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A Comparison of Reading Strategies Among Spanish Speaking University Students in Different Programs of English for Specific Purposes Based on An Indeterminate Likert Scale

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Abstract. This study examines the relationships of reading strategies among different English for Specific Purposes (ESP) programs. Ninety-seven students in four ESP programs in Ecuador were surveyed regarding their reading strategies. The results found that there were not significant differences among the four strategies. These findings were discussed regarding whether differences in reading strategies could potentially influence teaching effectiveness, learning outcomes, and English language applications. The survey was administered to a random sample obtained from four Ecuadorian universities for 97 ESP students. For the survey, we applied an Indeterminate Likert Scale. Unlike the classic Likert Scale, the indeterminate variant asks the respondent to express a degree of measurement regarding their opinions for each of the elements of satisfaction, dissatisfaction, and neutrality. This allows capturing the opinion of the interviewee in the most reliable way possible, obtaining more accuracy than in the crisp Likert Scale. These data were statistically processed with the help of a Chi-square test for contingency tables.

Keywords: English for Specific Purposes (ESP), Reading Strategies, Indeterminate Likert Scale, triple refined indeterminate neutrosophic set (TRINS), refined neutrosophic set, Chi-Square test.

1 Introduction

Different reading strategies have been researched with many different groups of participants, but no known research has evaluated reading strategies employed by different groups of English for Specific Purposes (ESP) students. Differences in reading strategies could potentially influence teaching effectiveness, learning outcomes, and English language applications. Many studies have been conducted about ESP and specifically to what students need to do in their vocations or jobs. Likewise, many studies have focused on reading strategies, however, no known studies have compared reading strategies among Spanish-speaking students in different programs of ESP.

Therefore, the key research question is: Do Spanish-speaking university students in various programs of English for Specific Purposes differ in their reading strategies and if there are any differences in their reading strategies, what are those specific differences? The answer to this research question is important because such information could be valuable in helping such specialized programs to be more effective and efficient in teaching students specific skills and for helping teachers to be more precise and effective in their teaching. Additionally, this area of inquiry is also significant because it could help students to learn more efficiently and to use reading concepts and strategies more effectively in the area of applied English for Specific Purposes.

Research has found that students often vary in the reading strategies they use to learn. The key question is whether such variance is also occurring with ESP students, independent of their knowledge of general English. Reading is the ability or activity of reading materials. This activity

can be performed silently or audibly verbalized. Reading is a mechanism for assisting in the transmission of information immediately and over time. Several studies have attempted to provide more precise measures of reading strategy activities. This research includes need assessment and evaluation. Some of them found that such activities produce better results and outcomes. The research of some authors focused on real-world applications with police officers and with physicians while others had similar findings with bankers. Research also found similar results with second-year medical students and ESP learning, while others found the same outcomes with aerospace engineers.

In regards to metacognition and reading strategies, we note that monitoring and awareness of comprehension processes are two key elements of skilled reading. Such awareness and monitoring processes are often referred to as metacognition in the literature, which can be thought of as the knowledge of the readers' cognition about reading and the self-control mechanisms they exercise when monitoring and regulating text comprehension.

From the perspective of metacognition, researchers have attempted to evaluate differences between unskilled readers and skilled readers in the area of reading comprehension. Thus, reading strategies have received a large amount of research attention regarding their effects on reading comprehension and regarding the most effective reading strategies.

In an attempt to find the most effective reading strategies, many researchers have developed their own comprehensive reading strategies instruments to use when evaluating this aspect in students. In addition, such research has provided teacher educators and practicing teachers with practical suggestions for helping struggling readers increase their awareness and use of reading strategies while reading. However, there are relatively few instruments to measure students' awareness and perceived use of reading strategies while reading for academic purposes. This assertion leads us to think that there is limited available research because of the shortage of standardized reading strategies surveys and because of the large investments of time and money necessary to evaluate the validity and reliability of such instruments.

ESP relates directly to what students need to do in their vocations or jobs. ESP is important because it helps to increase vocational learning and training throughout the world. As globalization is spreading, it is stated that knowledge of English has become the greatest need. It is not just the politician, the business leader, and the academic professor who needs to speak to international colleagues and clients: It is also the hotel receptionist, the nurse, and the site fireman. ESP can be, but not necessarily be, concerned with a specific discipline and it does not have to be focused on a specific ability range or particular age group. Rather, ESP can be viewed as an approach to teaching.

Two distinct perspectives regarding language for specific purposes are indicated. One perspective suggests that English has a common foundation of words that all learners should know. The other perspective suggests that all language is already for specific purposes, and therefore, specialization must begin at an early age.

Whether specialization begins early or late in the life of an individual, there are numerous methods of identifying vocabulary for specific purposes. However, there is a lack of a systematic way of identifying vocabulary for specific purposes. The lack of such a systematic methodology could have caused variations in outcomes. Therefore, these variations may have caused many researchers to produce very different and unique conclusions in their research findings.

In terms of theoretical background, some researchers have suggested that ESP is just technical vocabulary. Other researchers have suggested that ESP is more than technical vocabulary and that it is important to understand that vocabulary is a necessary part of any ESP course. Partly this is because specific technical words are used to describe particular features of the vocabulary specialization and that teaching and vocabulary development are ongoing processes. These concerns are important to this particular research study because much of the study of ESP is based on definitions of technical words and vocabulary, which may be perceived to be perceptually different in different countries and cultures.

In this study, we carried out a comparison between the results of the different universities. To do this we surveyed the selected students, where each of them expressed their opinion on an

Indeterminate Likert Scale [1-3]. Each element is based on a triple refined indeterminate neutrosophic set (TRINS) where instead of the triple of elements that are part of a Single-Valued Neutrosophic Set, two more elements are added, which are: "Indeterminacy leaning towards negative membership" and "Indeterminacy leaning towards positive membership". The respondent must assign a value to each of these elements, according to their feeling about each element of the scale. This way of surveying is more complex, however, more accurate because it allows capturing contradictory feelings, but which are more faithful to what the respondent feels about what is being asked.

TRINS are values that are part of Smarandache's Refined Neutrosophic Sets theory, where each of the elements of the original triple, which are truthfulness, indeterminacy, and falseness, can be divided into more specific components to obtain more accuracy in the results [4-12]. In TRINS, the indeterminacy element is partitioned into three elements, two more in addition to indeterminacy. This allows two more types of indeterminacy to be taken into account, which makes the study carried out more exhaustive.

The results obtained are classified into several nominal results and finally placed in contingency tables to study the independence of the relationship between different aspects, with the help of a Chi-square test.

Thus, to carry out the study, in section 2 of Materials and Methods, we recall the basic notions of Indeterminate Likert Scales. Section 3 contains the results obtained from the study. We finish with the conclusions of the work.

2 Materials and Methods

In this section, we recall the basic notions of the Indeterminate Likert Scale.

Definition 1 ([4-12]). The *Single-Valued Neutrosophic Set* (SVNS) N over U is $A = \{< x; T_A(x), I_A(x), F_A(x) > : x \in U\}$, where $T_A: U \to [0,1]$, $I_A: U \to [0,1]$, and $F_A: U \to [0,1]$, $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

Definition 2 ([4-12]). The *refined neutrosophic logic* is defined such that: a truth T is divided into several types of truths: $T_1, T_2, \ldots, T_p$, I into various indeterminacies: $I_1, I_2, \ldots, I_r$ and F into various falsities: $F_1, F_2, \ldots, F_s$, where all $p, r, s \geq 1$ are integers, and $p + r + s = n$.

Definition 3 ([13-17]). A *triple refined indeterminate neutrosophic set* (TRINS) A in X is characterized by positive $P_A(x)$, indeterminacy $I_A(x)$, negative $N_A(x)$, positive indeterminacy $I_{P_A}(x)$ and negative indeterminacy $I_{N_A}(x)$ membership functions. Each of them has a weight $w_m \in [0,1]$ associated with it. For each $x \in X$, there are $P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x) \in [0,1]$, $w_P^m(P_A(x)), w_{I_P}^m(I_{P_A}(x)), w_I^m(I_A(x)), w_{I_N}^m(I_{N_A}(x)), w_N^m(N_A(x)) \in [0,1]$ and $0 \leq P_A(x) + I_{P_A}(x) + I_A(x) + I_{N_A}(x)(x) + N_A(x) \leq 5$. Therefore, a TRINS A can be represented by $A = \{\langle x; P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x)\rangle | x \in X\}$.

Let A and B be two TRINS in a finite universe of discourse, $X = \{x_1, x_2, \ldots, x_n\}$, which are denoted by:

$A = \{\langle x; P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x)\rangle | x \in X\}$ and $B = \{\langle x; P_B(x), I_{P_B}(x), I_B(x), I_{N_B}(x), N_B(x)\rangle | x \in X\}$,

Where $P_A(x_i), I_{P_A}(x_i), I_A(x_i), I_{N_A}(x_i), N_A(x_i), P_B(x_i), I_{P_B}(x_i), I_B(x_i), I_{N_B}(x_i), N_B(x_i) \in [0,1]$, for every $x_i \in X$. Let w_i (i = 1,2,...,n) be the weight of an element x_i (i = 1,2,...,n), with $w_i \geq 0$ (i = 1,2,...,n) and $\sum_{i=1}^{n} w_i = 1$.

The generalized TRINS weighted distance is ([13-17]):

$$d_\lambda(A,B) = \left\{\frac{1}{5}\sum_{i=1}^{n} w_i \left[|P_A(x_i) - P_B(x_i)|^\lambda + |I_{P_A}(x_i) - I_{P_B}(x_i)|^\lambda + |I_A(x_i) - I_B(x_i)|^\lambda + |I_{N_A}(x_i) - I_{N_B}(x_i)|^\lambda + |N_A(x_i) - N_B(x_i)|^\lambda\right]\right\}^{1/\lambda} \quad (1)$$

Where $\lambda > 0$.

The Indeterminate Likert Scale is formed by the following five elements:

- Negative membership,
- Indeterminacy leaning towards negative membership,
- Indeterminate membership,
- Indeterminacy leaning towards positive membership,
- Positive membership.

These values substitute the classical Likert scale with values:

- Strongly disagree,
- Disagree,
- Neither agree or disagree,
- Agree,
- Strongly agree.

Respondents are asked to give their opinion on a scale of 0-5 about their agreement in each of the possible degrees, which are "Strongly disagree", "Disagree", "Neutral", "Agree", "Strongly agree", for this, they were provided with a visual scale like the one shown in Figure 1.

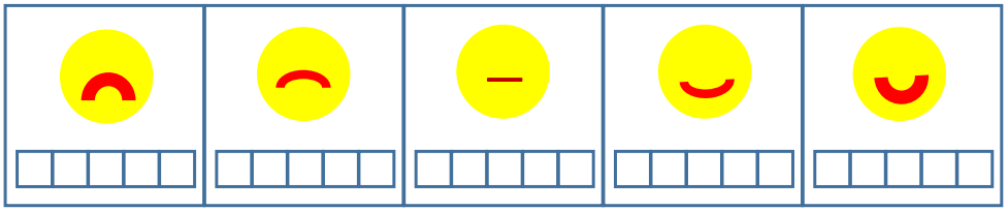

Figure 1. Graphic representation of the proposed Indeterminate Likert Scale. Source: [18].

3 Results of the Study

This research study examines the relationships of reading strategies among four different programs of English for Specific Purposes. 97 students enrolled in four English for Specific Purposes (ESP) programs in two public universities and two private universities in Ecuador were surveyed regarding their reading strategies.

There were a total of 65 items on the surveys completed by the 97 volunteer students in four reading strategy categories. These four categories were:

1. Organizing Reading and Planning, with the number of survey items to be 7.
2. Actions Undertaken While Reading, with the number of survey items to be 18.
3. Evaluation after Reading, with the number of survey items to be 11.
4. Dealing with Problems, with the number of survey items to be 10.

The question to answer is: Are there significant statistical differences between the four ESP groups? Table 1 summarizes the number of students for every university.

Table 1. Summary of Participants.

Summary of Participants		
A public university in Guayaquil	17	18%
A private university in Guayaquil	23	24%
A private university in Quito	32	33%
A public university in Riobamba	25	26%
TOTAL:	97	100%

A total of ninety-seven (97) ESP students were surveyed. Here are the numbers of students responding at each university: 17 surveys at a public university in Guayaquil, representing 18% of respondents, 23 surveys at a private university in Guayaquil, representing 24% of respondents, 32

surveys at a private university in Quito, representing 33% of respondents, and 25 surveys at a public university in Riobamba representing 26% of respondents.

The procedure to be followed to process the survey data was as follows:

1. Students filled out each item of the survey according to the Indeterminate Likert Scale, where they had to specify a degree of satisfaction, dissatisfaction, or neutrality, out of 5 points for each of the 5 elements, as shown in the example in Figure 2.

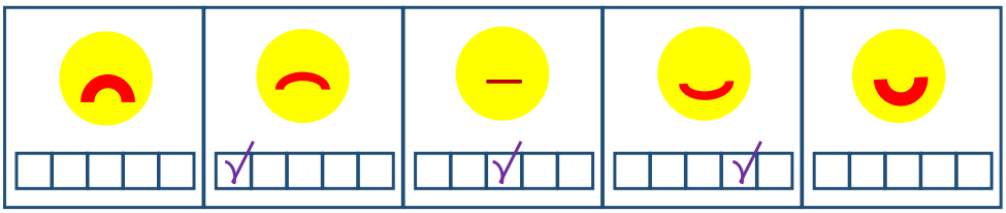

Figure 2. Example of the graphic use of the proposed Indeterminate Likert Scale. Source: [18].

2. They are aggregated to using the arithmetic mean of the TRINS corresponding to each student for each aspect to be measured, and normalized when dividing by 5. This results in a value $\bar{x}_{ij}$ that corresponds to the evaluation of the i-th student concerning the j-th aspect (strategy), where $i \in \{1, 2, \dots, 97\}$, $j \in \{1, 2,3,4\}$.

The strategies identified with the j indices are:

1. Organizing reading and planning,
2. Actions undertaken while reading,
3. Evaluation after reading,
4. Dealing with problems.

3. Let the elements of the following scale be based on TRINS associated with linguistic values, see Table 2:

Table 2. Linguistic scale with associated TRINS ideal values.

Linguistic Value	TRINS Associated
Strongly disagree (V_{-2})	$(0, 0,0,0,1)$
Disagree (V_{-1})	$(0, 0,0,1,0)$
Neutral (V_0)	$(0, 0,1,0,0)$
Agree (V_1)	$(0, 1,0,0,0)$
Strongly agree (V_2)	$(1, 0,0,0,0)$

4. For each $\bar{x}_{ij}$ we calculate the minimum $A_{ij} = min_{k\in\{-2,-1,0,1,2\}}\{d_2(\bar{x}_{ij}, V_k)\}$, using distance Equation 1. Thus, the nominal value of the evaluation of the i-th student for the j-th aspect $arg\ A_{ij}$ is taken as the linguistic value associated with it.

5. With these nominal values, the study is carried out using Contingency Tables and applying the Chi-square test as indicated below.

Below we show the results of applying the above procedure:

The use of the Chi-Square test is a method for evaluating possible statistical differences among groups. The null hypothesis is:

H_0: There is no independence between the two populations,

H_a: There is independence between the two populations.

For the rows, the five possible answers were A_1 (strongly disagree), A_2 (disagree), A_3 (neutral), A_4 (agree), and A_5 (strongly agree).

For this study, all responses to the survey from the four question categories were used. These responses are B_1 (Organizing reading and planning), B_2 (Actions undertaken while reading), B_3 (Evaluating after reading), and B_4 (Dealing with problems).

For the columns, the four elements are C_1 (A Public University in Guayaquil), C_2 (A Private University

in Quito), C_3 (A Private University in Guayaquil), and C_4 (A Public University in Riobamba).

This study presented variables called First Language (Spanish) and Second Language (English) and the responses were calculated using a separate contingency table. Those results are presented below in Tables 3-10.

Table 3. Contingency table for First Language – First Category

FIRST LANGUAGE				
FIRST CATEGORY: ORGANISING READING AND PLANNING				
	C_1	C_2	C_3	C_4
A_1	0	2	0	0
A_2	1	3	3	2
A_3	2	10	4	4
A_4	6	12	6	8
A_5	8	5	10	11

Table 4. Contingency table for Second Language – First Category

SECOND LANGUAGE				
FIRST CATEGORY: ORGANISING READING AND PLANNING				
	C_1	C_2	C_3	C_4
A_1	0	3	1	2
A_2	2	6	4	7
A_3	3	10	10	8
A_4	6	9	4	5
A_5	6	4	4	3

Table 5. Contingency table for First Language – Second Category

FIRST LANGUAGE				
SECOND CATEGORY: ACTIONS UNDERTAKEN WHILE READING				
	C_1	C_2	C_3	C_4
A_1	0	1	1	1
A_2	1	5	3	2
A_3	4	10	5	7
A_4	7	10	7	8
A_5	5	6	7	7

Table 6. Contingency table for Second Language – Second Category

SECOND LANGUAGE				
SECOND CATEGORY: ACTIONS UNDERTAKEN WHILE READING				
	C_1	C_2	C_3	C_4
A_1	1	2	1	2
A_2	2	7	4	6

SECOND LANGUAGE				
SECOND CATEGORY: ACTIONS UNDERTAKEN WHILE READING				
A_3	5	11	9	9
A_4	6	8	5	5
A_5	3	4	4	3

Table 7. Contingency table for First Language – Third Category

FIRST LANGUAGE				
THIRD CATEGORY: EVALUATION AFTER READING				
	C_1	**C_2**	**C_3**	**C_4**
A_1	0	2	1	1
A_2	2	6	2	1
A_3	4	10	4	4
A_4	5	10	7	10
A_5	6	4	9	9

Table 8. Contingency table for Second Language – Third Category

SECOND LANGUAGE				
THIRD CATEGORY: EVALUATION AFTER READING				
	C_1	**C_2**	**C_3**	**C_4**
A_1	0	4	0	2
A_2	2	7	3	5
A_3	5	11	10	11
A_4	6	7	5	4
A_5	4	3	5	3

Table 9. Contingency table for First Language – Fourth Category

FIRST LANGUAGE				
FOURTH CATEGORY: DEALING WITH PROBLEMS				
	C_1	**C_2**	**C_3**	**C_4**
A_1	0	1	0	1
A_2	1	5	2	1
A_3	3	10	4	5
A_4	6	12	7	9
A_5	7	4	10	9

Table 10. Contingency table for Second Language – Fourth Category

SECOND LANGUAGE				
FOURTH CATEGORY: DEALING WITH PROBLEMS				
	C_1	C_2	C_3	C_4
A_1	0	2	1	2
A_2	2	8	3	4
A_3	4	11	10	9
A_4	6	9	5	7
A_5	5	2	4	3

The results of applying the Chi-square test to the above contingency tables yielded p-values of 0.35532, 0.52974, 0.98541, 0.99568, 0.99568, 0.57146, 0.52244, and 0.69014, respectively. All of these numbers are greater than 0.05, therefore the dependence hypothesis is rejected.

Conclusion

English for Specific Purposes (ESP) is an English learning paradigm that can be very useful for Ecuadorian university students to master this language. In this work we evaluate four reading strategies that are used in ESP by students, these are: "Organizing reading and planning", "Actions undertaken while reading", "Evaluation after reading", and "Dealing with problems". Students from four Ecuadorian universities were selected for a sample of 97 evaluated. They were asked to fill out a questionnaire that evaluated each of the previous points. An Indeterminate Likert Scale was used and processed to apply a Chi-square test in contingency tables, where the evaluation given by the students to the university was compared for each of the strategies and Spanish and English. It was concluded that the results obtained are independent of the university; therefore ESP has the same effect for all higher education centers evaluated.

The best results were obtained for the strategies regarding the first language, with approximately 68, 59, 62, and 66 percentages for "Agree" and "Strongly agree", respectively. However, the same strategies for the English language gave lower percentages of satisfaction 42, 39, 38, and 42, respectively. Nevertheless, when these last percentages are added to the obtained percentages for "Neutral" the results exceed 50%. In general, there is no significant difference between the opinions of the students for each strategy of the same language.

The use of the Indeterminate Likert Scale allowed us to capture students' opinions more reliably, including the contradictions that may exist in opinions. This scale allows for feelings and conflicting opinions that are part of being human.

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