

# A Study on Logical Connectors Use

## Exploring Lebanese Learners' Cognitive Skills

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### **Abstract**

This research was conducted to investigate how frequently and accurately Lebanese master learners of English Language and Literature use logical connectors in their academic writings in an attempt to explore the level of their cognitive skills. Many researches have been extensively done to study learners' misuse, underuse, and overuse of logical connectors in their academic writing. However, the use of logical connectors in EFL learners' writings as an indicator of their cognitive skills remains under investigation. To explore this field, the researcher collected data from a corpus consisting of 28 papers of literature review (35,146 words) written by a sample of Lebanese EFL master learners at the Lebanese University. They developed their literature review in the form of a course assignment, not as a section of a master or dissertation project. The current study adopted quantitative analysis because the researcher wanted to compare the occurrences and accuracy of the logical connectors in three main parts of learners' literature review: summary part, analysis and synthesis part, and evaluation part. The results showed that there was no statistical difference in the frequency of logical connectors among the three parts. However, the nature of logical connectors used by learners revealed different semantic functions. In addition, examining the frequency and the nature of logical connectors used in learners' literature review revealed the cognitive skills of remembering, understanding, and analyzing findings of previous studies. As for the cognitive skill of evaluation, it was revealed at a lower scope of use in learners' literature review.

**Keywords:** cognitive skills, logical connectors, literature review, EFL writing

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## 1. Introduction

In their definition of literature review, Fraenkel, Wallen, and Hyun (2012) explained that researchers have to weigh the information they collect from literature and should “be able not only to locate other work dealing with their intended area of study but also be able to evaluate this work in terms of its relevance to the research question of interest” (p. 67). In the same line, Machi and McEvoy (2012) defined literature review as a written text that develops a case to set up a thesis that synthesizes data relevant to the research question. Literature review writers have to point out the limitations of previous studies after summarizing their significant information. As such, they have to follow an organizational and coherent pattern that reflects their cognitive abilities by tracing the intellectual progression of the major debates included in the field. Consequently, investigating the pattern through which learners follow when they summarize, analyze, synthesize, and evaluate the arguments identified in the field of studies would be of a great help to explore the level of their cognitive skills.

In academic writings, the basic element of writing quality is shown by developing well-organized texts (Basturkmen & Randow, 2014), which helps readers follow the developed ideas and be convinced (Stapleton & Wu, 2015). Thus, well-organized texts directly reveal learners’ ability of logical thinking that allows them to link a claim and its relevant, adequate and rational support (Wallace & Wray, 2011). In the same vein, Larsen-Freeman and Long (1991) defined the cognitive style of learners as “the preferred way in which learners process information or address a task” (p. 192). Moreover, tracing the logical flow of ideas in a written text is achieved by looking at the way learners use logical connectors to reveal logical relationships (Plakans & Gebiril, 2017). The appropriate use of these logical connectors helps learners achieve cohesion and coherence in their writing. In addition, Halliday and Hassan (1976) pointed out that the concept of cohesion “is a semantic relation which encompasses the connections of meaning inside the text” (p.4). Based on Halliday and Hassan’s study, many researches have been conducted on the connectors used in non-native writing and their various functions and meanings, as compared with those in native writing. However, specifying the relation between discourse connectors and learners’ cognitive abilities is still under research. Hence, the current study aims to explore Lebanese master learners’ logical thinking by tracing and studying how they use logical connectors in their literature review.

## 2. Literature Review

According to Kellogg (2008), writing and thinking are closely linked to each other that the two are almost twins because the written text serves as “external form of memory that others can read and

reflect upon, providing a scaffold for thinking and writing in the historical development of a literate culture” (p. 2). In addition, Kellogg explained that the skill of writing is constantly improving as a result of practice, like other perceptual-motor and cognitive skills. Accordingly, the way learners make decisions about the development and the organization of their written text reflects their cognitive skills. Similarly, Cottrell (2005) believed that developing a clear link between reasons and conclusions in an academic writing reveals writer’s logical thinking. As defined by Tittle (2011), logical thinking is the cognitive ability to think carefully; consequently, the use of certain cognitive strategies such as planning, summarizing, deducing, comparing, and contrasting depends on learners’ cognitive ability. In writing, language learners depend on connectors use while developing the aforementioned cognitive strategies. However, the use of connectors among language learners, especially EFL learners is problematic (R. Zhang, 2014) because they may misuse, overuse, or underuse certain structures in their writing in comparison to native speakers (Aijmer & Stensöm, 2004). Nevertheless, learners’ ability to use connectors accurately is an indicator of their language proficiency whether they are native or non-native speakers (Deng, 2006). Therefore, it is very significant to explore how EFL learners bridge sentences and paragraphs to make their writing logical.

In this study, the term ‘logical connectors’ was used, following the description of Celce-Murcia and Larsen-Freeman (1999) when they presented the types of cohesive devices of written texts. Logical connectors have been explored in a variety of languages and genres. One group of studies has examined the relation between the connectors used and writing quality. Many of these studies have tried to explore to what extent the use of logical connectors facilitates the understanding of written texts. Although there have been similar findings among some studies, the results have been contradictory in other cases. On one hand, some studies have revealed that the appropriate use of logical connectors facilitates the comprehension of a written text and has a positive impact on its clarity (Altenberg & Tapper, 1998). In the same vein, Castro (2004) and Leo (2012) found that the use of logical connectors contributes to a better understanding of the written text. Similarly, connectors are described as significant devices for cohesion because they are responsible for linking the pieces of a text (Biber, Conrad, & Leech, 2002) and help readers interpret the logical relationships that appear in texts (Green, Christopher, & Mei, 2000). As such, these studies have explicitly shown the significant role connectors have in building understandable written texts.

On the other hand, some studies have concluded that there is no difference in the use of cohesive devices between good and weak written texts. A study by Johnson (1992) found that there is a similar degree of cohesion between good and weak English writings of Malay and native speakers.

Another study by M. Zhang (2000) concluded that there is no significant relationship between the number of cohesive connectors used in English writings of Chinese learners and the quality of their writings. In addition, it was deduced that good and weak writings are similar in the most frequently used category in them, which is lexical cohesion, followed by conjunction and reference (Johns, 1980; M. Zhang, 2000). According to Crewe (1990), most studies of logical connectives revealed that the use of cohesive ties in a written text does not mean that the text is coherent. A second group of studies has focused on the frequency of logical connectors used in learners' writing either in one language (native or foreign) or in foreign vs. native language. Some of these studies have found no significant difference between native and non-native learners of English in the frequency of logical connectors used in their writing (Karasi, 1994). On the other hand, a study by Field and Yip (1992) revealed that the writings of Hong Kong EFL learners include more conjunctions, mainly at the beginning of sentences, than those of native speakers. Another study by Trillo (2002) showed that certain connectors are used much less by EFL learners vs. native speakers and that they are used in their ideational, not pragmatic usages. Moreover, in a study by Ahmed (2012), the results showed that Egyptian EFL university learners have problems in all aspects of cohesion. A third group of studies has investigated the nature of connectors used in different genres of writing. In China, a study by Ting (2003) indicated that Chinese EFL learners are weak in using additive, adversative, causal, and temporal connectors in their writings. Another study by Liu and Braine (2005) found that in argumentative essays of Chinese EFL learners, additive devices account for the highest percentage of use among the sub-categories of connectors. Moreover, a study by Bell (2010) concluded that "yet" accounts for the largest scope of use in contrast to "nevertheless" and "still" in fiction, news, and academic spoken and written English. In Libya, a study by Hamed (2014) concluded that Libyan EFL learners experience difficulty in linking logical connections using 'because' and 'so', or use them pointlessly in their argumentative essays. Whether the findings on the use of logical connectors have been contradictory or similar, the issue of misusing logical connectors in EFL academic writing has been evident.

The current study followed the classification of Larsen-Freeman and Celce-Murcia (2016), who identified two types of logical connectors: adverb subordinators used to identify "relationships between the subordinate clauses they mark and main clauses in sentences" and linking adverbs used to signal "relationships between independent clauses that in written English are punctuated as separate sentences or joined by a semi-colon" (p. 541). The first type was classified into simple adverb subordinators (after, although, because, once, until, while, etc.) and complex adverb subordinators (as long as, even though, in order that, so that, etc.). In addition, the classification comprised ten subtypes of different semantic functions: time, location, manner, purpose, reason,

simultaneous, conditional, concessive, substitutive, and additive. As for linking adverbs, they were also classified according to their semantic functions into four subtypes, with different roles. The first subtype of linking adverbs is the additive, with four semantic functions: simple, emphatic, appositive, and comparative. The second subtype is the adversative, with four semantic functions: concessive, contrastive, corrective, and dismissal. The third subtype is the causal, with two semantic functions: resultative and causal conditions. The fourth subtype is the sequential, with four semantic functions: listing, simultaneous, summative, and transitional. Moreover, Larsen-Freeman and Celce-Murcia (2016) explained that EFL learners have problems with the forms, meanings, and uses of connectors. They mentioned the problem of using connectors that have inappropriate meaning of the context and the problem of unclear reference of connectors in extended pieces of writing. Thus, the current study intends to explore the use and the meaning of logical connectors that appear in academic writing. Based on the definition of Bolton, Nelson, and Hung (2002), the use of logical connectors in academic writing is “the identification of linguistic items as ‘connectors’, the measurement of the ratio of occurrence of connectors in data, and the calculation of the ‘overuse’ of ‘connectors’” (p.173). Accordingly, this research explores how frequently logical connectors appear in each part of the literature review of Lebanese EFL master learners and to what extent these connectors reveal appropriate meanings and clear references in the context they are used.

According to Cooper (1984), the framework of literature review comprises four research stages: problem formation, data collection, data evaluation, analysis and interpretation, and public presentation. In his *Taxonomy of Literature Reviews*, Cooper (1988) explained that literature reviews serve different goals: integrating and generalizing findings, critically analyzing the previous research, and identifying central issues or explaining arguments. Additionally, Gall, Borg, and Gall (1996) explained that literature review writers serve many roles: specifying the limits of research problem, looking for new lines of inquiry, avoiding ineffective approaches, gaining methodological insights, providing recommendations for future research, and seeking support for grounded theory. Hart (1998) added other roles, including synthesizing and gaining a new perspective and rationalizing the significance of the problem. Taking into consideration the aforementioned stages and goals, it is crystal clear that writing a literature review demands higher cognitive skills.

In other words, writing a literature review requires analysis, synthesis, and evaluation of the findings, which are at the ‘top end’ of Blooms’s cognitive taxonomy (1956). As for Anderson and Krathwohl’s (2001) revision of the original Bloom’s taxonomy, the ‘top end’ includes analysis,

evaluation, and creation. Anderson and Krathwohl (2001) redefined the cognitive domain as the intersection of the Cognitive Process Dimension (remember, understand, apply, analyze, evaluate, and create) and the Knowledge Dimension (factual, conceptual, procedural, and metacognitive). Based on both models, the parts of analysis, synthesis, and evaluation necessitate higher cognitive skills to be coherently and accurately developed. When learners are able to use the acquired knowledge in new contexts or relate them to other elements beyond what they have been taught, it means they are able to think (Brookhart, 2010). According to Norris and Ennis (1989), critical thinking is a “reasonable, reflective thinking that is focused on deciding what to believe or do” (p. 3). Therefore, when learners produce a reasoned critique in their literature review, they reflect their decision about what they have collected, synthesized and analyzed. Hence, a well-developed literature review involves the use of connectors that show the development of studies, the accurate analysis and synthesis of their findings, and the logical evaluation of their outcomes.

Based on the results of the previous studies, exploring learners’ misuse, underuse, and overuse of logical connectors has been done by studying the written structures of the texts. However, exploring the issue of logical thinking, as revealed through the use of logical connectors, cannot be done in a similar direct way. Consequently, this study constitutes a departure from the previous studies by choosing the literature review written by EFL master learners and tracing the pattern they use logical connectors in an attempt to explore their cognitive skills.

### **3. Research Questions**

The current study explores three research questions:

- (Q.1) Is there a statistically significant difference in the frequency of logical connectors used among the main parts of the literature review written by Lebanese EFL master learners?
- (Q.2) Is there a statistically significant difference in the nature of logical connectors used among the main parts of the literature review written by Lebanese EFL master learners?
- (Q.3) How does the use of logical connectors in the literature review written by Lebanese EFL master learners reveal their cognitive skills?

### **4. Methodology, Population and Procedure**

The purpose of this research is to investigate how Lebanese EFL master learners use logical connectors in their literature review. The study follows the quantitative approach and explores the frequency and nature of logical connectors used in an attempt to find out whether this use is an

indicator of learners' cognitive skills or not. A sample of 28 EFL Lebanese master learners of English Language and Literature at the Lebanese University constitutes the population of this study. Data were collected from the literature review they developed in the form of a course assignment, not as a section of a master or dissertation project.

The learners were provided with three lectures on the process of writing a literature review. This was done on purpose because "Most graduate students receive little or no formal training in how to analyze and synthesize the research literature in their field" (Boote & Beile, 2005, p. 5). As a kind of practice, they were asked to develop their first literature review, and then they were provided with feedback. The last step was asking learners to write another well-organized literature review of 1200 to 1400 words. All papers were corrected, scored, photocopied, and returned to learners with feedback. Tally sheets were used in order to count and document the frequency of logical connectors used by learners in the three parts of the literature review. In addition, Excel Sheets were used to represent the analysis in terms of figures and tables.

## **5. Data Collection and Analysis**

Data analysis included many steps. First, the papers of literature review were subjected to analysis in order to draw out conclusions about the frequency and nature of the logical connectors used. Numbers and types of logical connectors were identified and marked by using tally sheets. Second, they were compiled and analyzed to determine whether there is a statistically significant difference in the frequency and nature of logical connectors among the three main parts of literature review. In addition, they were analyzed to find out how the use of logical connectors in learners' literature review reveals their cognitive skills.

### ***5.1. Data analysis of the frequency of logical connectors used in learners' literature review***

The first part of data analysis of the literature review revealed the total number of words, total number of logical connectors, and the percentage of logical connectors in each part. Table 1 shows that the total number of words in all papers was 35,146: 16,732 words (47.6%) in the summary part, 11,702 words (33.3%) in the analysis and synthesis part, and 6,712 words (19.1%) in the evaluation part. Moreover, the total number of logical connectors used in all papers was 1566: 782 logical connectors (50%) in the summary part, 511 logical connectors (32.6%) in the analysis and synthesis part, and 273 logical connectors (17.4%) in the evaluation part. Consequently, the use of words and logical connectors in the summary part accounted for the highest percentages. However, the percentage of logical connectors with respect to the total number of words in each part did not show

a significant difference among the three parts: 4.7% of logical connectors in the summary part, 4.4% of logical connectors in the analysis and synthesis part, and 4.1% of logical connectors in the evaluation part. As such, there was no significant difference in the frequency of logical connectors used with respect to the total number of words in each part. This is an indicator that the learners are able to develop clear links among ideas, reasons, and conclusions by using logical connectors in all the parts of their writing. In addition, it is an indicator that they depend on the use of connectors, at similar levels, while developing different cognitive strategies.

*Table 1. Distribution of logical connectors used in learners' literature review*

		Summary	Analysis and Synthesis	Evaluation	Total
<i>Words</i>	<i>f</i>	16,732	11,702	6,712	35,146
	<i>%</i>	47.6%	33.3%	19.1%	
<i>Logical Connectors</i>	<i>f</i>	782	511	273	1566
	<i>%</i>	50%	32.6%	17.4%	
<i>Logical connectors with respect to the number of words in each part</i>	<i>%</i>	4.7%	4.4%	4.1%	

As for the frequency and percentage of the two types of logical connectors under study, the total number of adverb subordinators was 657 (42%) and that of linking adverbs was 909 (58%). Figure 1 shows the percentages of each type with respect to the total number of logical connectors in each part of the literature review. The percentage of linking adverbs in the summary part was 59.9%, while that of adverb subordinators was 40.1%. The percentage of linking adverbs in the analysis and synthesis part was 56.8%, while that of adverb subordinators was 43.2%. Finally, the percentage of linking adverbs in the evaluation part was 54.9%, while that of adverb subordinators was 45.1%. Consequently, Lebanese EFL master learners use linking adverbs more frequently than adverb subordinators when developing their literature review. This is an indicator that they use more independent clauses than subordinate clauses in their writing, mainly when they present the results of their summary, analysis, synthesis, and evaluation.



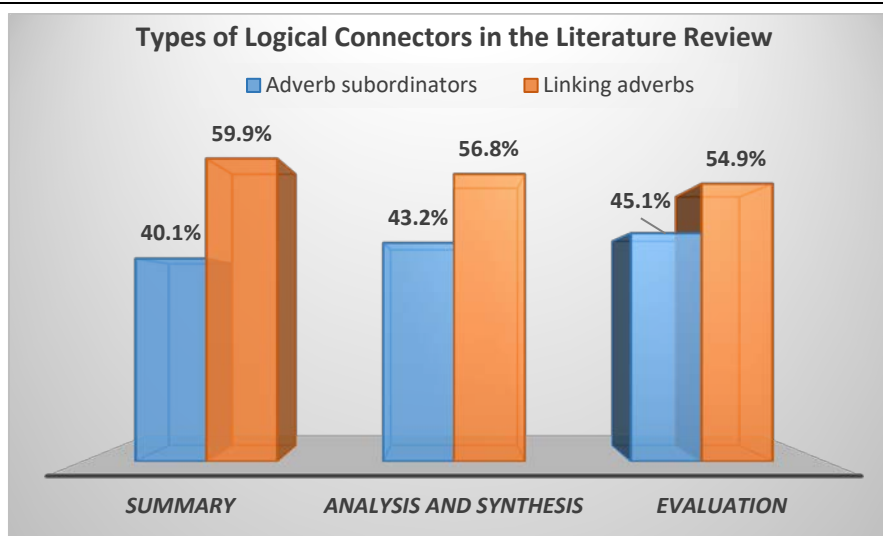


Figure 1. Types of logical connectors used by learners in each part of literature review

### 5.2. Data analysis of the accuracy of logical connectors used in learners' literature review

The second part of analysis involved examining the appropriate meanings and clear references of adverb subordinators and linking adverbs used in learners' literature review. The analysis revealed that the percentages of inappropriate meaning of both adverb subordinators and linking adverbs were higher than those of unclear reference in the three parts. However, the analysis among the three parts showed that the percentages of inappropriate meaning of adverb subordinators in the three parts were very close to each other: 1% in the summary part, 2.3% in the analysis and synthesis part, 0.7% and that in the evaluation part. Likewise, the percentages of unclear reference of adverb subordinators in the three parts were very close to each other: 0% in the summary part and 0.4% in the other two parts. According to inappropriate meaning of linking adverbs, the percentages were also close to each other: 3.6% in the summary part, 5.3% in the analysis and synthesis part, and 6.6% in the evaluation part. Similarly, the percentages of unclear reference of linking adverbs were close to each other in the three parts: 0.9% in the summary part, 1.2% in the analysis and synthesis part, and 2.6% in the evaluation part. Accordingly, the three parts of the literature review had similar levels of accuracy in the use of logical connectors.

Moreover, all the results proved that the percentages of inappropriate meaning of adverb subordinators did not exceed 2.3% and that of unclear reference of adverb subordinators did not exceed 0.4% in the three parts. As for linking adverbs, the percentage of their inappropriate meaning did not exceed 6.6% and that of their unclear reference did not exceed 2.6% in the three parts. Consequently, the researcher made sure that the logical connectors used in the three parts of the literature review were accurate and with clear reference at a percentage of more than 90%. In this case, it is a clue that the learners are able to recognize the different meanings and semantic

functions of the connectors used and that they do not encounter challenges when choosing certain logical connectors to link the ideas and clauses of their sentences.

### ***5.3. Data analysis of adverb subordinators used in learners' literature review***

The third part focused on the distribution of adverb subordinator subtypes used in the three parts of the learners' literature review, as shown in table 2. The total number of the subtypes in each part was taken into consideration to calculate the percentages of their use. The results revealed that "additive" adverb subordinators accounted for the highest scope of use: 31.3% in the summary part, 29.9% in the analysis and synthesis part, and 38.2% in the evaluation part. Moreover, "reason" adverb subordinators accounted for the second highest scope of use in the part of summary (20.8%) and the part of analysis and synthesis (17.2%). As for the part of evaluation, the percentage of "time" adverb subordinators (13.8%) was higher than that of "reason" adverb subordinators (12.2%). As for adverb subordinators with semantic functions of summarizing findings, other than the "additive" (31.3%), the sum total of their percentages in the summary part was 25.5%: "time" (13.7%), "location" (1.9%), "manner" (4.1%), and "simultaneous" (5.8%). As such, the total percentage of all adverb subordinators with semantic functions of summarizing findings was 56.8% in the summary part. In addition, in the analysis and synthesis part, the use of adverb subordinators with semantic functions that show analysis and synthesis of findings, other than "reason" (17.2%), the sum total of their percentages was 22.2%: "purpose" (2.3%), "conditional" (5%), "concessive" (7.7%), and "substitutive" (7.2%). Consequently, the sum total of all adverb subordinators with semantic functions of analyzing and synthesizing findings was 39.4%. As for the use of adverb subordinators with semantic functions that reveal evaluation of findings, other than "reason" (12.2%), the sum total of their percentages was 23.6%: "purpose" (3.3%), "conditional" (8.1%), "concessive" (7.3%), and "substitutive" (4.9%). Accordingly, the sum total of adverb subordinators with semantic functions indicating evaluation of findings was 35.8% in the evaluation part.

As such, the most frequently used subtypes of adverb subordinators in the literature review of Lebanese EFL master learners revealed addition, reason, and time relations. Specifically, the nature of adverb subordinators used in each part did not reveal statistical differences. Adverb subordinators with semantic functions of summarizing findings accounted for the highest scope of use (56.9%) in the summary part. However, adverb subordinators with semantic functions of analyzing and synthesizing findings did not account for the highest scope of use (39.4%) in the analysis and synthesis part. Likewise, adverb subordinators with semantic functions of evaluating findings did not account for the highest scope of use (35.8%) in the evaluation part. Consequently, subordinators with semantic functions of summarizing findings were dominant in the three parts. In

other words, the nature of adverb subordinators that accounted for the highest scope of use in the three parts was similar. One reason may be that the learners experience difficulty when using adverb subordinators with semantic functions of analysis, synthesis, and evaluation; hence, they choose other adverb subordinators with different semantic functions in their writings. Another reason may be that they prefer to present many of their collected data in terms of addition.

*Table 2. Main types of adverb subordinators used in learners' literature review*

Adverb Subordinators	Summary		Analysis and Synthesis		Evaluation	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
<i>Time</i> ( <i>after, before, since, etc.</i> )	43	13.7%	29	13.1%	17	13.8%
<i>Location</i> ( <i>where, wherever, etc.</i> )	6	1.9%	2	0.9%	2	1.6%
<i>Manner</i> ( <i>as, in that, etc.</i> )	13	4.1%	16	7.2%	0	0%
<i>Purpose</i> ( <i>so that, in order that, etc.</i> )	4	1.3%	5	2.3%	4	3.3%
<i>Reason</i> ( <i>since, because, etc.</i> )	65	20.8%	38	17.2%	15	12.2%
<i>Simultaneous</i> ( <i>while, as, etc.</i> )	18	5.8%	21	9.5%	13	10.6%
<i>Conditional</i> ( <i>if, in case, etc.</i> )	13	4.2%	11	5%	10	8.1%
<i>Concessive</i> ( <i>although, though, while, etc.</i> )	21	6.7%	17	7.7%	9	7.3%
<i>Substitutive</i> ( <i>rather, instead of, etc.</i> )	32	10.2%	16	7.2%	6	4.9%
<i>Additive</i> ( <i>and</i> )	98	31.3%	66	29.9%	47	38.2%
<b>Total</b>	313	100%	221	100%	123	100%

#### **5.4. Data analysis of linking adverbs used in learners' literature review**

The fourth part of analysis focused on the main types and subtypes of linking adverbs used in learners' literature review, as shown in Figure 2. In the part of summary, the percentage of "additive" linking adverbs was the highest (45.8%), followed by "causal" (22%), "sequential" (21.5%), and "adversative" (10.7%). Similarly, the highest percentage in the part of analysis and synthesis was that of "additive" linking adverbs (40%), followed by "causal" (26.6%), "adversative" (23.1%), and "sequential" (10.3%). Concerning the evaluation part, the highest percentage of linking adverbs was also scored by "additive" (38%), followed by "causal" (32%),

“sequential” (20.7%), and “adversative” (9.3%). Hence, the “additive” subtype accounted for the highest scope of use among other subtypes of linking adverbs in learners’ literature review. In addition, “causal” subtype accounted for the second highest scope of use, but its percentage in the evaluation part was higher than those of the other parts. Accordingly, Lebanese EFL master learners summarized, analyzed, synthesized, and evaluated findings by using more frequently “additive” and “causal” linking adverbs.

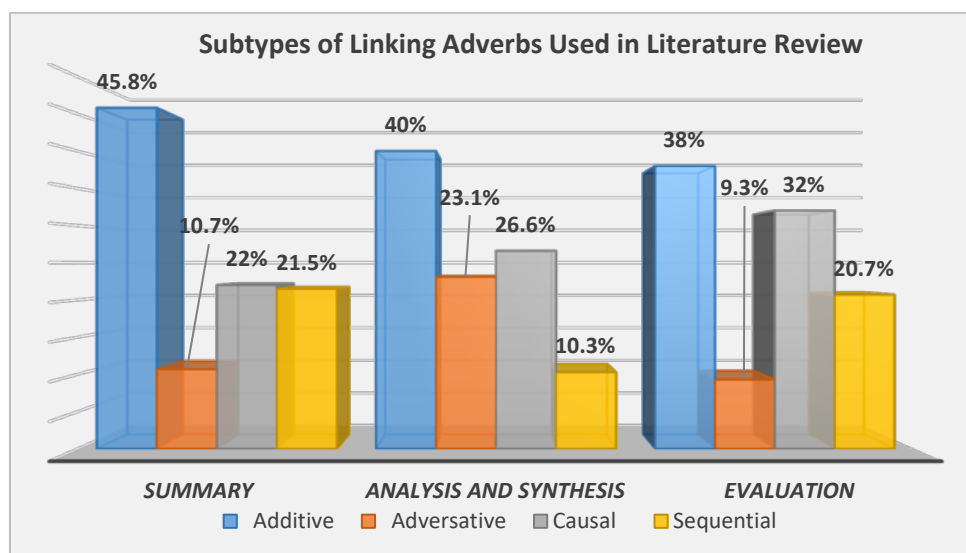


Figure 2. Subtypes of linking adverbs used by learners in the three parts of their literature review

In addition, the researcher analyzed the use of linking adverbs according to their semantic functions of each subtype, as revealed in Table 3. The highest percentage of linking adverbs used was that of “simple additive” in the three parts: 25.6% in the summary part, 25.9% in the analysis and synthesis part, and 32.75% in the evaluation part. The second highest percentage was scored by “causal resultative”: 21.8% in the summary part, 24.8% in the analysis and synthesis part, and 32% in the evaluation part. As such, “simple additive” and “causal resultative” connectors constituted about half the number of linking adverbs used in all parts. As for linking adverbs with semantic functions of summarizing findings, other than “simple additive” (25.6%), the sum total of their percentages in the summary part was 36.9%: “additive emphatic” (2.4%), “additive appositive” (13%), “sequential listing” (18.1%), “sequential simultaneous” (0.2%), “sequential summative” (1.7%), and “sequential transitional” (1.5%). As such, the sum total of all linking adverbs used to summarize findings was 62.5%.

Moreover, in the analysis and synthesis part, the use of linking adverbs with semantic functions that show analysis and synthesis of findings, other than “causal resultative” connectors (24.8%), the sum total of their percentages was 29.7%: “additive comparative” (5.2%), “adversative concessive” (12.1%), “adversative contrastive” (6.2%), “adversative correction” (1.4%), “adversative dismissal”

(3.1%), and “causal conditions” (1.7%). Consequently, the sum total of all linking adverbs used to analyze and synthesize findings was 54.5%. As for the use of linking adverbs with semantic functions that reveal evaluation of findings, other than “causal resultative” connectors (32%), the sum total of their percentages was 11.3%: “additive comparative” (1.3%), “adversative concessive” (6%), “adversative contrastive” (1.3%), “adversative correction” (1.3%), “adversative dismissal” (0.7%), and “causal conditions” (0.7%). Accordingly, the sum total of all linking adverbs used to evaluate findings was 43.3%.

Consequently, linking adverbs with semantic functions of summarizing findings accounted for the highest scope of use (62.5%) in the summary part. Additionally, linking adverbs with semantic functions of analyzing and synthesizing findings accounted for the highest scope of use (54.5%) in the analysis and synthesis part. However, although the use of linking adverbs with semantic functions of evaluating findings accounted for a high scope (43.3%) in the evaluation part, the highest scope of use was for linking adverbs with other semantic functions. Consequently, there was a statistical difference in the nature of logical connectors used among the main parts of literature review of Lebanese EFL master learners. In this case, the reason might be related to the previous finding of this research that Lebanese EFL master learners use more independent clauses than subordinate clauses in their writing, so they choose to depend on specific linking adverbs.

*Table 3. Subtypes of linking adverbs used in learners' literature review*

Linking Adverbs	Summary		Analysis and Synthesis		Evaluation		
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	
<i>Additive</i>	<i>Simple (in addition, also, etc.)</i>	120	25.6%	75	25.9%	49	32.7%
	<i>Emphatic (as well, besides, etc.)</i>	11	2.4%	11	3.8%	1	0.7%
	<i>Appositive (that is, for example, etc.)</i>	61	13%	16	5.5%	5	3.3%
	<i>Comparative (similarly, etc.)</i>	23	4.9%	15	5.2%	2	1.3%
<i>Adversative</i>	<i>Concessive (however, despite this, etc.)</i>	41	8.7%	35	12.1%	9	6%
	<i>Contrastive (on the other hand, etc.)</i>	7	1.5%	18	6.2%	2	1.3%
	<i>Correction (instead, etc.)</i>	2	0.4%	4	1.4%	2	1.3%
	<i>Dismissal (anyhow, anyway, etc.)</i>	0	0%	9	3.1%	1	0.7%

<i>Causal</i>	<i>Resultative (hence, thus, etc.)</i>	102	21.8%	72	24.8%	48	32%
	<i>Causal conditions (otherwise, in turn, etc.)</i>	1	0.2%	5	1.7%	1	0.7%
<i>Sequential</i>	<i>Listing (then, first, finally, etc.)</i>	85	18.1%	14	4.8%	11	7.3%
	<i>Simultaneous (meanwhile, etc.)</i>	1	0.2%	3	1%	2	1.3%
	<i>Summative (in short, to sum up, etc.)</i>	8	1.7%	6	2.1%	13	8.7%
	<i>Transitional (incidentally, etc.)</i>	7	1.5%	7	2.4%	4	2.7%
<b>Total</b>		469	100%	290	100%	150	100%

## 6. Results and Discussion

According to research Q.1, data analysis showed that the summary part of the literature review was the dominant part, in contrast to the part of analysis and synthesis and that of evaluation. However, similar percentages of logical connectors were used in the three parts, with respect to the total number of words in each. Moreover, it was revealed that Lebanese master learners used linking adverbs more frequently than adverb subordinators in their literature review. Additionally, data analysis of logical connectors accuracy in each part of the literature review proved that the percentage of accuracy was more than 90%. Thus, there was no statistically significant difference in the frequency of logical connectors, which were used accurately in the literature review of the learners. This is an indicator that Lebanese EFL master learners do not have the problem of logical connectors misuse, the fact that reveals the ability of using connectors accurately and appropriately. Besides, it indicates that there is a similar degree of cohesion in different parts of their literature review.

Regarding research Q2., data analysis of adverb subordinators used in each part proved that Lebanese EFL master learners summarized, analyzed, synthesized, and evaluated findings by using more frequently adverb subordinators that reveal addition, reason, and time. Specifically, they summarized, analyzed, and synthesized findings by using more frequently “additive” and “reason” adverb subordinators. Moreover, when learners evaluated findings, they used more frequently “additive” and “time” adverb subordinators. However, the sum total of “reason” and other adverb subordinators that show semantic functions of “purpose”, “conditional”, “concessive”, and “substitutive” did not account for the highest scope of use in the part of analysis and synthesis and

that of evaluation. Therefore, adverb subordinators used for summarizing findings accounted for the highest scope of use in the three parts. Hence, there was no statistically significant difference in the nature of the most frequently used adverb subordinators in Lebanese EFL master learners' literature review.

According to data analysis of linking adverbs, it was revealed that the use of "additive" linking adverbs accounted for the highest scope of use, in contrast to other subtypes. This high scope of use was followed by that of "causal resultative" in all parts. However, when learners evaluated findings, the percentages of "additive" and "causal resultative" linking adverbs were close to each other. In addition, the use of "causal" linking adverbs, specifically the resultative ones, was the highest in the part of evaluation, in contrast to the other parts. Moreover, the nature of the subtypes of linking adverbs showed difference among the three parts. First, linking adverbs with semantic functions of summarizing findings accounted for the highest scope of use in the summary part. Second, linking adverbs with semantic functions of analyzing and synthesizing findings accounted for the highest scope of use in the analysis and synthesis part. Third, linking adverbs with semantic functions of evaluating findings accounted for a high scope in the evaluation part, but the scope of using linking adverbs with other semantic functions was higher. As such, there was a statistically significant difference in the nature of linking adverbs used among the main parts of literature review of Lebanese EFL master learners. This result concurred with the finding that the use of certain logical connectors more frequently than others is a way through which learners made their decisions about developing and organizing findings, which reflects their cognitive skills (Kellogg, 2008) and their logical thinking (Tittle, 2011). In the case of Lebanese EFL master learners, it is an indicator about the decisions they make when choosing specific linking adverbs and adverb subordinators, which is based on their cognitive skills and strategies.

As for research Q3., the aforementioned results helped the researcher analyze the use of logical connectors that reveal certain cognitive skills. Based on Bloom's Taxonomy (1956) and Anderson and Krathwohl's (2001) revision of Bloom's taxonomy, adding ideas and presenting findings in reference to time reveal learners' ability to remember and understand ideas or concepts. They show the "remember" and "understand" categories of the Cognitive Process Dimension and the factual category of the Knowledge Dimension of Anderson and Krathwohl's revision. However, the use of adverb subordinators and linking adverbs with semantic functions of analysis and synthesis reveal learners' ability to break concepts or ideas into parts in order to attribute certain findings to their direct causes and to show how they relate to one another or how they interrelate. This result

matched with the “analysis” category of the Cognitive Process Dimension and the “conceptual” category of the Knowledge Dimension.

As for the cognitive skill of evaluation, adverb subordinators and linking adverbs with semantic functions of evaluation did not account for the highest scope of use in the evaluation part. This is because both types of logical connectors accounted for a percentage of use less than 50%. Instead, adverb subordinators and linking adverbs with other semantic functions accounted for higher scopes of use. Logical connectors of evaluation, which is located at the top level of the Cognitive Process Dimension category, were not dominant in the part where learners were expected to evaluate findings. As such, the ability to judge, check, and even critique the value of material for a given purpose (Bloom, 1956), or the ability to make judgments based on criteria and standards through checking and critiquing (Anderson & Krathwohl, 2001) was shown at a lower scope of use than the cognitive skills of analysis and synthesis in the learners’ literature review. Consequently, the use of logical connectors in the literature review of Lebanese EFL master learners revealed more cognitive skills of remembering, understanding, and analyzing findings than of evaluating them. This agreed with the findings of Green et al. (2000) that connectors help readers interpret the logical relationships that appear in the text, a fact that directly reflects the writer’s logical thinking. Therefore, in the case of Lebanese EFL master learners, logical connectors use shows that they have their own logical decisions and thinking, which is revealed by the way they organize and present the data they have collected.

## **7. Conclusion**

The current study proved that Lebanese EFL master learners developed the summary, analysis, synthesis, and evaluation parts of literature review by using approximately the same frequency of logical connectors. In addition, the use of logical connectors in their literature review revealed appropriate meanings and clear references in the context they were used. As for the nature of adverb subordinators used, it was evident that it was similar in the three parts and revealed the cognitive skills of remembering and understanding. However, the nature of linking adverbs used in learners’ literature review was of different semantic functions among the three parts. The learners used more linking adverbs with semantic functions of summarizing in the part of summary, the fact that revealed the cognitive skills of remembering and understanding. Besides, they used more linking adverbs with semantic functions of analyzing and synthesizing findings in the part of analysis and synthesis, the fact that revealed the cognitive skills of understanding and analyzing. Finally, the use



of linking adverbs with evaluation semantic functions was lower than those with other semantic functions, which revealed lower levels of evaluation cognitive skills.

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