

Fishbone Diagram as a Catalyst Tool in Teaching Cohesive Ties for Undergraduate Students at the University of Sulaimani

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Abstract

This quasi-experimental study seeks to identify the impact of the Fishbone Diagram on improving students' use of cohesive ties. It also seeks to elucidate whether a notable difference exists in their performance before and after the implementation of this visual instructional method. The sample comprises sixty students in their final year of study at the English Department, College of Languages, University of Sulaimani for the academic year (2023-2024). They are divided into experimental and control groups, with the former being instructed using the Fishbone Diagram and the latter receiving conventional teaching instruction. Tests, which are widely recognized as effective and reliable research tools for examining interventions' impact, are used to collect necessary data and evaluate the impact of the intervention. Both pretest and posttest are conducted to figure out the significant differences observed prior to and following the treatment. The analysis demonstrates that the experimental group outperforms the control group and significantly differs from it in the posttest results, implying the effectiveness of the diagram for teaching cohesive ties and the noticeable positive impact of the intervention on the students' performance in comparison to the control group.

Keywords: *Fishbone (Ishikawa) Diagram, Cohesion, Cohesive Ties, Undergraduate Students*

1. Introduction

Writing is a complex and intricate skill that demands extensive practice. It is a thoughtful process that requires sufficient time to consider the topic and go over any relevant prior knowledge. The multiple dimensions of writing in teaching practices, evaluation processes, and language development must be included in every reading and language curriculum (Suleiman, 2000). Because of its capacity to connect disparate textual elements, **cohesion** is seen as a crucial factor in writing. Without it, sentences would be fragmented and would only consist of unrelated parts; cohesion is what holds a text together. It distinguishes a text from non-text (Halliday and Hasan, 1976). Halliday and Hasan propose that certain grammatical elements, such as *reference*, *ellipsis*, *substitution*, and *conjunction*, along with some lexical ties, such as *reiteration* and *collocation*, are what create text cohesiveness (ibid). In the realm of education, instructors normally face a huge challenge when they try to provide effective feedback on their students' written work. Furthermore, university students find it difficult to use cohesive devices effectively in academic writing. Traditional teaching methods cannot adequately address the challenges students face when understanding and utilizing these devices. Writing that is disjointed, fragmented, or unduly basic may result from this learning gap. The current study aims to employ a visual tool called the Fishbone Diagram to teach cohesive ties in a more structured and engaging way. The aim is to investigate how this diagram can aid in the learning process. To achieve this aim, two groups from the fourth stage constitute the sample for the study. One group is taught in the conventional teaching way in which cohesive ties are introduced to gain text cohesion; the other group is taught by the researchers to detect, understand and interpret the cohesive ties in the text through applying the Fishbone Diagram. With the fishbone shape as the organizer, students of the experimental group are able to identify and use different types of cohesive ties.

Based on the explanation of theoretical and conceptual framework and the research variables, the hypotheses of this research are formulated as follows:

1. The pre- and post-test means of the control group studying the subject conventionally show no statistically detectable difference at the 0.05 significance level.
2. The pre- and post-test means of the experimental group studying the subject through the Fishbone Diagram show no statistically detectable difference at the 0.05 significance level.

3. The posttest means of the control group and experimental group show no statistically detectable difference at the 0.05 significance level.

The current study intends to investigate the potential of a novel teaching approach that utilizes the Fishbone Diagram in order to solve common issues with cohesive devices in academic writing at the University of Sulaimani.

2. Theoretical Framework

2.1 Fishbone Diagram

The Fishbone Diagram is a visual tool that was first used to examine and assess the relationships between a problem or cause and solution or effect. Sorting through the potential reasons makes it feasible to pinpoint the roots of the problem (de Saeger and Feys, 2016). The diagram is designed as the bone of a fish with several branches, hence its name. Every bone branch is examined separately, each of which most likely has a root cause. Every measurement element can be used to identify the bone. Those elements can be replaced as needed, depending on the nature of the problem being analyzed. A fishbone diagram aids in organizing potential causes, understanding the problem as a whole, and analyzing gaps in present knowledge (Omachonu and Ross, 2005).

Kaoru Ishikawa, a Japanese professor and chemical engineer at the University of Tokyo, created the Fishbone Diagram to help find the source of a problem and generate possible solutions for improving the quality of a product. The figure has also been called the Ishikawa diagram after its originator (ToolsHero, n.d.). The Ishikawa Fishbone Diagram, initially intended for quality control, has evolved to serve as a flexible problem-solving tool that can be used to address a variety of manufacturing challenges. This paradigm can be used and modified by many institutions to improve overall process management, reduce downtime, and boost operational effectiveness beyond traditional quality troubleshooting. In the field of education, educators attempt to utilize diagrams as a tool to help students think more methodically, identify concepts, and develop them in a sequential, pertinent manner, hence the Fishbone diagram is considered as a fitting option. Many teachers and researchers began utilizing it and considering it as a teaching method that may aid students' learning (Gencer, 2025).

The 5Ms diagram is another well-known alternate name for the Fishbone Diagram. Its designer, Ishikawa, divided the various sources of a problem into five divisions, which are represented by the long bones of a fish: *material*, *mother nature*, *method*, *machine*, and *manpower*. Depending on the level of information required, each category may contain additional causes or categories of causes (de Saeger and Feys, 2016). The figure appears as follows:

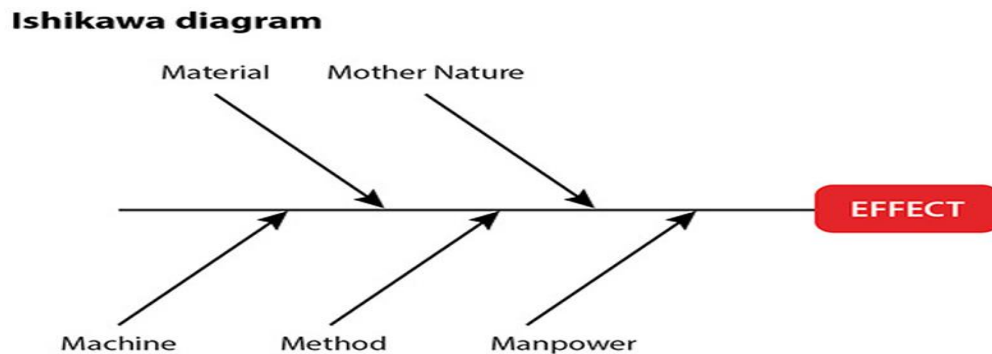


Figure 1: Adopted from de Saeger and Feys (2016)

As will be discussed in the following sections, the fishbone shape and its shortened form process (5Ms) have been used in the current analysis to match the investigated elements (cohesive ties).

2.2 Cohesion

Cohesion refers to how a text's elements are tied together and considered meaningful to the readers. The term 'cohesion' is a collective name for all of those ties (links) that weave together its various parts to create a logical progression of ideas (Sunderland, 2016). Halliday and Hasan (1976: 10) define cohesion as "the set of semantic resources for linking a sentence with what has gone before". This means that cohesion is a textual process that ensures that the text's elements are correctly related through specific links. These links or devices can be thought of as a glue that holds sentences together to establish a unified and well-structured text. Texture refers to the defining feature that turns a group of words or sentences into a cohesive text instead of a haphazard assembly of language elements. A language user's capability and language proficiency to distinguish between a text and non-text "is due to the inherent texture in the language and to his awareness of it" (Halliday, 1968: 210).

Coherence is frequently brought up while talking about text cohesion. Despite their similarities, the two processes focus on different facets of the organization of texts or discourse. *Cohesion* is the interconnection between textual elements where the interpretation of one is reliant on another. It includes both grammatical items and lexical features (Renkema and Schubert, 2018). *Coherence*, on the other hand, refers to the connections established by factors external to the text. These factors are typically the background knowledge that a hearer or reader is expected to possess (ibid). That is, coherence does not exist in words and structures, but it mainly refers to the way by which people interpret the messages and information they read and hear (Yule, 2010). A text is considered coherent if it allows readers to map the sentences into a logical reality made up of events and objects that belong together. One essential component of successful written communication is coherence. It includes the rational and systematic organization of concepts, information, and arguments in a text, making sure that they all work together to produce a coherent and understandable message. Coherent writing makes it possible for readers to follow the author's ideas without being confused or interrupted. In coherence, readers depend on knowledge of what the text is about. This possible interpretation permits the reader to bring other knowledge to bear on the process of interpreting the text (Abbadia, 2023). The following is an example originally from Widdowson (1978):

(1) Her: That's the telephone

Him: I am in the bath.

Her: OK!

one can notice that no textual connections have been used, however, one can understand the exchange as being a coherent instance of discourse. The first remark made by her serves as a request from him to perform action. This remark has been given the value of a request due to its connection to the rest of the exchange. His remark is interpreted as a response to her request, an excuse for not complying with the request. He states the reason why he cannot comply with the request. Her second remark is viewed as an acceptance of the excuse. The interpretation of the exchange in this way shows that speakers need extensive knowledge about how conversations work, which involve both *linguistic* (within the text) and *non-linguistic* (outside the text) knowledge (Yule, 2010). The distinction between cohesion and coherence is that cohesion focuses on the internal connections present within a text, showing how the text's different parts are tied together, while coherence is the general organization or order of elements in the

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discourse that matches the readers' assumptions regarding how different sorts of texts are deemed to be organized based on external knowledge (Renkema and Schubert, 2018).

Because it guarantees that the text's components are connected and flow naturally, cohesion is essential to writing. Cohesion makes a piece of writing easier to read and comprehend by ensuring that its concepts are related and well-structured contributing to its overall coherence (Abbadia, 2023). In a text, a single occurrence of cohesion or a paired cohesive item is referred to as a 'tie' (Halliday and Hasan, 1976). These ties are surveyed in the section below.

2.3 Cohesive Ties

Cohesive ties, also known as *linking words, devices* or *connectors*, are lexical and grammatical words or phrases that link different parts of a text together and allow it to flow logically (Waring, 2017). Understanding these cohesive connections within a text offers insights into how writers organize their thoughts and ideas. An appropriate quantity of these ties is essential in determining the quality of a piece of writing (Yule, 2010). Cohesion may be grammatical or lexical. These two types are explained with their subtypes in the following sections

2.3.1 Grammatical Cohesion

Grammatical cohesion is primarily concerned with the grammatical and organizational features of a text that sustain its unity. It comprises using linguistic strategies to establish coherent linkages between ideas and sentences. This kind of cohesion guarantees a fluid writing flow and helps readers form associations between various textual elements (Abbadia, 2023). It includes four subtypes:

2.3.1.1 Reference (R)

Reference is an association between a linguistic item and another situational or textual item. It refers to elements that cannot be interpreted by themselves but instead rely on the surrounding context for their clarity and interpretation. It is typically achieved through pronouns, which are commonly used in language to maintain clarity and cohesiveness in discourse. Halliday and Hasan (1976) outline three distinct kinds of references in English, which include: (a) **personal**: I, we, they, us, yours, etc. (b) **demonstratives**: these, there, those, etc. and (c) **comparatives**: less, than, more, most etc. In language, references can either refer backward to earlier text (anaphoric reference, as shown in examples 2a and 2b) or forward to later text (cataphoric reference, as seen

in examples 2c and 2d):

- (2) a. Lisa told me a story. I was about her first visit to Dubai.
 b. Elina painted the picture in Istanbul.
 c. When they return to work, Cathy and Sami plan to start a new project.
 d. This is something I never expected to happen.

In sentence (2a), the anaphoric reference “it” refers back to the earlier phrase “a story.” Likewise, in (2b) there are four anaphoric references as follows: “She” stands for “Elina”, “did” for “painted”, “it” for “the picture” and “there” for “in Istanbul”. In contrast, in (2c) “they” serves as a cataphoric reference, pointing ahead to “Cathy and Sami,” and in (2d), “this” refers to something addressed later in the sentence (Waring, 2017).

Another instance of anaphoric reference is the use of the definite article (the), which usually redirects the reader to a noun mentioned earlier, as illustrated by:

- (3) I saw a dog outside the mall. The dog ran toward me.

In sentence No. 3, the second use of “the” refers back to the earlier mention of “a dog”. Anaphoric reference serves to enhance the clarity and efficiency of the text, while cataphoric reference seeks to capture the reader’s attention (ibid).

2.3.1.2 Ellipsis (E)

Ellipsis is the omission of an element, which can be either nominal, verbal, or clausal, Haliday and Hasan (1985:146-225):

- (5) a. I have three mobiles, and she has two [~~mobiles~~]. **Nominal**
 b. I will go to the store and she [~~will go~~] to the library. **Verbal**
 c. I will prepare lunch, and you [~~will prepare lunch~~]. **Clausal**

In sentences 5a to 5c, the meaning remains obvious without the elliptical elements because they are inferred contextually.

2.3.1.3 Substitution (S)

Substitution refers to replacing one element with another to avoid unnecessary repetition and create cohesion. It is divided into three categories: nominal (e.g. one, the same; example 6a), verbal (e.g. do, will, do so; example 6b), and clausal (e.g. so, as, not; example 6c). Nominal, verbal and clausal substitutions replace noun phrases, verb phrases, clauses, respectively:

- (6) a. I want to get a new house, but **it** is very expensive.
 b. I will help you with your travel arrangements. You can depend on me to **do so**.
 c. My research student said she would finish the research by Monday, and I hope **so**.

In the examples above, the terms, “it”, “do so” and “so” serve as substitutes for “house”, “help” and “she will finish the research”, respectively. The substitutions prevent the repetition of previously mentioned elements, Hasannejad *et al.* (2012).

Ellipsis and substitution happen when a lexical item is substituted with any other grammatical resource that is available in writing or conversation, without any repetition. Although they both serve as linguistic links, ellipsis is different from substitution in that it replaces an item with zero (Halliday and Hasan, 1976). It is important to note that, although substitution is typically explained before ellipsis, in the current study it is explained after it in order to accommodate the proposed acronym that will be used to teach these cohesive linkages (see section 2.4 below).

2.3.1.4 Conjunctions (C)

These are words that link ideas together, serving as connectors to signal relationships such as additions, contrasts, causality, and time- based connections (Renkema and Schubert, 2018). They can be divided into:

A. Additives: These conjunctions provide additional details to the preceding statement. Examples include “in addition”, “likewise”, “thus” and others.

(7) The entire news article is poorly written. **Moreover**, it is inaccurate.

B. Adversative (contrastive): These conjunctions create a form of opposition with the earlier part of the text. Examples are “instead”, “however”, “yet”, “actually”, etc.

(8) He wanted to go to Hawler; however, it started raining.

C. Causal: These conjunctions establish a cause-and-effect connection between clauses and sentences to show how one event leads to another. Examples are “consequently”, “as a result”, “otherwise”, “because of”, and “therefore”.

(9) He did well **because** he studied hard.

D. Temporal (Sequential): These conjunctions indicate the order and timing in which events or events occur. Examples are “next”, “firstly”, “at once”, “this time”, “in the end” “until”, “next”, etc.

(10) Children are allowed to play outside **until** it gets dark.

2.3.2 Lexical Cohesion

Proceeding to the second type of cohesion, **lexical cohesion**, it pertains to the connections formed by content words that are utilized across various parts of a discourse. The main categories of lexical cohesion, according to Halliday and Hasan (1976), are *reiteration* and *collocation*.

2.3.2.1 Reiteration (R)

It occurs when a word is systematically tied to a preceding word, it has five types:

A. Repetition (repeating same element)

(11) I can't wait for the movie to start. The movie seems quite entertaining.

In example No.11, the word “movie” is repeated to reinforce the subject.

B. Synonymy (semantically related elements)

(12) The cake is tasty. The dessert is appetizing. (Synonyms: “cake” and “dessert”; “tasty” and “appetizing”)

C. Hyponymy (subordinate- superordinate relationship)

(13) I love fruits. Strawberries my favorite. (Hyponym: “fruits” and “strawberries”)

D. Meronymy (part-whole relationship)

(14) I am reading a book. The cover is worn and the pages are delicate.

Here, “cover” and “pages” are parts (meronyms) of the “book”, providing more specific information about it.

E. Antonymy (opposite meaning)

(15) The soup was hot, but the drink was cold.

In (15), reiteration occurs through the use of the antonyms, “hot” and “cold,” to highlight the difference between the two items, the soup and the drink.

2.3.2.2 Collocation (C)

It refers to a group or pair of words that a native speaker frequently uses together and considers to be natural. Different types of collocations may be detected as when verbs collocate with nouns as in “*make a decision, take a shower, etc.*”; adjectives collocate with nouns as in “*bright light, strong coffee, etc.*”; nouns collocate with nouns as in “*job interview, table tennis, etc.*”; prepositions collocate with nouns as in “*in the morning, on the train, etc.*”, adverbs collocate with verbs as in “*loudly sigh, quickly run, etc.*”; and adverbs collocate with adjectives as in “*extremely tired, highly recommended, etc.*” (Learn English Team, n.d.). Example (16) below shows a collocation between the verb “do” and the noun “dishes”:

(16) It is your turn to *do the dishes* tonight.

The phrase promotes cohesion by combing “do” and “dishes” which is a common and expected pairing, helping the reader easily understand the intended action (Renkema and Schubert, 2018). Because these combinations are frequently hard to guess, English language learners must work extra hard to master them even though they seem normal to native speakers. For native English speakers, certain combinations simply sound ‘wrong’ since they do not go together (Learn English Team, n.d.).

In cohesion (whether grammatical or lexical), the interpretation of a text item relies on another identifiable item in the text which makes it a textual trait. The current study deals with examining how the use of the Fishbone Diagram can facilitate the learning of these ties within any kind of text.

2.4 Teaching Cohesive Ties Through the Fishbone Diagram

As explained earlier, the Fishbone Diagram serves as a visual aid on which specific categories are distributed. Integrating the bones with the cohesive ties, the researchers of the present study distribute the grammatical cohesive ties into *the top bones* to get the abbreviation form of RESC

standing for (Reference, Ellipsis, Substitution and Conjunction), while the *bottom bones* constitute the lexical cohesive devices to get RC abbreviation that stands for (Reiteration and Collocation). The diagram can be schematized as the following:

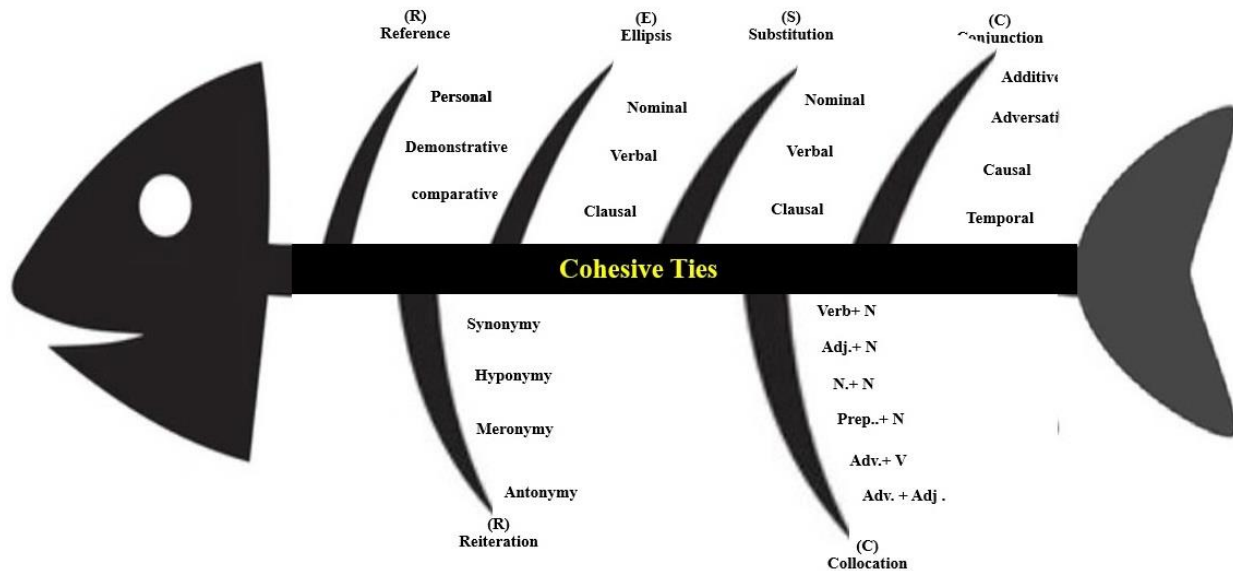


Figure 2: Cohesive Ties on the Fishbone Diagram

In order to effectively teach cohesive ties using a Fishbone Diagram and help students visualize how these ties work together in writing and speaking, we begin by introducing the Fishbone Diagram concept. Then, utilizing the board and data projector, we draw the diagram. The central spine is labeled “Cohesive Ties,” with the primary categories represented as the “bones” of the diagram, as depicted in Figure (2). Each “bone” is further broken down into specific cohesive ties. After explaining each category, students are encouraged to provide their own examples, followed by exercises like group work, matching activities, sentence rewriting, substitution challenges, and fill- in- the- blanks tasks to practice and reinforce their understanding.

3. Review of Related Studies

Several investigations are undertaken to explore the effect of the Fishbone Diagram on improving learners’ skills. Those researchers used the diagram as a tool to mainly improve the writing ability. The current study differs from them in that it tries to use the fishbone tool as an instigator that assists learners to detect, identify and understand the cohesive ties that are used in

any text. The aim is to grasp the whole text by considering these ties. Below, one can see some of the studies that have dealt with Fishbone Diagram.

Arunkumar and Gnanaprakasam' study (2018) examined the inadequate academic progress in secondary schools across India. Having more than one problem in mind about the academic performance at schools, the researchers used the Fishbone Diagram to categorize the possible causes behind the poor performance. Each problem has been addressed by asking detailed questions which, in turn, helped to identify the root causes of the problem. With the aid of Fishbone Diagram, identifying the causes and organizing them under each category (problem) has prioritized the causes according to their significance. For example, causes associated with *procedures* and *people* can be prioritized, making it easier to notice improvement in academic performance. *Policy* and *facility*- related causes, on the other hand, can take longer time to resolve as changes in procedures and facilities like buildings might not be made quickly. The study concluded that categorizing causes using tools like Fishbone Diagram enable schools to attain continuous progress in quality. Identifying the significant causes allows schools to focus on the causes that significantly affect academic performance.

Another study by Razoqey, Razoqey and Yahya in (2019) has investigated how the Ishikawa strategy can improve critical thinking skills in the writings of Iraqi EFL College Students. The researchers investigated 103 third- year students in the English Department of the College of Basic Education/ University of Diyala. The sample was arranged such that the experimental group consisted of 52 students, while the control group had 51 students. After 10 weeks of intensive training for the experimental group on the implementation of the fishbone strategy, all the students have been submitted to the posttest. The researchers concluded from their study that the experimental group showed a high proficiency level (8.164) over the control group (4.813). Hence, the Ishikawa diagram boosts students' critical thinking abilities capabilities in text production and offers them opportunities to actively enhance their abilities, empowering them to find, gather, examine, critique and apply information effectively across multiple contexts.

Kasim, Erdiana, and Aulia conducted a study in (2021) that is entitled "The Use of Fishbone Diagram Technique to Improve Students' Writing Ability". They tried to investigate the results of different studies conducted on this topic and check their results. Having the studies of Ardianto (2019), Mahsunah and Durotun (2018), Al-Khataybeh (2018), Apriliya and Putri

(2018), Razoqey and Yahya (2019), Safitri and Nanda (2016) as their sample data, the researchers read the articles deeply, reviewed them as well as paraphrased and elaborated the main points in each study. After examining these studies, Kasim *et al.* (2021) found that all those researchers agreed that the Fishbone Diagram can upgrade students' writing proficiency and that applying the Fishbone Diagram technique in writing instruction will duly enable students to get better results.

As has been mentioned at the beginning of this section many studies have been conducted to implement the Fishbone Diagram in their methodology, however, only these three studies have been mentioned here since they are of different types. The aim is to show the readers that the Fishbone Diagram can be used in different ways. For example, it is used to examine problems and their causes in whatever field as in study (1); it can also be used to improve students' writing (or any other) skills as in study (2); and it can be used to analyze whatever data to check their findings and conclusions without having any specific data to analyze as in study (3). The current study aims to analyze students' performance on the aspect of cohesive ties so as to check the efficacy of implementing the Fishbone Diagram in teaching and how such a diagram (with its qualities) facilitates the process of learning.

4. Research Methodology

4.1 Research Approach and Design

Considering the nature of the research hypotheses and the subject being taught, this research employed a quantitative approach which primarily based on the collection and analysis of numerical and statistical data to adequately explain variables, Gay, Mills, and Airasian, (2012). This type of research method can be used for descriptive, correlational and experimental research. The present study uses it for experimental research which is regarded as “the only type of research that can test hypotheses to establish cause- effect relations.” (ibid:250). It, therefore, allows the research to be conducted in an objective manner through which “precision is maximized and specific conclusions can be drawn regarding the hypothesis statement” (Gda, 2022).

In the literature, three main types of experimental design are differentiated: pre- experimental design, true experimental design and quasi (also named in-situ or field) experimental design. Each of these designs has its own features and types (Jha, 2024, Plattfaut, 2014). In respect to the quasi-experimental two group pretest- posttest design implemented in this study; the investigation does not depend on participants' random distribution to various groups. Rather, it relies on pre- existing conditions to establish the groups. This, of course, limits distortion and verifies the equivalence of the assigned groups. The study was implemented in the English Department, College of Languages, University of Sulaimani in the academic year (2023-2024).

4.2 Sampling

A total of 60 fourth- year students were selected to take part in the research. The sample was divided into two groups: An experimental group (n=30) that is taught using the Fishbone Diagram and a control group (no- 30) that receives traditional lecture- based instruction. Pretest (prior to the treatment) and posttest (afterward) are administrated to both groups. The pretest assesses their existing knowledge of cohesive ties and the posttest gauges any changes induced by the intervention. The pretest was delivered at the first time before applying the treatment in both groups. Then, the experimental group received instruction using the Fishbone Diagram while the control group was instructed the same subject conventionally. Following the instruction, the students of both groups were given a posttest. Their pre- and post- treatment scores are compared to assess the treatment's impact and determine whether the assigned intervention results in considerable progress in students' use of cohesive ties.

4.3 Research Instrument

As a quasi-experimental study, a set of tests was employed as the data collection tool due to its reliability, validity and feasibility. A test is defined as "a set of stimuli presented to individual in order to elicit responses on the basis of which a numerical score can be assigned," Ary *et al.* (2010:201). The testing approach is typically divided into two main types: pretest and posttest. In this study, both were given to the experimental and control groups to assess the impact of the intervention. Both groups underwent a pretest, treatment and a posttest. The experimental group has been taught by the Fishbone Diagram while the control group has received instruction in the

usual way without applying the visual diagram. The procedures to conduct this quasi-experimental study were as outlined below:

1. Administrating a pretest to both groups to measure the students' performance in using cohesive ties.
2. Subsequently, the groups undergoing the designated treatment sessions where the experimental group instructed by using the Fishbone Diagram and the control group using traditional lectures.
3. Following the treatment period, a posttest was administrated to both groups to measure the students' performance in using cohesive ties to explore the impact of the intervention.

The pretest was conducted to assess students' initial performance in using cohesive ties prior to the intervention while the posttest administrated to determine whether their performance enhanced following the treatment. The tests were divided into two questions: one objective question (consisting of 15 multiple choice items) and one subjective question (comprising 5 items). The integration of these two essential question types helps to fully assess the sample's understanding and ability to use cohesive ties.

4.4 Instrument Validity and Reliability

4.4.1 Validity

An essential consideration for any effective instrument is its validity which, by definition, pertains to how accurately a measurement instrument checks what is designed to assess, Anastasi and Urbina (1997). To achieve valid tests, the researchers submitted the tests to 5 experts for review and feedback. Eighty percent of the tests were confirmed, thereby allowing for a comprehensive evaluation of the target construct with greater accuracy and convenience.

4.4.2 Reliability

As an integral component of any evaluation, the reliability of the measuring tool in the current study is crucial for numerous reasons, such as ensuring the overall caliber of the research, fostering consistent results and sustaining the consistency of the conclusions reached. Reliability coefficient generally ranges between '0-1' where 0 signifies 'no reliability' and 1 signifies 'full reliability'. The higher the test's reliability, the more the coefficient approaches 1.

The reliability of the present study's test is ensured using the test- retest method. It involves administrating the same test twice to the same group of participants under consistent testing conditions, with a fifteen- day interval between the two administrations. Then, the test scores from both instances were compared employing Pearson- product- Moment Correlation Formula to check out the stability of the results over time. Computing the correlation between two sets of scores is vital in establishing that the test precisely checks the intended construct. Twenty students, who were not included in the main sample, participated in this process. The analysis demonstrated a reliability coefficient of 0.87, confirming the test's reliability and credibility for implementation.

4.5 Data Analysis Techniques

Once the necessary quantitative data was collected, the researchers proceeded to data analysis by employing SPSS statistical analysis software.

5. Discussion of the Results

The data presentation and discussion are organized in accordance with the research hypotheses that were developed.

Pertaining to the results of the first hypothesis, which proposes that “The pre- and posttest means of the control group studying the subject conventionally show no statistically detectable difference at the 0.05 significance level,” after using the statistical calculation of t- Test between the mean results of pre- and post- tests of the control group, the results are as follows:

Table 1: The Control Groups' Pretest and Posttest Means, Standard Deviations and t-Statistic and t- Table Values

| Group | Test | Sample Size | Mean | Mean Differences | Standard Deviation | Degree of Freedom (df) | t- Value | | Significance Level (0.05) |
|---------|----------|-------------|-------|------------------|--------------------|------------------------|--------------|----------|---------------------------|
| | | | | | | | t- Statistic | t- Table | |
| Control | pretest | 30 | 18.33 | 0.5 | 5.01 | 29 | 1.25 | 2 | There is no significant |
| | posttest | | 18.86 | | 5.28 | | | | |

| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--------------------|
| | | | | | | | | | difference. |
|--|--|--|--|--|--|--|--|--|--------------------|

Drawing from the preceding table, the calculated t- statistic is 1.25 which is smaller than the t- table of 2 at the significance level of 0.05 with the degree of freedom of 29. The mean score of the posttest of the control group 18.86 is remarkably higher than the control group's pretest 18.33. Although the posttest's mean is relatively high but it could not cause significant difference in the value of calculated t- statistic. Hence, there is no substantial difference between the pre- and posttest scores. Based on that, the first hypothesis holds true: The pre- and posttest means of the control group studying the subject conventionally show no statistically detectable difference at the 0.05 significance level.

Concerning the results of the second hypothesis, which claims that "The pre- and posttest means of the experimental group studying the subject through the Fishbone Diagram show no statistically detectable difference at the 0.05 significance level," the t-Test statistical calculation between the pre- and posttest means of the experimental group led to the following results:

Table 2: The Experimental Group's Pretest and Posttest Means, Standard Deviations and t- Statistic and t- Table Values

| Group | Test | Sample Size | Mean | Mean Differences | Standard Deviation | Degree of Freedom (df) | t- Value | | Significance Level (0.05) |
|--------------|----------|-------------|-------|------------------|--------------------|------------------------|--------------|----------|----------------------------------|
| | | | | | | | t- Statistic | t- Table | |
| Experimental | pretest | 30 | 18.33 | 0.5 | 4.34 | 29 | 3.44 | 2 | There is significant difference. |
| | posttest | | 23.10 | | 4.21 | | | | |

Consistent with the above table, the calculated t- statistic is 3.44 which exceeds the t- table value of 2 at a 0.05 level of statistical significance with 29 degrees of freedom. The experimental group's mean posttest score of the experiment of 23.10 is significantly greater than the pretest score of 18.33, establishing a considerable variation in favor of the posttest results. This indicates statistically significant evidence against the second null hypothesis, thereby prompting the

development of a new alternative hypothesis that declares a marked contrast benefiting the posttest scores.

In reference to the results of the third hypothesis, which posits that “The posttest means of the control group and experimental group show no statistically detectable difference at the 0.05 significance level,” after using the statistical calculation of t-Test between the results of both groups, the results are as depicted in Table (3):

Table 3: Statistical Analysis of Means, Standard Deviations, t- Statistic and t- Table Values for Both Experimental and Control Groups

| Group | Sample Size | Mean | Standard Deviation | Degree of Freedom (df) | t- Value | | Significance Level (0.05) |
|--------------|-------------|-------|--------------------|------------------------|--------------|----------|----------------------------------|
| | | | | | t- Statistic | t- Table | |
| Experimental | 30 | 29.41 | 5.18 | 58 | 3.78 | 2 | There is significant difference. |
| Control | 30 | 26.77 | 5.73 | | | | |

The results show that the experimental group had a mean score of 29.41 with a standard deviation of 5.18 while the control group had a mean score of 26.77 with a standard deviation of 5.73. The calculated t- statistic was 3.78, which exceeds the tabulated value of 2 at a 0.05 level of significance.

As the above table indicates, the calculated t- statistic is 3.78 which is greater than the t- table of 2 at the 0.05 level with the degree of freedom of 58. The mean score of the experimental group 29.41 is significantly higher than that of the control group 26.77. The fact shows that there is statistically significant difference in favor of the experimental group in the posttest results. The rise in the mean score from 26.77 to 29.41 attributes to the effectiveness of the intervention in improving the participants’ performance in using cohesive ties. Following this, the third null hypothesis is refuted, leading to propose an alternative hypothesis signifying a notable difference favoring the posttest scores.

The results of the hypotheses testing demonstrate that implementing the Fishbone Diagram in teaching cohesive ties significantly improved students' understanding and use of cohesive ties in their writing. Compared to the control group, the experimental group could develop a more analytical perspective of how cohesion functions in text structure.

6. Conclusion

This study examines the impact of the Fishbone Diagram in augmenting students' proficiency in applying cohesive ties. The results expose that the implementation of the Fishbone Diagram has led to a substantial improvement in the use of cohesive ties. Students who received Fishbone-based instruction outperformed those who received traditional instruction. By visually representing how they function within sentences and paragraphs, this graphical tool makes learning cohesive ties more dynamic and stimulating. English instructors are, therefore, encouraged to include this and other similar graphical tools into their teaching strategies to stimulate structure and organization, expedite practice and build students' comprehensive understanding of cohesive ties.

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