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Abstract

The present paper investigates one aspect of questionable research practices relating to Arabic L1 learners of foreign languages, namely the use of statistics. The objective of the paper is to argue that reproducible research requires adopting wise practices in linguistics and that the excessive focus on quantification does not seem to serve this purpose. Statistical significance tests in quantitative research are routinely used in linguistic inquiry as well as language teaching and learning studies with a view to supporting the relevant explanatory insights in linguistics. In this article, I will expose the misuse of statistics by doctoral students in English departments of Morocco working on Arabic L1 learners' data, by highlighting some practices that are at odds with international good practices in academic research in linguistics. I will take stock of the current questionable practices in this regard to dispel some of the misunderstanding about the use of statistics which is now gaining grounds lest this becomes an orthodoxy. I will argue that research on Arabic L1 learners' data should be focused more on exploration and discovery, as well as the validation of epistemological insights than on mere descriptive quantification geared to hypothesis verification. These areas of focus constitute the crux of academic research in linguistics, but they seem to be lost in statistics in doctoral students' theses. Recommendations and solutions are provided for enhancing transparency and improving reproducibility of doctoral research outcomes to advance theory building and the delivery of new research lines in linguistics as well as to avoid the risk of research waste, in line with the requirements of open science.

Keywords: Arabic L1 learners' data, questionable practices, statistics, misconceptions, objectivity, academic standards

1. Introduction

The core subject matter of linguistics is obviously research into knowledge of language. The related research agenda aims mainly at the construction of a general theory of the description of the nature, development, structure and use of language. In this respect, the data that linguists work on hardly require any quantification or numerical values; in other words, statistics is not needed, all things being equal. However, there are quite a few areas that require quantification for practical reasons, such as corpus linguistics, sociolinguistics, lexicology, historical linguistics, applied linguistics and machine translation. For example, there is no other way corpus linguists can test or summarize their quantitative findings without recourse to statistics, as the huge body of data and the related numerical complexity (probability) necessitate statistical treatment. More specifically, many applications in computational linguistics (part-of-speech tagging and information retrieval) require complex statistical methods. Still, the use of statistics in these areas themselves should be perceived as a contribution that statistics makes to linguistic studies, as a tool of description, though it may very well serve in the reproducibility of research in terms of quantification when the relevant research problem relates to quantification itself. That is, quantification in linguistic studies should be used if and when it is dictated by the theoretical framework, with a view to advancing knowledge, and specifying the uses of the knowledge gained through the study of linguistics, with reference to a well-defined valid research problem.

Nonetheless, a remarkable trend among linguistics doctoral students in Morocco, working on Arabic L1 learners' data, indicates that statistics is misconstrued in many key respects, chief of which is that the numerical quantification is foregrounded in their theses, while the objectives of doing research in linguistics are backgrounded, which significantly compromises the academic strength of their theses, especially in terms of reproducibility. The objective of this article is to sensitize doctoral students and supervisors to the academic demerits of this questionable practice and suggest ways to avoid this pitfall in academic research in linguistics. The structure of this article can be seen along the following lines. The next section reviews the major works in the published literature on questionable practices in linguistic studies with reference to statistics, with a view to

outlining the problem of the misuse of statistics in doctoral research theses studying Arabic L1 learners' data. The method adopted is then presented in Section 3 to expose the aspects of this issue, substantiated by (1) a survey conducted among doctoral students in Morocco, (2) interviews with doctoral students conducting research, (3) examination of a sample of doctoral theses that have been completed, and (4) the insights drawn from my examination of Moroccan doctoral theses, as an external examiner. Section 5 highlights the questionable research practices related to the problem, benchmarking them against the required practices accepted in international universities. Section 6 offers some recommendations as to what should be done to redress this situation.

2. Literature Review

Questionable research practices have been the subject of serious debate in recent years with a view to reducing avoidable research waste in linguistic studies. Two major arguments emerge from this debate with regards to the heavy reliance on statistics. The first relates to the ethical dimensions of handling quantitative data, as well as the inadequacy of the empirical value of statistical significance. The second concerns the excessive reliance on statistical analysis and the relegation of problem-based inquiry in linguistic studies to a secondary position. Isabel et al (2022), Sterling and Gass (2017), Fanelli (2009) and Vanhove (2020), among many others, cogently argue that it is the integrity of data and research findings that determine academic progress and advancement of knowledge. Their examination of empirical research practices in linguistics showed both intentional and unintentional distortion of statistical data and findings. They concluded that such questionable practice hinders reduplication of research and blocks the advancement of knowledge in this field. They suggest various ways to improve ethical quantitative data handling and reporting in linguistic research.

Moreover, many arguments have been leveled against the validity of statistical significance. Amrhein et. al (2019), Diaz-Quijano et. al (2020), Colquhoun (2018), Kline (2004), Larson-Hall (2012) and Nickerson (2000) call into question statistical significance in scientific investigations, including language studies. They argue that what determines the credibility of a statistical result is replication, rather than significance. The use of "significance" as well as exact p -levels constitute merely a strategy to avoid this reality. Some researchers in the survey of Amrhein et al. (2019) went as far as to be in favor of removing statistical significance altogether from empirical inquiries. Also, Norris (2015) presented valid arguments in this regard indicating that statistical significance tests using p values have always been the object of misinterpretation, so much so that they hinder the advancement of knowledge in linguistics.

With regard to the second major argument against the excessive reliance on statistical analysis and the relegation of problem-based inquiry to a secondary position in linguistic studies, Gries (2009) posits that instead of focusing exclusively on statistical frequencies, researchers should attach more importance to the linguistic theoretical dimensions. Kerlinger and Lee (2000), Creswell (2005), Ellis and Levy (2008) corroborate this stance by arguing that the academic value of research in social studies is largely determined by the interaction of the research problem with the other elements of research. More specifically, it is the research problem, rather than the numerical quantification, that determines the research questions and the discussion of the relevant issues. Winter (2020) takes it that the ultimate goal of statistics is to obtain *meaning* from statistical data, rather than considering such data as an end unto itself.

Swanson (2013) posits that statistical data can only make sense if it is discussed within a theoretical framework, which enables the researcher to investigate and optimally solve the research problem, as well as to interpret the findings in the data obtained and draw the relevant conclusions. Isaacs and Chalmers (2023) rightly point out that the theoretical framework helps the researcher avoid the pitfall of conducting research that addresses a question for which an answer is either already known in the published literature or potentially obvious based on common sense, which reduces "avoidable research waste". It is the discussion of the data within a theoretical framework, rather than statistical significance, that guarantees the advancement of knowledge as to how languages are learned, whether there are linguistic universals, whether language faculty is innate, how cognition affects language and how language affects cognition, to name but a few objectives of conducting research in linguistics.

Against this backdrop, Moroccan doctoral studies involving Arabic L1 learners' data will be assessed in the light of the insights of the literature reviewed above in order to argue that the excessive reliance on quantification leaves much to be desired for these studies to contribute to the advancement of knowledge in linguistics, particularly due to their excessive focus on significance. Put differently, the present paper provides evidence from the Moroccan reality in this regard to corroborate the insights put forward in the research works above. Neither quantification nor significance should blind doctoral students to the fundamental objectives of conducting research in linguistics.

2.1 The Problem

Students of linguistics engage in language studies mainly to contribute to the understanding of the knowledge that

humans possess about language in its various forms and manifestations, such as the universal and parametric structures of language, language variation, along with the relationship between language use and worldviews. The ultimate objective of the doctoral program in linguistics is to train supervisees to design and conduct original research within a well-defined theoretical framework, with a view to solving a valid research problem. The related assumption here is that doctoral students have a broad knowledge of linguistics, and they are equipped with the required skills to independently conduct research in a subfield of linguistics. In theory, this is what the situation should be like. In practice, the story is quite different, as the picture is fraught with practices that are moving away from the goal of conducting a doctoral study in linguistics, through the excessive focus on statistics (Larsson et al, 2020; Greco et al, 2023).

3. Method

This article is set to answer the questions below:

- In what ways is the use of statistics misconstrued in Moroccan students' doctoral theses studying Arabic L1 learners' data?
- What are the consequences of the related misconceptions?
- What should be done to redress this situation?

This study is exploratory in the sense that it defines the issues of misconstruing statistics in doctoral studies in linguistics, for further investigations to be conducted in this regard. It is a small-scale preliminary study targeted at identifying the major issues, with a view to helping doctoral students avoid the practices that weaken their theses in linguistics. A survey among doctoral students in Morocco (Appendix A), including 9 students who have completed their theses and 27 whose work is still in progress, was conducted to capture their views on the use of statistics in their studies. Interviews (Appendix B) were also conducted to explore how doctoral students perceive the function of statistics, to brainstorm potential solutions, and determine the aspects of investigation needed for more insights into the obtained data. A sample of twelve (12) doctoral theses that have been completed were also examined to capitalize on the data obtained from the survey and interviews.

The major questionable aspects in students' theses arising from the misuse of statistics will be exposed relating to the thesis titles -reflecting the topic of the study- the review of literature, the methodology as well as the discussion of the findings. The related observations will be corroborated by the outcomes of the survey, interviews and the inspection of the 12 completed theses.

4. Survey Results

The research findings will be presented with reference to the key components of the thesis, along with the related analysis to answer the questions above. The results of the survey (see Questionnaire in Appendix A) regarding the first 9 questions of the survey are given below, where percentages have been rounded up or down the integer values as appropriate, since the decimals are not consequential in this context:

Q#1: Paramount importance of statistics in research	Agree = 64%	Do not agree = 36%
Q#2: Lack of academic strength without statistics	Agree = 69%	Do not agree = 31%
Q#3: Necessity of statistics in the discussion section	Agree = 58%	Do not agree = 42%
Q#4: Frequency of significance-based titles	Always = 53%	Rarely = 47%
Q#5: Frequency of statistics-oriented titles	Always = 64%	Rarely = 36%
Q#6: Frequency of stats debates in viva voce	Always = 75%	Rarely = 25.00%
Q#7: Statistics as a source of concern for students	True = 61%	False = 39%
Q#8: Students' struggle with statistics	True = 72%	False = 28%
Q#9: Getting stats right without worrying about the rest	True = 53%	False = 47%

As can be seen from the results above, a good number of doctoral students believe that their thesis strength, objectivity and validity are largely determined by the use of statistics. Students' answers to Question 2 indicate that statistics is perceived as a key element of doctoral research. 25 out of 36 doctoral students (69%) believe that it is statistics that makes a thesis academically strong. 27 out of 36 (75%) stated that statistics is usually discussed at some length during the thesis defense (viva voce).

15 students out of the 36 who answered the questionnaires were interviewed to provide more information about their perception of the use of statistics in linguistic studies. The main reasons given by the interviewees for the importance of statistics in linguistics research are (1) it is a predominant perception among doctoral students that incorporating statistics in the thesis is mandatory, (2) it is emphasized by some supervisors, (3) it is essential for the study to be objective and valid and (4) it takes much space in the viva discussions that they have attended.

However, some students are aware that statistics does not contribute to the strength of a linguistic study unless it is dictated by the research problem/questions. The relevant excerpts from the interviews are given below:

Interviewee 1

“Most of the students have this issue of statistics; whenever we meet, uh, new or even old doctoral students, we always talk about statistics in the thesis.”

Interviewee 3

“Concerning statistics, my supervisor is satisfied to some extent. Although I didn't include some sophisticated or more complicated statistics, I know that it's needed. But still I didn't include this. Maybe because of time.”

Interviewee 4

“Statistics is the core of any research, it's the main or the heart of any research actually, so we cannot get any research without statistics. We do all the research to get certain results. This is the main objective and to get the results, we need statistics.”

Interviewee 6

“For the validity and objectivity of the research, you need statistics, of course; otherwise, how can you prove it, I mean, the evidence is statistics.”

Interviewee 9

“Statistics is important because the examiners talk about it a lot in the thesis defense, and it is presented in detail by the doctoral candidate during the viva discussions. Sometimes, heated discussions arise between the examiners talking about the details of statistics.”

Interviewee 10

“Half of the thesis should be statistics, and the other half the analysis of linguistic examples and discussions; but without the help of your supervisor, you cannot get the statistics correct.”

Interviewee 11

“Students can request help from some experts in statistics, but it is better to have workshops, not courses, for us to be able to do statistics by ourselves.”

Interviewee 13

“we are not supposed to be statisticians or computer programmers ... our main concern is linguistics and the study of language in some specific aspects.”

Interviewee 14

“No, statistics is not necessary in linguistics; but you can do a simple quantitative study in your thesis. [...] Students should change their mindset about statistics and not be afraid if they are required to do it.”

Interviewee 15

“In the thesis defense, the discussion is always about statistics, like sample size, wrong presentation of results, talking about tables and graphs, or incorrect statistical tests.”

The information obtained through the interviews indicates that only 3 out of 15 students are aware that statistics is used only as needed to support linguistic analysis. The remaining 12 interviewees believe that statistics is a *sine qua non* of conducting research in linguistics.

5. Questionable Practices

In this section, the misconceptions relating to the use of statistics in Moroccan students' doctoral theses will be exposed briefly. This will be conducted with reference to theses' titles/topics, methodology section and discussion section. In so doing, we will highlight the pitfalls that weaken the academic value of doctoral students' theses. It should be noted that all the theses object of this inquiry use data relating to Arabic L1 learners of English.

5.1 Topics/Titles

A look at the topics of the sample doctoral theses completed in the last nine years (from 2015 to 2023) reveals that there is a drift away from the core components of linguistics, namely syntax, semantics, morphology, phonology, and pragmatics, which constitute the pillars, objects and objectives of research in linguistics. These key topics tend to be replaced by topics dealing with the so-called experimental areas in language learning and teaching, mostly

focusing on *causal* relationships. It is perfectly healthy to devote research to solving learning and teaching problems, but they should be approached based on theoretical linguistics, for the goals stated above to be reached. Examples of the topics covered recently in English departments in Morocco relate mainly to the causal relationships involved in learning certain aspects of language, as their titles contain phrases that mostly read as follows:

- A correlational study of the relationship between and ...
- The correlation between ...
- An experimental study of phrase structure errors in ...
- Effects of ... in the learning of
- A mixed-method study of ...
- A quantitative study of

The titles above are usually taken for granted partly because students reproduce the tendencies of previously completed theses, and partly because the title should reflect the core focus area of research in the dissertation. The reader of the theses titled in such a way would expect to be exposed, besides statistics, to the linguistic theories supported by the research design and method adopted stated in the title. However, the research endeavor invested in students' "experimental" linguistic studies seems to be conducted in the absence of a solid background in theoretical linguistics, the core knowledge without which there would be no prism through which the findings of experiments could make sense. Such titles would drive the observer to suspect that students believe that their research should be driven by statistics, and it is this quantification that determines the strength of their theses.

This perception was confirmed by the results obtained from both the survey and interview results above. By way of illustration, in one of the theses inspected, 99 pages out of 196 pages are devoted to statistics (from page 78 to page 177). Also, a good deal of space in the discussion of the findings is devoted to a mere repetition of the numerical results, with emphasis on whether or not the related computations are significant. Therefore, the space amounting to about 51% of the thesis devoted to statistics clearly indicates that this thesis which is supposed to be about the development of the speaking skill is in fact about statistical significance through the use of a variety of tests leading to the same result. This endeavor would be totally acceptable if the author of the thesis were assessing the strength of various statistical methods related to his variables, or the validity of various quantifications of other authors addressing the same variables. Moreover, reference to the content presented in the literature review tend to be rather cursory, which gives the impression that the review and the discussion sections are hardly connected. While this thesis is an extreme case and does not represent the entire set of theses inspected, it would send the wrong message to other students who might engage in the same practice, which carries the risk of "research waste" in the sense of Isabel et al. (2022).

Many arguments could be leveled against the validity of this questionable practice. First of all, as indicated above, Amrhein et. Al (2019) and Diaz-Quijano et al. (2020) cast doubt on statistical significance in the inquiries conducted in social sciences. They claim that the credibility of a statistical result is determined by replication, rather than significance (Note 1). Significance and exact p -levels can by no means replace replication, so much so that some scholars call for removing statistical significance from empirical inquiries (Amrhein et. al, 2019). This position is also supported by Norris (2015) who argues that statistical significance tests using p values have been shown to lead to misinterpretation, which may very well hinder the advancement of knowledge in social studies.

Secondly, significance in statistics hides another red herring. Student-researchers tend to engage in lengthy statistics to answer research questions such as "*Is there a significant relationship between learning reading in small group discussions and learning reading as a class?*" and "*Is there a significant relationship between motivation and achievement in learning reading?*" The use of statistics to answer such questions is both superfluous and redundant. There are hundreds of resources in the published literature providing obvious answers to this question. Also, students are not addressing the general public who might be interested in receiving an answer to this question. Their work is addressed exclusively to academics and examiners. Such practice clearly carries the risk of research waste, as demonstrated in Isabel et al. (2022). What contributes to the strength of the thesis is the linguistic conceptual and practical dimensions of the research problem addressed in the thesis, substantiated by the related quantification, as we will explain in Section 5.3 below. In one of the 12 theses inspected, for example, the results show that the total number of errors made by the control group is 191 as against 62 made by the experimental group. Still, the student used all sorts of tests (17 pages), along with histograms, bar charts, line charts or line graphs, pie charts and scatter plots, to prove that the difference between the two groups is significant, objective and valid (Note 2).

Moreover, the traditional stance associated with the objectivity of numerical quantification has been the subject of

much criticism. Gelman and Hennig (2017), among others, cogently argue that statistical objectivity is dubious partly because subjectivity is at play with regard to the nature and source of the data, and partly because “the focus on what can be quantified can narrow down what can be observed, and may not necessarily do the measured entities justice.” (Section 2.2. Objectivity, subjectivity, and quantification in scientific measurement, Parag. 1). More arguments in this connection are put forward in Gelman (2014) and Sauerbrei et al. (2014). The more doctoral students foreground numerical quantification, the more this problem of the misguided eagerness to achieve “objectivity” compromises their capacity to reach ground-breaking research outcomes. Such weakness can only be counterbalanced by the linguistic analysis of textual examples from the data collected rather than the excessive focus on numerical results, with a view to advancing knowledge in linguistics and decrease the risk of avoidable research waste.

Another issue in this regard relates to the quantification of perception. One of the 12 theses inspected relates to the evaluation of writing courses in Moroccan universities. The author assumes that his subjects’ perception is reliable and reflects objective reality, merely because it is supported by statistics. This is a rather weak position in academic research in language learning, because such perceptions could easily be influenced by what students expect, or simply by the way they wish to behave. Students lack the required expertise to judge, for example, whether writing is easy or difficult. They cannot provide substantial evidence supporting the reliability and validity of their perceptions. For example, they may not ascribe their failure to their own lack of effort in the classroom (Note 3). Therefore, students’ perceptions should not be taken for granted and calculated through statistics to serve as the basis of valid conclusions. To the extent that this is true, measuring such perceptions through lengthy statistics would only be helpful if it is strongly balanced by the relevant conceptual insights relating to the research problem. While the calculation of students’ and teachers’ perception may serve as an auxiliary resource, writing deficiency in Moroccan students should rather be analyzed in linguistic terms, drawing parallels with the analytical views in the review of literature, with references to the theoretical insights advanced by other authorities in the discipline of L2 writing.

5.2 Methodology Section

Besides the typical steps relating to the choice of a research question, participants selection, data collection and data description, a recurring questionable practice in the methodology section of doctoral students’ theses is what looks like a review of literature of the discipline of statistics, including the definition of the concepts of statistics. 5 theses out of 12 contain subtitles such as “*what is a variable?*”, “*what is t-test?*”, “*what is chi-square test?*”, “*what is a categorical variable?*”, “*what is a numeric variable?*” and “*what is a correlation test?*”. They end up reviewing the concepts of statistics, rather than the components of the theoretical framework within which the research problem is studied. This is yet another indication that students focus more on statistics than linguistics, which compromises the academic value of their dissertations and increase the risk of research waste.

Moreover, regardless of the numerical complexity involved in the study, students seem to have developed the habit of using as many tests as they can (t-tests, analysis of variance (ANOVA), correlation, regression, and chi-square tests) to prove the validity of their description, even when they have only two groups. The standard practice, however, is that a t-test alone would be enough to compare two groups to see if there is a significant difference between the means of these groups, all else being equal. This indicates that doctoral students are eager to foreground statistics in their study, on the inaccurate understanding that this would ensure objectivity and validity, which would give more strength to their studies.

5.3 Discussion Section

Much of the discussion section in 7 of the inspected theses is devoted to numerical information. In one of the inspected theses, the student concludes that the relationship between listening and reading is significant, but invites researchers to conduct more investigations using larger groups with different levels of proficiency to check if the difference is significant. While this seems to be a good move to verify the validity of research results, it should be coupled with an invitation to check the strength of arguments and analyses of the conceptual dimensions involved. Also, the raw data and materials are rarely submitted along with the thesis. This does not help in ensuring the transparency and reproducibility of students’ research outcomes. The reliability of research is measured against the extent to which (1) it is reproducible and (2) it has a strong impact on theory or application. More specifically, confirming a hypothesis through statistics alone does not constitute a strong move conducive to advancing knowledge. While the reproducibility crisis is a global issue, heavy reliance on statistics on the detriment of linguistic analysis makes it even worse. The excessive focus on statistics prevents students from generating strong lines of research to be conducted by other researchers, and hinders the possibility of making their research more reproducible, in the sense of replication advanced by Bochynska et al. (2023), Berez-Kroeker et al. (2018) and

Cumming & Calin-Jageman (2017).

Replication in research does not rely exclusively on numerical results. Rather, it aims at uncovering the learning mechanisms underlying the acquisition of a foreign language. In the absence of the linguistic analysis of the aspects of interest to be manipulated in replication, the findings of the initial study to be systematically manipulated would not produce valuable insights. By the same token, the same holds for replication studies that intend to launch a new line of research based on the findings of an existing set of studies. For replication to be conducted properly, it should adopt both the design and analytical procedures of the initial study. More importantly, conceptual replications seek to put forth claims relating to theoretical constructs in language acquisition theories. This would be difficult to achieve if the researcher of the initial study focuses on numerical results and relegates linguistic analysis to a secondary position.

As a researcher of linguistics, “you don’t just want to talk about frequencies or distributional information, which is why corpus linguists must make a particular fundamental assumption or a conceptual leap from frequencies to the things linguists are interested in.” (Gries, 2009: 3). More specifically, instead of focusing exclusively on numerical frequencies, students should attach more importance to the linguistic theoretical dimensions. In this regard, three major reasons could be advanced in support of the subordination of statistics to the conceptual framework of the study. Firstly, given that a study is conducted with a view to advancing a theory that contributes to a better understanding of a linguistic phenomenon, any endeavors made in the thesis should contribute to highlighting and strengthening such theory, including statistics. To the extent that this claim is valid, then statistics should go beyond hypothesis testing and help the researcher ensure any or all of the following:

- It should help the researcher make their theory convincing to the specialized reader (not the general public);
- It should enable the theory to have a clearly defined domain of application;
- It should enable the theory to have explanatory (rather than merely descriptive) power, for it to be able to make predictions that transcend existing theories;
- It should enable the theory to predict what will happen in the future (answering the question “so what?”).

Only when statistics is used in this way would it serve its appropriate function in linguistic studies; and this is what doctoral students should understand in the supervision process.

Secondly, the statistical description and analysis should be determined, guided and informed by the theoretical framework -which shapes the researcher’s theory- for them to be able to interpret the data properly. It is the theoretical framework that ensures that the statistical data is meaningful enough to solve the study research problem and to propose the way forward in the relevant area of research. If the statistical description is not closely guided by the theoretical framework, then it would be meaningless, and the entire set of charts, tables and histogram in the thesis would consume much needed space for linguistic analysis.

The theoretical framework helps the researcher analyze and discuss the findings in the data, with reference to the major theories in the published literature connected with the researcher’s research problem. In some doctoral theses that I have examined, many students content themselves with discussing the figures of results (not the findings), mostly related to statistical significance. This seems to weaken their contribution to knowledge in linguistics, one of the key reasons of engaging in doctoral research (Jmila, 2021; Jmila, in press).

Thirdly, if the theory does not drive statistical description, and if the theoretical framework does not guide the numerical quantification, then the conceptual framework of the thesis itself will definitely be weakened to a considerable degree, as the umbrella covering all the research components of the study would be leaking. This is simply because it is the theoretical framework that determines the nature of data needed and the statistical tools appropriate for their description. Conversely, data description and analysis should also justify that the theoretical framework is suitable. In the absence of this mirror-image interaction of statistical description and the theoretical framework, the study would be lacking in both academic strength and research rigor. Consequently, the entire vision of the study will be lost in statistics, and students’ efforts may very well drift into research waste.

The arguments above should constitute a good motivation for supervisors to find ways to urge students to focus more on consciously subordinating statistics to the conceptual framework of the study, rather than naively treating numerical quantification as the flagship component of their study, though dissociated from the aspects that constitute its *raison d’être*, as Larsson et al. (2022) rightly point out:

“Any act of quantifying linguistic phenomena forces us away from our primary object of study, namely language itself. As a result, if we are to ensure linguistically valid and interpretable conclusions, we need to make a conscious effort to return to the texts, linguistic tokens, and other linguistic data to interpret quantitative results.” (Section 3.2 *What appears to be the flipside of increased statistical focus?*)

Statistical reporting could be conducted by linguists or non-linguists, while linguistic analysis could only be performed by a linguist. The issues to be addressed in the discussion section should be of linguistic relevance, for the student to draw linguistically interpretable conclusions relating to language development and language use. This section of the thesis should reflect, *inter alia*, the understanding that the objective of academic research in linguistics is geared to finding answers to whether language learning is a matter of habit formation (structuralist answer), is governed by systematic, cognitive, rule-governed knowledge of language (generative answer), or is guided by the communicative functions dictated by the context of usage (functionalist answer). The strength of the discussion and its contribution to the academic value of the thesis itself should be measured against the number of text excerpts or linguistic examples, as well as drawing parallels with the views, concepts and analyses outlined in the literature review.

More importantly, the excessive reliance of students on statistics does not help them in determining where their own research falls along the positivist-mentalist-functionalist continuum, which makes it difficult for them to specify the ways in which their studies contribute to knowledge in linguistics. One way around this snag is to transform data and numerical results into linguistically meaningful information (Egbert et al, 2020). To this end, doctoral students should be encouraged to establish linguistically-motivated rather than quantification-based research questions, and work on linguistically interpretable variables, using the required minimum of statistical methods, with a view to interpreting the finding both qualitatively and quantitatively, drawing primarily on linguistic theories. This seems to constitute the appropriate strategy to contribute to the advancement of knowledge and reduce the risk of research waste. Such emphasis on the role of the doctoral researcher as a linguist should be translated into the space of the thesis devoted to linguistic analysis, keeping statistical details to the strict minimum that helps achieve their linguistic goals in the study. It is this course of action that paves the way to generating academically strong insights conducive to linguistically significant lines of research.

It stands to reason that many studies require purely quantitative analyses to reach significant conclusions. By way of illustration, this move was required in testing the acoustic parameters associated with stress in Moroccan Arabic (F0, duration, center of gravity and vowel quality) for Bruggeman et al. (2021) to conclude that this language lacks lexical stress. However, the related quantification in this study is couched in conceptual terms and driven by theoretical considerations triggered by the research problem. It follows that students would better adopt the principles of the constructivist grounded theory outlined in Charmaz (2000). To move beyond hypothesis verification and assumed objectivity, which are problematic since linguistic aspects are dynamic rather than stagnant, doctoral students would better compare data with data to generate concepts, compare concepts to generate meta-concepts and compare these categories to generate theories that would move knowledge forward, all of which should be conducted in linguistic terms, supported by numerical quantification if need be.

6. The Way Forward

An easy and accessible way for doctoral students to avoid the pitfall of excessive reliance on statistics is simply to benchmark their work against good practices in leading universities with a long-standing tradition in research in linguistics. An example of a thesis on bilingualism recently completed at the University of Edinburgh can be seen along the following lines (Note 4). The discussion and analysis in this thesis address the aspects of first language loss due to bilingualism. More specifically, they relate to the variation of attrition degrees according to the language domain as well as the syntactic and lexical dimensions. Again, it is the discussion of these descriptive, analytical and explanatory aspects of linguistics, rather than statistics, that invite researchers to challenge or validate these findings, with reference to theoretical approaches of bilingual development. They would also invite other researchers to conduct investigations into first language loss and second language acquisition to shed light on the poorly understood complex relationship between the two languages in the bilingual mind. This endeavor would also trigger inquiry into the major factors involved in the cognitive plasticity in bilinguals, one of the overarching objectives of the linguistics enterprise, at least in the generative paradigm. The limited statistical descriptions in this thesis are used only to the extent that they support the analytical and explanatory dimensions of the thesis. This constitutes a good example of the aspects that ensure the advancement of knowledge in linguistic studies.

For the sake of comparison, consider the titles of theses recently completed in Edinburgh University (UK) and the inspected theses (Morocco) (Note 5). The titles of Moroccan dissertations read like the following:

- Investigating students' attitudes ...
- The relationship between listening and reading ...
- Examining the relationship between teachers' ...
- Investigating the relationship between critical thinking skills ...
- The relationship between social media use and ...

- Evaluation of writing courses in
- Effects of group learning on ...
- Investigating teachers' attitude ...
- A correlational study of

Recently completed doctoral theses at Edinburgh University are given below:

- First language attrition in late bilingualism: lexical, syntactic and prosodic changes in English-Italian bilinguals
- Syntactic change during the anglicization of Scots: insights from the Parsed Corpus of Scottish Correspondence
- Sentence processing in first language attrition: the interplay of language, experience and cognitive load
- Mechanisms underlying pre-school children's syntactic, morphophonological and referential processing during language production
- Development and processing of non-canonical word orders in Mandarin-speaking children
- Role of transparency in the acquisition of inflectional morphology: experimental studies testing exponence type using artificial language learning
- How language adapts to the environment: an evolutionary, experimental approach

Source: Linguistics and English Language PhD thesis collection (ed.ac.uk)

As may be readily noticed from the titles above, the focus of Moroccan theses is laid on causal relationships that turn out to be mainly numerical, while Edinburgh theses emphasize the insights regarding language acquisition, development and use. This does not mean that these theses do not seek the help required from statistics. They do. The numerical results, however, describe only "the what", and they are used to go beyond quantification to analyze linguistic content, drawing on a theoretical framework for the description of language, as well the use of the knowledge gained through the study of linguistics to solve practical problems, such as the elaboration of improved methods of language teaching, as the benchmarking example above indicates. Therefore, it goes without saying that Edinburgh theses seem to contribute to linguistic theory, and open new lines of research for further related studies. As for the inspected theses, the conclusions put forward as to the development of language skills in foreign language learners need replication, conducted within the framework of a clear research agenda and driven by a solid institutional research policy. Hence, the academic and professional effect of such theses remains to be seen. It should be noted here that several academically strong theses have been completed in Moroccan universities. The rationale behind addressing the selected theses is to prevent questionable practices from gaining ground.

Students' focus on foregrounding statistics in their studies drives them to think primarily about what they can measure, which may lead to less interesting topics of research (Jmila, in press). Advanced research at the doctoral level should focus on areas that really need inquiry to solve pending problems in linguistics, with the strict minimum of quantification needed, with the active assistance of supervisors and in line with the research agenda of the university. Any investigation in linguistics may require quantification to verify hypotheses; however, this should be coupled with and driven by the analysis of textual, linguistic material with a view to filling an outstanding gap in the relevant areas to contribute to the advancement of knowledge.

7. Concluding Remarks

I am by no means playing the gatekeeper of linguistics as against statistics here. The ultimate goal of this viewpoint article is not to fight off statistical sophistication in linguistics theses, but to highlight the objective of a thesis in linguistics, namely to make a difference in better understanding human language with the help of statistics (if required); that is linguistics with statistics, not statistics instead of linguistics. Foregrounding statistics to the detriment of linguistics is a case of the tail wagging the dog. This is where we are not, and this where we need to be. Otherwise, the whole business of linguistic research will be lost in statistics, and we may very well run the risk of research waste. This is because in linguistics, as Einstein put it, "Many of the things you can count, don't count. Many of the things you can't count really count."

A fundamental question which remains unanswered here is how come that students have developed this unhealthy habit. Though doctoral students' prior academic performance and research training play a key role in producing an original contribution to knowledge and significant research outputs, as measured by citations, number of publications and the impact factor of journals of such publications, the question remains whether the research environment where they study is conducive to supporting them in this endeavor. The local doctoral research culture should not be divorced from the practices adopted in leading universities worldwide. The circulation of "local" standards is not an option in this regard. Only by thinking globally and acting locally can we secure a place among

the institutions that contribute to the advancement of knowledge.

This is a pressing issue that needs more investigation in order to gain a clearer understanding of how, when, and to what extent this questionable practice occurs, and to what extent it is problematic. This viewpoint article is an opportunity for researchers (especially supervisors of linguistics theses) to identify the unanswered questions and outstanding gaps in the evidence presented here. It is a call to action for researchers to investigate the issues raised herein to provide more nuanced answers, with reference to the requirements of admission to the doctoral program, research agenda, supervision policies and quality assurance approaches in universities, to help doctoral students unlearn the habits that weaken their dissertations, on the one hand, and to meet the requirements of open science, on the other.

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Competing interests

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Obtained.

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Notes

Note 1. None of the theses inspected attempted to obtain significance through the same statistical method. They rather focus on the significance related to their own claims (hypotheses). More arguments are put forward in this regard in the sources below:

Colquhoun, D. (2018). The false positive risk: a proposal concerning what to do about p-values. *The American Statistician*, 73, 192-201. <https://doi.org/10.1080/00031305.2018.1529622>

Greco, M., Cometa, A., Artoni, F., Frank, R., & Moro, A. (2023). False perspectives on human language: Why statistics needs linguistics. *Frontiers in Language Sciences*, 2, 1178932. <https://doi.org/10.3389/flang.2023.1178932>

Kline, R. (2004). *Beyond significance testing: Reforming data analysis methods in behavioral research*. Washington, DC: American Psychological Association. <https://doi.org/10.1037/10693-000>

Larson-Hall, J. (2012). Our statistical intuitions may be misleading us: Why we need robust statistics. *Language Teaching*, 45(4), 460-474. <https://doi.org/10.1017/S0261444811000127>

Note 2. This questionable practice is partly due to the absence of a pre-registration system established by the university. Doctoral students are not required to record the research questions, design, and methods of their studies in an electronically searchable and accessible database, which would ensure confidence in results.

Note 3. See Herbert et al. (2022) for more arguments in this connection.

Note 4. Zingaretti, Mattia (2022) First language attrition in late bilingualism: lexical, syntactic and prosodic changes in English-Italian bilinguals. Doctoral thesis, University of Edinburgh.

Note 5. This is not the full list of theses in linguistics, but we would like to focus on the ones reflecting questionable practices.

Appendix

Appendix A

Questionnaire

Section 1

1. The most important element in doing research in linguistics is statistics.
 - I agree
 - I do not agree
2. A linguistics doctoral thesis that does not contain statistics is not academically strong.
 - I agree
 - I do not agree
3. In the discussion chapter of the thesis, we should mainly discuss statistical results.
 - I agree
 - I do not agree
4. "The correlation between **X** and **Y** in the development of skill **Z**". How often have you encountered thesis titles like this in your university?
 - Always
 - Rarely
5. "A mixed method study of **X** in in the development of skill **Z**". How often have you encountered thesis titles like this in your university?
 - Always
 - Rarely
6. How often are the details of statistics discussed in a thesis defense that you attended?
 - Always
 - Rarely
7. When you started thinking about doing research in linguistics, the first thing that you worried about was statistics.
 - True
 - False
8. While students are doing research, a major element that they struggle with is statistics.
 - True
 - False
9. If you get the statistics right, then you do not have to worry about anything else in your thesis.
 - I agree
 - I do not agree

Section 2

10. How do you get help with statistics? (Tick one or more)
 - Ask assistance from a student of Economics
 - Ask assistance from a teacher of Economics
 - Study statistics online (YouTube)
 - Study statistics online (Course)
 - All of the above
 - Otherwise (Please specify)

How?

11. If a class of statistics is offered at your university, what should it be like to help you in your research?
12. How do you know that you have chosen the right statistical method that suits your *research problem*?
13. How do you know that you have chosen the right statistical method that suits your *research questions*?
14. How do you know that you have chosen the right statistical method that suits your *theoretical framework*?
15. How do you know that you have chosen the right statistical method for you to advance knowledge in your area?
16. How do you know that you have chosen the right statistical method for your research to count within the philosophy of language/linguistics?
17. How do you know that you have chosen the right statistical method for decision makers to act upon your results?
18. List the advantages of statistics in academic research in linguistics, in your opinion.

[THANK YOU]

Appendix B

Interview Questions

SECTION I: WARM UP

Q.1 First, tell me how are things going with your doctoral research?

Q.1.1 Positive Developments:

What's going on in the right direction? Even if you are somewhat unhappy, there must be certain things that are going well. What are these things?

Q.1.2 Negative Developments:

What's going on in the wrong direction? Even if you are generally happy about your doctoral studies, there must be certain things that are not going so well. What are they?

SECTION II: PERCEPTION OF STATISTICS IN ACADEMIC RESEARCH

Q.1 When I say the expression "academic research", what are the first thoughts and ideas that come to your mind?

☞ Probe: Explain to me please; what makes you say that?

Q.2 There are many concerns that preoccupy doctoral students. Which ones did you hear about?

☞ Probe: Probe on the concerns cited.

Q.3 When I say the word "significance", with reference to statistics, what are the first thoughts and ideas that come to your mind?

☞ Probe: Explain to me, please; what makes you say that?

Q.4 What is the role of statistics in a thesis? How do you know?

☞ Probe: Give me an example from your experience.

Q.5 What is the space taken by statistics in your thesis? Too much? Too little?

☞ Probe: Is this positive or negative? What makes you say so?

Q.6 Are you satisfied with the use of statistics in your thesis?

☞ Probe: What makes you say so?

Q.7 What would be the things that should change for you to be more satisfied with the use of statistics in your thesis?

Q.8 In academic research, should we focus more on numerical description or linguistic analysis?

☞ Probe: What makes you say so?

SECTION III: CONCLUSION

To conclude, keeping in mind all the issues we've discussed so far, let me ask you a final question:

If you had the opportunity to be a doctoral thesis supervisor, what would you tell your supervisees about the use of statistics in their studies?

[THANK YOU]