. M8: 269)
The ‘Independent Sample T-Test’ method	<u>was applied</u>	<u>to work out</u> the results of the experimental and control groups. (M19: 438)
<i>In the present study</i> , the split half statistical procedure	<u>was used</u>	<u>to measure the reliability level of the test</u> . (M19: 440)
T-tests	<u>were used</u>	<u>to determine if there were differences in the mean scores of first year students on selected variables</u> . (M25L 355)

B. Step 2: Justifying Data Analysis Procedure/s

Step 2 is closely associated with inter-rater reliability (not internal consistency reliability) which should be considered as part of the data analysis procedure (because the reliability is measured only after the data have been collected), and when the inter-rater reliability is based on values obtained after the data have been analyzed. This way of categorizing the move is supported in part by the fact that inter-rater reliability is only mentioned under the heading ‘Analysis’ in most articles (e.g., M16: 422). In contrast, some articles (e.g., M8), segments pertaining to test reliability (such as internal consistency reliabilities) appear in a separate section before the section ‘Analysis’ because they are related to justifications for the use of the instruments (e.g., tests, questionnaires, etc.) rather than justifications for the data analysis procedures. Such justifications may be embedded in ‘recounting data analysis procedures’. Instances of such embedments are shown as follows:

- 14) The writing data were coded using TLU (Pica, 1991) scores. (M8: 266)
- 15) Each story was then typed, and the errors were coded by both researchers according to a 40-category classification system adapted from Polio (1997, in turn adapted from Kroll, 1990). (M10: 77)
- 16) Writing test scores were calculated by means of obligatory occasion analysis (Ellis and Barkhuizen, 2005). (M28: 361)

As shown above, analysis procedures are presented using passive procedural verbs (e.g., ‘were coded’, ‘was typed’, ‘were calculated’, etc.), but justifications of these procedures are embedded in the adverbials in the form of prepositional or participial phrases (e.g., ‘using TLU (Pica, 1991) scores’, ‘according to a 40-category classification system adapted from Polio’, ‘by means of obligatory occasion analysis (Ellis and Barkhuizen, 2005)’, etc.). These are relatively implicit justifications that engage the citations of previous researchers’

analysis procedures to augment the acceptability of the data analysis procedures.

Justifications may also be embedded in ‘recounting data analysis procedures’ when writers insert important keywords indicating objectivity (e.g., ‘independent’, ‘second rater’, ‘second set of listener judgments’, etc.) as shown below:

- 17) For the test data, three independent coders each coded 25 per cent of the data... (M2: 419)
- 18) Two independent coders coded 100 per cent of the noticing data of forms... (M2: 419)
- 19) In the dictation and writing tests, a second researcher coded a sample of 25% of the total data. The sample came equally from the pretests, posttests, and delayed posttests... (M8: 268)

These justifications of data analysis are considered relatively implicit. Apart from using adjectives denoting objectivity (e.g., ‘independent’), authors merely use numerical and ordinal adjectives (as in ‘three independent coders’, ‘two independent coders’, etc.) to convey the message that the data were analyzed in an acceptable and reliable manner that involved multiple raters, thus minimizing subjectivity resulting from a single rater’s judgment.

In contrast to the embedment exemplified above, most justifications may appear in separate main clauses without directly mentioning steps taken in analyzing the data. The following instances illustrate how distinct justifications are provided:

- 20) This was done so that the three stages, along with the transcripts of the think-alouds (where applicable), could be compared directly with each other, side by side, in order to evaluate changes in accuracy from one version to the next and to investigate any relationships between reported awareness and revision changes. (M10: 79)
- 21) To increase the chances of obtaining acceptable reliability, assessors of oral proficiency can of course be helped by detailed guidelines reminding them of different aspects of language use to be taken into account ...If different interviewers show a similar appreciation of an interviewee’s performance, then this is at least an indication that this interviewee’s level of oral proficiency is likely to be perceived similarly by different interlocutors. (M15: 252)
- 22) They allow quantitative analysis to be carried out and offer an objective view of the situation under investigation. (M17: 170)
- 23) The correct selection of NPs was confirmed by two other raters. Acceptable and exact word scoring were used. For the former a response had to be grammatically correct and provide a suitable meaning within the context of the passage as judged by a native English speaker. (M31: 335)

As shown above, justifications generally incorporate (i) noun phrases containing adjectival pre-modifiers indicating acceptability (e.g. ‘acceptable reliability’, ‘detailed guidelines’, ‘acceptable and exact word scoring’, etc.), (ii) predicator-adverbial (PA) combinations signaling precision and comparability (e.g. ‘could be compared directly’, ‘to be perceived similarly’, etc.), and (iii) predicator-object combinations indicating reliability and objectivity (e.g. ‘to increase the chances of obtaining acceptable reliability’, ‘show a similar appreciation’, ‘offer an objective view’, etc.).

Another form of justification for data analysis procedure/s has to do with inter-rater agreement. Given that inter-rater agreement refers to the extent to which the data have been rated or analyzed in an acceptable way, it should be

considered as a form of justification for the data analysis procedures. Instances of justifications that focus on inter-rater agreements are provided in Table VII. Justifications of data analysis procedures that focus on inter-rater agreements generally appear in three principal structures. First, writers may use noun phrases denoting degrees of agreement (e.g., ‘interrater agreement’, ‘the percentage agreement scores’, ‘higher levels of reliability’, ‘Pearson Product Moment Correlation’, etc.) in the sentence-subject position. Most of these instances involve the use of copular verbs (e.g. ‘was’, ‘were’, etc.) in post-predicator positions. Second, authors also use a noun phrase denoting an analysis procedure in the sentence-subject position (e.g. ‘the coding system’, ‘interrater reliability analyses’, etc.) followed by a transitive predicator and object (PO) indicating a considerably high degree of inter-rater reliability [e.g., ‘had an 85.3% interrater agreement’, ‘yielded moderate to very high indexes (a range: .70–.99)’, etc.].

TABLE VII: INSTANCES OF ‘JUSTIFYING DATA ANALYSIS PROCEDURES’ THAT FOCUS ON INTER-RATER AGREEMENTS

Linguistic choice	Segments of Move 5-Step 1 pertaining to inter-rater agreements
Using noun phrase s denoting degrees of agreement in sentence-sub ject positions	Because all of the individual errors had already been coded, <u>interrater agreement was very high</u> , at over 99%. (M10: 79) In the dictation test, the <u>percentage agreement scores</u> were 89.3%, 87.2%, 91.4%, respectively. In the writing test, the <u>percentage agreement scores</u> were 78.4%, 83.3%, 79.2%, respectively. Although <u>higher levels of reliability</u> for the writing test are desirable, <u>the levels achieved all exceeded 75%</u> , which is <u>satisfactory</u> . (M8: 268) <u>To examine the reliability</u> of the scoring of the writing tests, 20 texts from the pre-test were randomly selected from the three groups and <u>re-scored by the same researcher one month</u> after they were initially scored. <u>The Pearson Product Moment Correlation (r)</u> for the two sets of scores was .97. (M28: 361) <u>Correlation between acceptable and exact scoring</u> was 0.899. (M31: 335)
Using noun phrases denoting analysis procedures in sentence-sub ject positions	<u>This coding system</u> had an 85.3% interrater agreement. (M10: 79) <u>Interrater reliability analyses</u> comparing accuracy ratings within the first listener group (using the original 40 recordings) and within the two listener groups combined (using a subset of 7 recordings) <u>yielded moderate to very high indexes (a range: .70–.99)</u> , which suggests that the listeners were <u>consistent in their judgments</u> . (M11: 416)
Using noun phrases denoting raters in sentence-sub ject positions	Of the 3740 scores that each rater assigned in total, <u>the two raters assigned identical scores</u> in 3115 cases (83.3%). (M12: 465) In one case (immediate receptive performance on idiom 4), <u>both raters assigned the same score to all participants (n = 57)</u> ...Because of <u>this high agreement between the raters</u> , the scores of the first rater were used for subsequent analyses. (M12: 465) Prior to the experiment, <u>10 native speakers of English identified the stimuli with a 98% accuracy</u> in an open-choice identification task. (M22: 236)

Third, writers often use noun phrases denoting raters (in data analysis procedures) in sentence-subject positions (e.g., ‘the two raters’, ‘both raters’, ‘10 native speakers of English’, etc.) ensued by the transitive predicators in the form of active procedural verbs and subsequent phrases indicating high degrees of agreement (e.g., ‘assigned identical scores’, ‘assigned the same score to all participants’, ‘identified the stimuli with a 98% accuracy’, etc.).

A more important salient feature of such justifications has to do with the use of an intra-step shift (i.e., a shift from a segment with a communicative function to another segment with a related function within the same step) from an indication of agreement to an acknowledgment of disagreement between raters while justifying a data analysis procedure (see Figure 1). While agreement is indicated using percentages which are all above the level of 60, writers have a propensity to provide more specific details pertaining to the aspects in which disagreements emerge in the process of analyzing the data. Such candid acknowledgments of the parts in which raters initially or eventually disagreed actually convey an overall positive message about the acceptability of the analysis procedure.

Indicating agreement while justifying data analysis procedure	Further justification via explanations of procedures used to deal with disagreement/s
Inter-rater agreement of 94 per cent was obtained, and it was determined that a single coder could code the remaining data.	Disagreements in the test data that were coded by more than one rater were not included in the analysis. (M2: 419)
Inter-rater reliability for these data was 89 per cent based on simple agreement.	Where there was disagreement in coding data elicited through stimulated recall (11.5 per cent of the data set), the data were reviewed and re-rated by a third rater, and retained for the analysis. During this third rating of these data, it became apparent that many of the disagreements stemmed from one particular video clip of the 25 clips used in the stimulated recall. Upon review of the tape, it was determined that the specific clip was unclear, and therefore not a good example. The clip was discarded and all learner reports related to it were removed from the data set. (For the other three sources of noticing data, disagreements between the two raters resulted in removal from the data. (M2: 419)
The level of interrater agreement was 83.1% (simple percentage agreement), slightly higher than the reliability found in Polio.	Each of the disagreements was discussed until a consensus was reached, and the agreed-upon coding was included in the data analysis. The researchers also jointly identified some expressions that they agreed were not technically incorrect in terms of grammar but were unlikely to be used by a native speaker. These were also marked for correction. Accidental oversights of unambiguous errors (such as faulty subject-verb agreement) were not counted as disagreements. (M10: 77)
Results were as follows: Part A1 = 100%, Part A2 = 62.5, and Part B = 75.0.	Following this, the raters discussed the scoring criteria and their application in an attempt to minimise future discrepancies in the study proper. (M29: 348)

Fig. 1. Shifts from indications of agreement to acknowledgments of disagreement .

This is an important sub-step in which writers augment the reliability of their analysis procedures (and that of the results to be presented subsequently) by clearly stating that portions (where disagreements emerged) were excluded from the data analyzed.

The aforementioned justifications involving points of disagreement (as illustrated in Figure 1) are characterized by the use of predicator-adverbial (PA) combinations denoting exclusion (e.g., ‘were not included in the analysis’, ‘were

removed from the data set’, ‘resulted in removal from the data’, ‘were not counted as disagreements’, etc.), each of which contains a past tense verb followed by a prepositional phrase. These PO combinations are generally preceded by expressions denoting disagreements and mistakes (e.g., ‘Disagreements in the test data that were coded by more than one rater’, ‘disagreements between the two raters’, ‘Accidental oversights of unambiguous errors (such as faulty subject-verb agreement)’, etc.).

Recounting data analysis procedure	Justifying data analysis procedure
A conservative emergence criterion was used to assess learners’ developmental stage; learners were assigned to the highest level on the scale for which they produced two distinct questions during the test tasks. (M2: 419)	This is similar to the criterion used in other acquisition studies involving question development (Spada and Lightbown 1993; Mackey and Philp 1998; Silver 2000; Philp 2003; McDonough 2005). (M2: 419)
Again, all of the errors were coded separately by the researchers and tallied with regard to the number and type of errors that had occurred in each version. At this point, all of the participants’ writing, the corrections and reformulations, the error coding, and their verbalizations were put into a column format, an example of which can be seen in Appendix B. (M10: 79)	This was done so that the three stages, along with the transcripts of the think-alouds (where applicable), could be compared directly with each other, side by side, in order to evaluate changes in accuracy from one version to the next and to investigate any relationships between reported awareness and revision changes. (M10: 79)
On photocopies of the students’ texts, obligatory uses of the targeted features were identified and marked according to whether they were correct or incorrect. Accuracy on each occasion was calculated as a percentage of correct usage for each script given the range of obligatory occasions. For example, in any one script, three correct uses of the targeted features from 10 obligatory occasions meant a 30% accuracy rate. (M16: 422)	Inter-rater reliability calculations with a trained research colleague revealed a 95% agreement on the identification of targeted errors and a 98% agreement on the assignment of errors to the targeted categories. (M16: 422)
Finally, SPSS (Statistical Package for Social Sciences) was used, in line with current research on different aspects of social sciences. Although SPSS allows us to make various statistical studies, only two of them will be used for this analysis: multiple regression and correlation analysis. (M17: 170)	They allow quantitative analysis to be carried out and offer an objective view of the situation under investigation. (M17: 170)
Noun phrase calculation was based on the following rules: conjoined NPs were counted as single units; complex NPs (NPs with embedded NPs) were treated as single units and pronouns were ignored. (M31: 335)	The correct selection of NPs was confirmed by two other raters. Acceptable and exact word scoring were used. For the former a response had to be grammatically correct and provide a suitable meaning within the context of the passage as judged by a native English speaker. Correlation between acceptable and exact scoring was 0.899. (M31: 335)

Fig. 2. Shifts from the recounting of data analysis procedures to their supporting justifications.

As justifications involve acknowledgments of some flaws and oversights identified, it is noticeable that these segments

comprise clauses indicating some shortcomings discovered only during the analysis process (e.g., 'the specific clip was unclear...not a good example', 'were unlikely to be used by a native speaker', etc.). These expressions that acknowledge weaknesses discovered in the analysis procedures are often used in combination with verb phrases indicating subsequent repeated evaluation (e.g., 'were reviewed and re-rated', 'discussed the scoring criteria...to minimize future discrepancies', 'were also marked for correction', etc.).

While the aforementioned shifts appear within a rhetorical step pertaining to justifications, Figure 2 lucidly demonstrates the shifts involving inter-step transitions from 'recounting data analysis procedure' to 'justifying data analysis procedure'. Shifts usually occur under several circumstances. First, when a certain analysis criterion is used, writers generally cite some similar criteria used in past research as a form of justification, thus giving readers an impression that the criterion is part of a time-tested procedure with a proven record (as shown in the instances extracted from M2). Second, after writers have stated that their data were analysed separately by different raters in step 1, they may proceed to provide reasons pertaining to the comparability of the data in stages via step 2 (see the second instance from M10). Third, after the method of calculation has been described in step 1, writers may immediately support it with (i) numerical values indicating a high level of agreement (as shown in the examples from M16 and M31), or (ii) phrasal combinations carrying positive connotations concerning objectivity, such as 'offer an objective view', 'was confirmed by two other raters' (as illustrated in the instances from M17 and M31).

IV. CONCLUSIONS AND IMPLICATIONS FOR READING AND WRITING INSTRUCTION

This investigation has resolved several important issues connected with the prominence, rhetorical strategies and language resources needed in elucidating the data analysis procedures of experimental research reports on language education. This major move (i.e. 'elucidating data analysis procedures') is realized in two distinct ways via (i) recounts of the data analysis procedures which occur in a majority (nearly two-thirds) all of the experimental reports, and (ii) justifications of data analysis procedures that appear in less than half of the research papers in this academic discipline. Like medical research articles [5], 'elucidating data analysis procedures' also occurs in a majority of the experimental research reports in language education. Overall, step 1 (i.e. 'recounting data analysis procedures') occurs more than once on average, thus showing that it is a principal communicative category in the experimental reports. While step 1 focuses on recounting how the data were processed, treated and illustrated in an analysis, step 2 demonstrates the acceptability of the data analysis procedures via citations of past research procedures and explanations about the extent to which the expected methodological shortcomings have been minimized.

Using the Mann-Whitney U-tests, we have confirmed that the frequencies of both steps are not contingent upon the differences between the procedure-focused and investigation-focused headings of the Method-related

sections. In experimental studies, supervisors and instructors may therefore allow novice writers to incorporate step 1 under either a procedure-focused heading or an investigation-focused heading as they do not imply significantly different frequencies in the recounting and justification of data analysis procedures.

In terms of pedagogical implications, this study has revealed the prominent occurrence of specific linguistic mechanisms that merit attention in supervision and instructional sessions. In the language training given to novice writers, attention may first be directed to the passive forms of procedural verbs, usage verbs, and execution-related verbs in the simple past tense. Novice writers can also be given relevant exercises requiring them to use phrasal verbs denoting conceptualization and/or procedural verbs denoting arithmetical calculations. Using the pre-writing instances provided in Table III, supervisors or instructors may introduce these past tense verbs to learners in pertinent contexts requiring the use of appropriate additive and temporal linkers so that learners are trained to use the appropriate tense to construct sentences expressing past successive actions in elucidating data analysis procedures.

More importantly, the syntactic structures that can be recommended to learners in an initial frame of reference may include the SPA structures, as shown in Tables 4 and 6, in which predicators in the form of passive procedural verbs or usage verbs in the simple past tense are ensued by adverbials comprising either (i) *means adjuncts* explaining how variables are measured, or (ii) infinitive clauses expressing the purpose of using the data analysis procedures. In cases where novice researchers need to indicate the context in which their data are coded in the analysis process, instructors need to direct learners' attention to the use of temporal and conditional clauses which engage *situational adjuncts* that describe the coding processes.

It is also recommended that novice writers incorporate detailed justifications using citations of past researchers' data analysis procedures, particularly in cases where a procedure is not really a 'mainstream' or established procedure in language education. To show learners a relatively implicit way of embedding a justification in a description of data analysis procedures, the focus may be on the use of numerical and ordinal adjectives that suggest that the data have been analyzed in an acceptable manner. In alternative cases where distinct and overt justifications are needed, instructors may highlight the use of noun phrases containing adjectival pre-modifiers indicating acceptability, predicator-adverbial combinations signaling precision and comparability, predicator-object combinations indicating reliability and objectivity, and noun phrases denoting inter-rater agreements. More precisely, to acquaint learners with the specific rhetorical development of justifications, the intra-step shifts (as demonstrated in Figure 1) can be used to demonstrate how an indication of inter-rater agreement may be supported by further explanations concerning how cases of disagreements have been appropriately dealt with. Under circumstances where novice writers are not able to distinguish 'recounting data analysis procedures' in step 1 from their related justifications in step 2, instructors may use the inter-step shifts (as illustrated in Figure 2) in pre-writing activities to familiarize novice writers with the range of prevalent

rhetorical transitions.

In brief, guiding novice researchers in the presentation of data analysis procedures requires an in-depth understanding of a wide range of rhetorical strategies and language resources. Citing similar analysis criteria employed in past research constitutes merely one of the major strategies used to highlight the 'time-tested nature' of a data analysis procedure in this long-established social science discipline. Providing pertinent reasons for the comparability of the data and highlighting the strengths of a new procedure are common rhetorical strategies used to enhance the acceptability of the procedures concerned. Overall, experienced writers' descriptions and justifications of data analysis procedures are not merely restricted to the use of numerical values indicating reasonable levels of agreement, but may include a broad spectrum of persuasive language expressions that demonstrate sufficient consideration of the objectivity and acceptability involved in data analysis procedures.

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