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Grammatical Cohesion Analysis in the Introduction of Chemistry Research Articles from JFAS Journal

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Abstract:
This study examines grammatical cohesion in Chemistry research article introductions from Algerian and international journals. Descriptive case study as form of research was applied. Using AntConc software, 24 introductions (12 from each journal) were analyzed for cohesive devices – reference, conjunction, substitution, and ellipsis – as per Halliday's (1976) taxonomy. The question was to know if Algerian Chemists use grammatical cohesive devices qualitatively and quantitatively in similar way as chemists from international community. Conjunction was most frequent, with 230 and 540 occurrences in Algerian and international articles; reference followed with 172 and 308 instances. Substitution and ellipsis were infrequent, likely due to a preference for more direct cohesive elements possibly due to vocabulary limitations among Algerian chemists.
Keywords: Grammatical Cohesion, Article Introductions, Discourse Analysis, Chemistry, English

1. Introduction

Writing research articles is essential for scientists, enabling them to contribute to their fields. Crafting an engaging introduction is crucial since it's the first part reader encounter. Employing rhetorical conventions, including macro and microstructures, is vital for creating compelling introductions. Previous research by scholars like Mirahayuni, Hirano, Loi & Evans, Sheldon, and Rakhmawati has explored the use of the widely recognized Create a Research

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Space (CARS) model by Swales. However, there's a focus on articles by experts in reputable journals, often overlooking research from francophone areas, including Algeria. In the best of our knowledge, no study was so far dedicated to Algerian corpus concerning hard disciplines such as Chemistry. Despite this, these scholars can contribute significantly to knowledge. It's unclear if exposure to English writing in academic classes enhances non-native writers' skills, especially in creating cohesive introductions. Crafting a cohesive introduction requires seamlessly connecting sentences to create an integrated text. Given the importance of adhering to rhetorical conventions and cohesion theory, this research aims to evaluate the grammatical cohesion in introduction sections of research articles written by Algerian chemists in a local journal. This underscores its significance in justifying the research's importance. The focus is exclusively on grammatical cohesion. Some background is given below to shed light on essential key issues helping the comprehension of practical part.

2. Background

2.1. Text and Textuality

Text linguistics was first introduced in 1967 by H. Weinrich, but the buildup of text linguistics as an autonomous discipline occurred in the1970s. Hence, a number of researchers have been involved with similar topics. However, textuality refers to the characteristics and features of a text that contribute to its coherence, meaning, and communicative effectiveness in discourse analysis (Neubert & Shreve, 1992). It encompasses elements such as cohesion, coherence, structure and the use of language devices like referencing, tense and modality. The significance of textuality lies in its ability to shape and convey meaning within discourse. Simply put, a text differs from a collection of phrases or paragraphs by virtue of certain characteristics. The features include various kinds of linkages that aid in the text's arrangement. The first kind of link has to do with how clauses are structured and how they relate to the sentences that come before and after them. This is critical for upholding and expanding the text's central idea. The second kind of link is based on surface-level information from the text's characters and events, which contribute to coherence. Coherent interpretation depends on the last form of link, which deals with the text's underlying meaning

Concerned with providing a more formal, concise explanation of how English speakers come to recognize a text as constituting a text, a number of authors have focused on this question (Halliday & Hasan, 1976; Brown &

Yule, 1983).These scholars are interested in the connection principles that tie text together and need co-interpretation.

According to Brown and Yule (1983:190), text is the **spoken** documentation of a communication event. Beaugrande and Dressler (1981:3) defined a text as **a communicative event** that satisfies seven **textuality** criteria. That is to say that these seven standards of textuality have to answer the addressee about the following questions on a given text:

How do the clauses hold together within the text (cohesion)? ; How do the propositions hold together across the text? (coherence) ; Why did the doer produce this piece of text?(Intentionality**)** ; How does the addressee get it? (Acceptability) ; What does it reveal? (Informativity); What does the text acknowledge? (Relevance) ; What other texts does this resemble? (Intertextuality).

The text will not be considered communicative if any of these requirements have not been met. As a result, non-communicative texts are considered to be non-texts. Besides, the term "text" is used in linguistics to refer to any spoken or written passage of any length that does not form a coherent whole, according to Halliday and Hasan (1976:1).

2.2. Cohesion

In order to establish a connection between the reader and the writer, it is important to demonstrate how the writer uses language to convey acceptance and rejection, as well as approval and disapproval, certainty and uncertainty (Briones, 2016). In other words, any language conventions used by the author are deemed capable of revealing both the written work's substance and its effect on its audience. Incorporating the idea of cohesiveness into the writing process is one of the language norms that can be used to show the author's viewpoint on a certain problem.

Halliday (1976) coined the concept cohesion, which is thought to be a determining factor in recognizing whether a text is just an agglomeration of unrelated sentences or a well-connected series of sentences. Another concept of cohesion relates certain words and grammatical elements to how it connects one sentence to its predecessors and successors in a text (Hoey, 1996). Cohesion, in other words, provides a surface structure linkage between textual components (Tarnyikova, 2009). Grammatical cohesion and lexical cohesion were the two classes of cohesion (M. A. K. Halliday, 1976). In this introduction we are only concerned with the former. In relation to the text structure of grammar within a text, the grammatical cohesion (GC) consists of reference, conjunction, substitution and ellipsis.

2.2.1. Reference

A specific type of cohesion connected to a specific and clear meaning of the content that is referred to within a sentence or text is provided by the first category of GC, known as the ***reference*** (R) (M. A. K. Halliday, 1976). The text should relate to and match the semantic attributes that are being referenced. *Personal reference* (PR), *demonstrative reference* (DR), and *comparative reference* (CR) are the three categories into which the reference has been separated. The possessive pronouns, possessive determiners, and personal pronouns are concerned in the personal reference. PR can be divided into two sub classes: *Existential Personal Reference* (EPR) and *Possessive Personal Reference* (PPR). The demonstrative reference refers to a type of reference that is specified by the scale of closeness and uses "*this*" or "*that*" as a reference to a singular noun and serves as the head, the modifier, or the adjunct as well as "*these*" or "*those*" when referring to a plural word. The comparative reference typically points out similarities between various items within a text. Adverbs of comparison, such as deictic, as well as comparative adjectives, can serve as a structure for presenting the comparison.

2.2.2. Substitution

This category of GC refers to a replacement of an item with another item that has the same grammatical classification. Due to the fact that it can be functioned as a noun, a verb, or even a clause, the substitution is divided into three forms, namely nominal substitution (NS), verbal substitution (VS), as well as clausal substitution (CS) (M. A. K. Halliday, 1976). The head of a nominal group is referred to as the NS. The substituted item should serve the same purpose and occupy the same position as the preceding item. "*Do*" can be used to replace text elements that denote an event or an activity and can be expressed by other variants such as *did*, *doing* and *done*. Finally, the CS points to the process of replacing an entire sentence rather than given specific textual elements, and it is limited to substitute the declarative sentence.

2.2.3. Conjunction

The sole purpose of conjunctive elements is to bring a sentence together by virtue of their particular meaning. The conjunctive elements typically have specific meanings that correlate to the following text. According to M. A. K. Halliday (1976), conjunctive category can be classified into additive conjunction (AC), adversative conjunction (AdvC), causal conjunction (CC), or temporal conjunction (TC). The former class known as an AC, links new information to earlier one that already exists and occupies the same position in the sentence structure. Then, AC designates a kind of cohesion that depends on the text's coordination. Next to, the AdvC class focuses on the

expressions of contrary expectation. In addition, the third category of conjunctive elements, the CC, establishes the connection between the cause and the effect (Nunan, 1993). The causal relation includes the outcomes, causes, and intentions in order to create a logical chain. Lastly, typically, several terms, such as *then*, *and then*, *after that*, and a broad variety of other expressions, are used to describe the temporal conjunction (TC).

2.2.4. Ellipsis

Ellipsis can be used to both clarify sentence structure and demonstrate a connection between key elements of texture and sentences. Even if ellipsis does not always reveal the structural relationship between the sentences, it is nonetheless regarded as a crucial component to study grammatical cohesion and written discourse analysis. The three types of ellipsis offered within the grammatical cohesion are the nominal ellipsis (NE), verbal ellipsis (VE), and clausal ellipsis (CE) (M. A. K. Halliday, 1976). According to McCarthy (1991, p. 43), the first type which is NE "... frequently involves omission of noun headword." The second type, VE, happens in the verbal group when a verb is left out of a sentence but the meaning can still be inferred from another one. The third sort of ellipsis, CE, occurs when a clause is entirely or partially omitted.

3. Rationale of the study

Researchers such as Hassan and Halliday see that using linguistic ties makes the text more cohesive and understandable. But, it seems that non native writers do not use grammatical cohesive devices (GCDs) efficiently because the problem noticed by supervisors is that post-graduates students have many problems in writing effective discourse in general and in using cohesive devices in particular. Moreover, several papers are rejected by journals referees due to linguistic problems such as grammar, vocabulary, punctuations and above all discoursal features problems including coherence and cohesion problems.

4. Research questions and hypotheses

The present study attempts to answer the following questions:

Q1. What are the most frequent grammatical cohesive devices used by Algerian researcher chemists, while writing the introduction section according to the categorization of Halliday & Hasan (1976)?

Q2. Is there any difference between Algerian Chemists and native writers in using GCDs (qualitatively and quantitatively)?

The above-indicated research questions are based on the following hypotheses, which will be tested later on via collected data:

H1: Algerian researchers from Chemistry discipline may use extensively and repeatedly some grammatical cohesive devices than others while writing the introduction section.

H2: Algerian researchers from Chemistry discipline may differ from native writers in using GCDs

5. Methodology

5.1. Corpus

The text corpus of the present study contains 12 introductions taken from articles submitted in the **J**ournal of **F**undamental and **A**pplied **S**ciences (JFAS) in the time frame 2020-2021. Given that the journal is multidisciplinary, **three criteria** were used to select the appropriate sample, namely, to be from **Chemistry discipline**, to be **experimental** (i.e., not theoretical) and to have an **IMRAD plan**. Besides, 12 other articles were chosen from an International journal of good reputation which is Chemosphere Journal in order to compare with an international corpus where native writers are involved (used articles DOI's are given in the appendix)

5.2. Method

A corpus analysis method is used whereby GCDs will be analyzed independently, based on the four grammatical cohesive devices considered by Halliday & Hasan (1976): **conjunction**, **reference**, **substitution** and **ellipsis**. An automatic analysis is carried out in order to get valid results and exact frequencies of GCDs devices.

The collected data are analyzed using the previous version of AntConc 3.5.7 (window) 2018; a corpus analysis toolkit. It was designed by Laurence Anthony for carrying out corpus linguistics research and data-driven learning. Its two most important analytical tools are, **KWIC Concordance** and **Wordlist** which generates lists of exact frequencies of different words and phrases. The collected data were only available in a PDF form, which called for their conversion into a TXT format, which is required for concordance analysis. AntConcFileConverter software is used. The converted data are entered as a whole corpus in the "corpus files" column and scanned to look for the used GCDs. Finally, this study faced major setbacks due to its narrow focus on GCDs in a single discipline's English research article introductions. Recognizing the need for broader coverage, future research should employ a larger and more diverse corpus to address these limitations and offer a more comprehensive analysis of cohesiveness.

6. Results Analysis and Discussion

6.1. Results Analysis

Table 01 illustrates the distribution of GCDs in the two journals. Overall, conjunction category was the most dominant category in both data followed by reference. Substitution and ellipsis are quasi absent from both corpora. In fact, the two most dominant devices in chemosphere journal are conjunction and reference with 63.53% and 36.24% respectively. Substitution decreased to the smallest percentage of 0.24%.

As for the JFAS journal, it recognizes approximately the same fate where conjunction and reference rank first with 57.07% and 42.38% respectively provided that the substitution does not exceed one quarter percent. Finally, ellipsis was totally absent from both data.

Table(01): Categorical distribution of GDCs in JFAS and Chemosphere corpora

	JFAS		CHEMOSPHERE	
	F	**P**	**F**	**P**
CONJUNCTIONS	230	57,07%	540	63,08%
REFERENCES	172	42,68%	308	35.98%
SUBSTITUTION	1	0,25%	8	0,93%
ELLIPSIS	0	0%	0	0%
Total	403	100%	856	100%

***F:** Frequency; **P:** Percentage*

6.1.1. JFAS results analysis

6.1.1.1. Reference Subtypes

According to the Figure1, 73 DR items—or 43% of the total gadgets used in this category were used by Algerian researchers. This could be as a result of the fact that learners frequently employ them excessively as they are thought to be extremely basic GCDs (Hinkle, 2013). With 54 devices, the personal sub-type items appear in second place (31%), most likely because learners are already familiar with this sub-type because it is covered in early levels of instruction. Regarding comparative reference, it is obvious that the authors embraced it last with 45 items it only accounts for (26%).

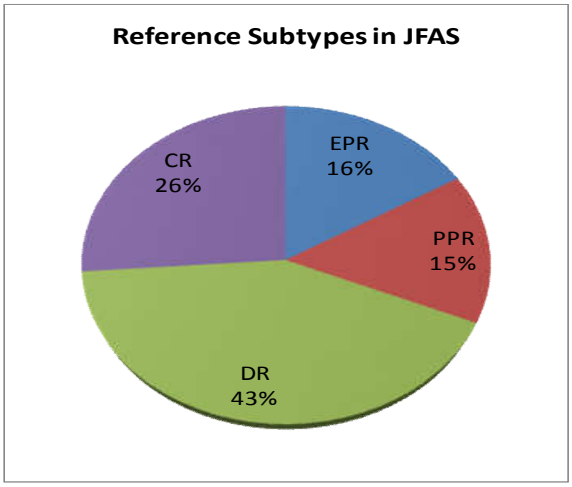


Fig 01. Pie chart of the percentages of Reference subtypes in JFAS

6.1.1.2. Substitution Subtypes

Substitution category forms only 1 item (0.25%) among the four categories. This single item concerns exclusively NS sub-type (table 02).

	CS F(%)	NS F(%)	VS F(%)	Totals
JFAS	0 (0)	1 (100)	0 (0)	1(100)
CHEMOSPHERE	1 (12.5)	7 (87.5)	0 (0)	8(100)

Table (02) substitution subtypes in JFAS

6.1.1.3. Conjunction Subtypes

Conjunction is the most frequently created grammatical coherent connection in RAIs in the JFAS, with 230 items, or 57% of all items. This can be explained by the writers' experience with numerous of these GCDs. Table 3 and Figure 2 below display the frequencies and percentages of the four conjunction subcategories: additive (AC), adversative (AdvC), causal (CC), and temporal (TC).

Table (03) Conjunction Subtypes in JFAS

	AC F(%)	AdvC F(%)	CC F(%)	TC F(%)
JFAS	199(86.52)	12(5.22)	12(5.22)	7(3.04)
CHEMOSPHERE	445(82.41)	42(7.78)	35(6.5)	18(3.34)

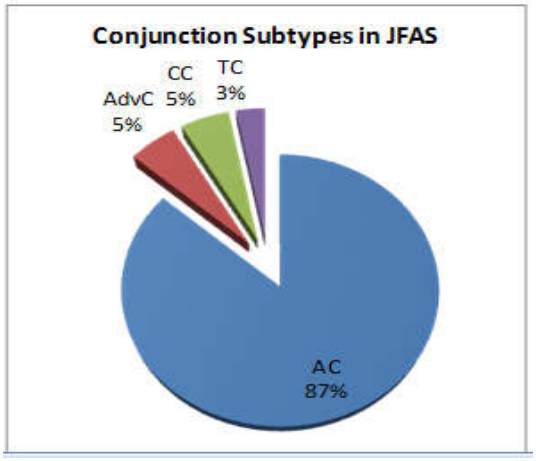


Fig 02. Pie Chart of the Percentages of Conjunction Subtypes in JFAS

According to Figure 2, students created 199 additive relations in 12 RAI from JFAS journal, accounting for 87% of all devices utilized with the conjunction category. They adopted 12 adversative sub-category-related devices, which account for 5% of the total similar to causal cohesion links, which come in second place. The temporal conjunction sub-type is the last of the four conjunction sub-types, with 7 devices or 3%.

An examination of the frequencies reveals that there is diversity in the use of such types of conjunction in all the papers, even if it was not used with same frequency.

6.1.2. Chemosphere results analysis

6.1.2.1. Reference Subtypes in Chemosphere

Figure 3 displays percentages of the reference sub-types.

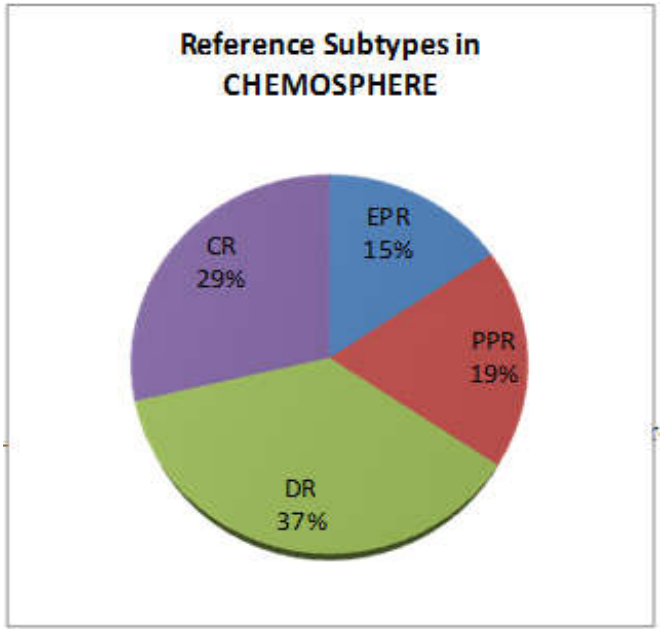


Fig03. Pie Chart of Percentages of Reference Subtypes in Chemosphere

The distribution is not far qualitatively from the one in JFAS journal. DR sub-type occupy the head of the rank (37%) followed by PR (34%) and CR (29%) respectively. PR can be split into existential reference (EPR) and possessive reference (PPR). The former contains essentially personal pronouns. This class is predominated by the personal pronoun "it" (20 occurrences out of 51), the pronoun "they" (13/51), the pronoun "we" (11/51) and the existential personal reference "one" (12/51). The latter, PPR, includes possessives and dominated by "their" (32 items/59), "its" (20 items/59), and "our" (7/59). DR shows demonstrative pronouns "that", "this", "these", and "those" in the first position with 46, 29, 24, and 4 occurrences/110 respectively. Lastly, we found comparative reference mostly represented in this corpus by "such" (45/85), "different" (16/85), "other" (10/85), and "more" (8/85).

6.1.2.2. Substitution Subtypes

Substitution is less abundant in the corpus than Conjunction and Reference. Nominal Substitution exhibits 88% (7items/8) and Clausal Substitution comes secondly with 12% (1item/8). No one used verbal substitution among researchers (Figure 4).

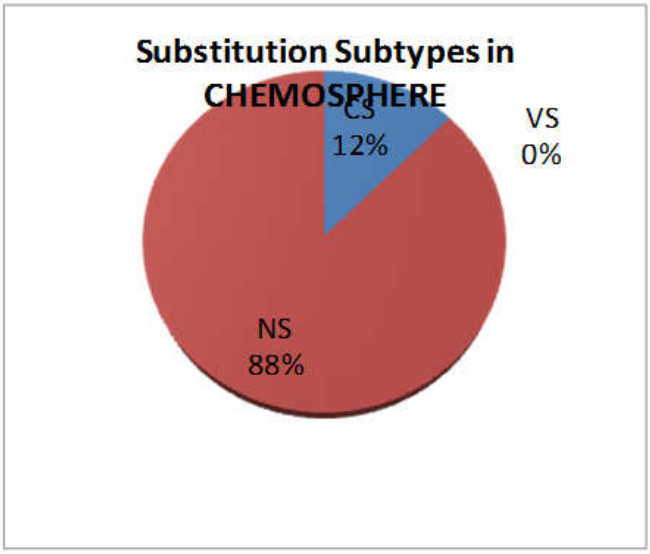


Fig 04. Pie Chart of the percentages of Substitution Subtypes in Chemosphere

6.1.2.3. Conjunction Subtypes in Chemosphere

This category is largely predominated by Additives (AC) as sub-type with highest percentage of 82% (445occurrences/540). The coordinating conjunction "*and*" overweighs the others (370/421) followed by "*also*" (23/421), "*thus*" (10/421), and "*furthermore*" (6/421). The second sub-type is AdvC (8%) including specially, "*however*" (10 items/33), "*but*" (10 items/33); and "*only*" (9 items/33).

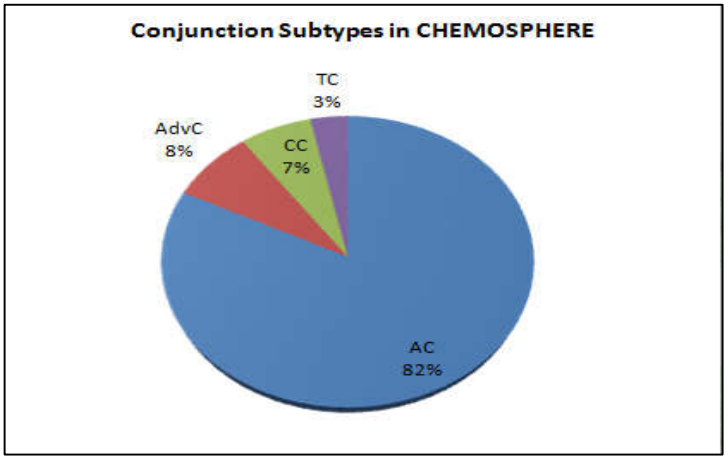


Fig 05. Pie Chart of the percentages of Conjunction subtypes in Chemosphere

6.1.2.4. Ellipsis Subtypes

In analyzing the two sets of data from JFAS and from Chemosphere it is evident that no researcher utilized **ellipsis** as GDCs in the introduction sections of their written papers. This absence of ellipsis usage suggests that researchers in both sets preferred other GDCs.

6.2. Discussion

The grammatical cohesion is typically used to show a semantic relationship between the sentences. **Conjunction** was found to be the most often used type of grammatical cohesion in the current study followed by reference. Contrarily, no researcher from JFAS or Chemosphere writers used Ellipsis to provide grammatical consistency in any of their introduction sections of their papers. In fact, rare items reporting substitution category are found in Chemosphere in selected introductions and these items are totally absent in JFAS papers. Ellipsis and substitution were only seldom used in formal written speech. Meanwhile, these categories are more characteristically found in spoken discourse dialogue (Halliday and Hasan, 1976).

On another hand, the wording between the two sets is essentially different: The JFAS corpus is 4020 words types and 1372 word tokens whereas Chemosphere contains 2089 word types and 8059 word tokens. The ratio of types is over 1.5 and of tokens is closer to 2 in favor of Chemosphere in the two cases. Frequencies in the sets of data show clearly this reality. In fact, Figure6, shows native writers from Chemosphere overweigh their Algerian colleagues in using quantitatively GCDs. Qualitatively, it seems that two group perform the same. This difference could be due to the fact that native writers are often more exposed to academic writing conventions and have already internalized the expectations and standards of their respective disciplines. They have likely read and analyzed numerous research articles, allowing them to understand how GCDs are commonly employed and how much in introductions. This exposure and knowledgeableness about academic discourse may contribute to their ability to use GCDs more quantitatively. In coming paragraph we will show few examples of some GCDs used by authors, especially conjunction and reference categories as they have the highest frequencies in both corpora.

- ✓ **Conjunction**

a-CC: "*Therefore*"

"*Therfore*" acts as general causal conjunction in both sets of research papers and occurs more frequently in Chemosphere RAs (8 items) than in JFAS RAs (2 items). In particular, the findings show that "*therefore*" is frequently used in the beginning of a sentence. (Examples 1-2). This preference emphasizes Chemosphere authors' propensity to develop distinct cohesions between sentence structures or clauses (Narita et al.). This preference can be related to the writers' efforts to establish effective connections between two sentences. Additionally, "*therefore*"'s role as a conjunction strengthens its use showing causal or resultative relationship.

Example1: "…separation of CPs is only partially achieved. *Therefore*, masse analyzers must provide sufficient mass resolution.." (Chemosphere RAs).

Example2: "…and flavonoids are safe and also bioactive. *Therefore*, in recent years, considerable attention has been…" (JFAS RAs).

It is worthy to notice that native writers use therefore also in the middle of a sentence in 50% of cases (4 cases out of 8) whereas, Algerian Chemists use it in the starting of a sentence in all cases (2 out of 2), but in any case therefore is not used at last position by natives or non natives (example3).

Example3: "…abstraction of fresh water bears high cost, ***therefore***, wastewater is commonly utilized for irrigation…" (Chemosphere RAs).

b-AdvC: "*However*"

The adversative relationship between two clauses in the sentence's beginning position was favoured by both groups of writers (Examples 4,6). The reader's interpretation of the speech might be aided by this use. The use of AdvC "*however*" can be explained by the writers' preference for connecting the text portions to produce surface logicalness.

Example4:"…The main chromium species in water are Cr (+6) and is highly soluble in water. ***However***, forms stable salts and hydroxides". (JFAS RAs).

Here again researchers from JFAS use "*however*" only in the beginning of the sentence (in 6 cases of 6), while native writers from Chemosphere diverse its position (5 cases of 10) (Examples 5-7).

Example5: "This evidently depends on the nutrient status (N, P); ***however***, the P content of duckweed has direct connections to the P content in the wastewater". (Chemosphere RAs)

Example6: "Dehalogenation reactions of CPs are considered as chemically stable. ***However***, some transformation reactions have been observed." (Chemosphere RAs)

Example7: "…organisms, honeybees and non-targeted organisms, **however**, risks for exposure of organisms to metabolite 3-OH-…". ((Chemosphere RAs)

c-AC: "*Also*"

After the conjunction of coordination "*and*", "*also*" was the second most frequent additive conjunction in both sets of corpora (23 occurrences in Chemosphere and 14 occurrences in JFAS). Since there were arithmetically significant variations between the two groups of RAs on a regular basis, this suggests that Chemosphere RA authors prefer to add information and construct component sentences using the conjunction "also" to explicitly demonstrate this function. Knowingly, "also" serves to add information or reinforce a point that has already been made. It is also used to include oneself or others in an action or situation. It implies that the subject of the sentence is participating or experiencing something along with others.

"*Also*" can be placed at the beginning, middle, or end of a sentence. In all cases in both data is placed in the middle of sentences except two cases in JFAS RAs where "*also*" took position at the beginning of sentences (examples (8-9).

Example8: "The type of pesticide, the duration, exposure voice, and the individual health status are the main factors in the possible health outcome. ***Also***, in a human or animal body, pesticides may be metabolized, excreted, or bioaccumulated in body fat". (JFAS RAs)

Example9: "The recycling of plastics is ***also*** very difficult and is not at all economical." (Chemospher RAs).

- ✓ **Reference**

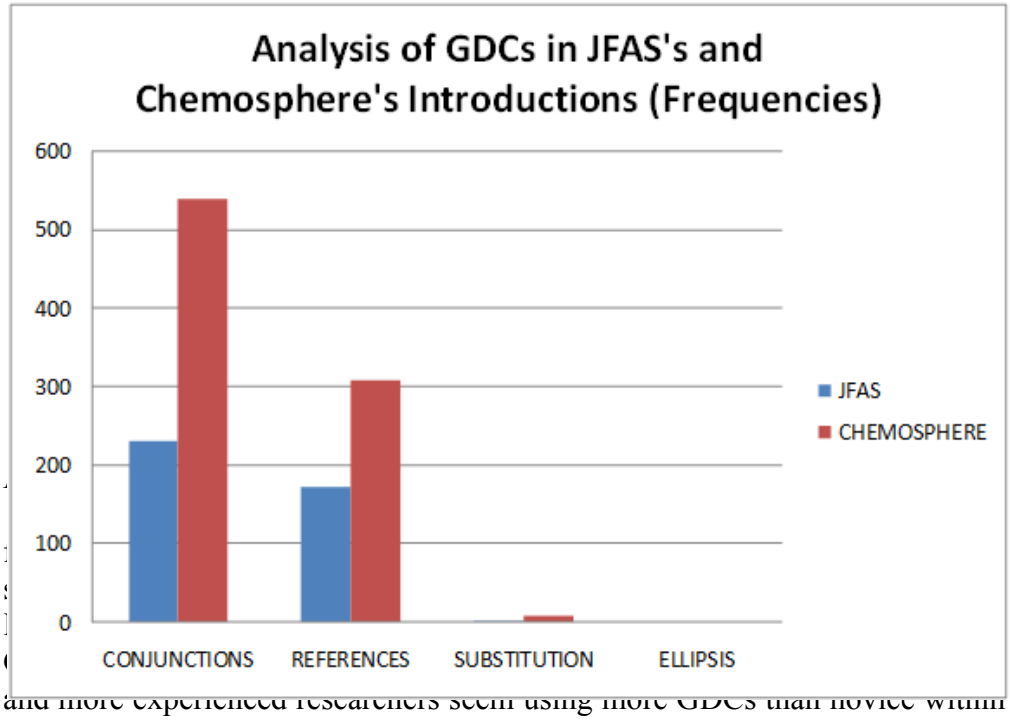
As we can infer from the data, reference serves as crucial GCDs in written communication. Authors include varieties of personal, demonstrative, and comparative sub-types. Personal reference, such as pronouns or possessives (e.g., "it","they"; "its", and "their") allows writers to refer back to previously mentioned entities, establishing continuity and avoiding repetition (see examples below). In addition, demonstrative reference, entities like 'this", "that', and "these", helps authors point to specific objects or ideas, aiding in the clarity and specificity of their message. Lastly comparative reference, through words like "*such*", "*more*", and "*different*" enables scholars to establish connectedness and draw comparisons between different elements, enhancing cohesion and coherence of their writing. By using all these reference compounds, researchers ensure that information flow smoothly and that readers can follow and understand the logical progression of their arguments.

Example9: "Nowadays, the production and use of **plastics** have been increased to a great extent worldwide. When these **plastics** are disposed after ***their*** use, ***they*** remain in environment for longer period of time and generally aren't degradable." (Chemosphere RAs)

Example10: "Despite of high adsorption capacity of **silica**, ***its*** separation from solution is difficult." (Chemosphere RAs)

Example11: "The MNPs fabrication through this route is based on the ch using the organic extracts from different source, ***such*** as plants, polysaccharides, fungi, and bacteria". (Chemosphere RAs)

Example12: "***This*** work represents synthesis of 2 new Schiff bases and ***these*** compounds have been characterized by various spectroscopic means as the infra-red..." (JFAS RAs)



and more experienced researchers seem using more GDCs than novice within the same discipline. In fact, native writers use longer sentences that need more use of GCDs.

7. Recommendations

Pedagogical implications arise from this study as it offers Algerian Chemistry researchers valuable insights into the diverse categories of grammatical cohesive devices (GCDs) used by both international and national

counterparts. To enhance writing coherence, educators should emphasize these structures, drawing on the study's main findings. Curriculum designers can further promote GCDs awareness by integrating them explicitly into writing courses, potentially improving comprehension skills for learners. Additionally, future research should explore GCDs prevalence not only in introductions but also in abstracts, conclusions, and discussions, expanding into various academic fields beyond Chemistry. Furthermore, analyzing cohesive devices in oral presentations at symposiums can provide a more holistic perspective. Instructors and post-graduate students should also consider disciplinary conventions when employing GCDs in their writing.

8. Conclusion

Only the grammatical cohesion of the introduction section of research articles authored by Algerian Chemist writing in a local multidisciplinary journal (JFAS) and as reference those written by native writers in an internationally renowned journal (Chemosphere) are the subject of the current study. The findings and discussion reveal that the introductory section's use of grammatical cohesion, particularly the conjunction and reference as a means of revealing the relationships between each sentence in the research articles, is thought to be of the highest order. However, it is thought that the grammatical cohesion used in the introduction sections of the research articles examined in the present study can help the readers draw a significant and noteworthy inference about the topic and significance of the research articles. Results showed that novice Algerian writers from JFAS use GDCs qualitatively in the same way as native writers from Chemosphere. However, quantitatively the contrast is evident. Clearly, native writers from Chemosphere are able to produce longer sentences with large variety of cohesion tools. A process of avoidance of using excessively these devices can be inferred from the production of short sentences and very short introductions as well by novice non-natives. Helped enough by their extended exposure to their mother language, native writer produce longer and more elaborated written discourse.

Lastly, gathered data and their analysis helped in answering research questions formulated and testing their related hypotheses:

This study addresses two questions. First, it identifies common grammatical cohesive devices used by Algerian chemists and native speakers. Second, it compares the types of items used by both groups, highlighting differences in quantity. Regarding hypotheses, the first one is well-supported, while the

second is partially confirmed; both groups use similar grammatical elements, but with varying frequencies (Figure6).

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Appendix: *DOIs* of 24 used papers in this study:

https://doi.org/10.1016/j.chemosphere.2020.127679	loi.org/10.4314/jfas.v13i2.13
https://doi.org/10.1016/j.chemosphere.2021.131107	https://doi.org/10.4314/jfas.v13i2.8
https://doi.org/10.1016/j.chemosphere.2021.131199	doi.org/10.4314/jfas.v13i2.9
https://doi.org/10.1016/j.chemosphere.2020.127684	doi.org/10.4314/jfas.v13i2.27
https://doi.org/10.1016/j.chemosphere.2021.131193	loi.org/10.4314/jfas.v13i2.15
https://doi.org/10.1016/j.chemosphere.2021.131114	https://doi.org/10.4314/jfas.v13i2.18
https://doi.org/10.1016/j.chemosphere.2019.125464	doi.org/10.4314/jfas.v13i3.4
https://doi.org/10.1016/j.chemosphere.2020.128107	loi.org/10.4314/jfas.v13i1.15
https://doi.org/10.1016/j.chemosphere.2020.127762	loi.org/10.4314/jfas.v13i1.16
https://doi.org/10.1016/j.chemosphere.2019.06.036	loi.org/10.4314/jfas.v13i1.24
https://doi.org/10.1016/j.chemosphere.2019.1254	loi.org/10.4314/jfas.v12i3.20
https://doi.org/10.1016/j.chemosphere.2019.06.071	http://dx.doi.org/10.4314/jfas.v13i3.22