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The Effects of Implementing the Strategy of Semantic Feature Analysis (SFA) in Promoting Vocabulary in School-Aged Portuguese Children in Inclusive Schools

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Abstract: Background: The purpose of this study was to apply and analyze the impact of the semantic feature analysis (SFA) strategy on vocabulary development and comprehension of texts and theoretical concepts in Portuguese school-age students with and without special educational needs (SEN) attending inclusive schools. Method: The research design was quasi-experimental. The SFA was administered in ten sessions of approximately 60 min each. The sample was a convenience sample and consisted of selecting three classes in each school: (i) in the first cycle of basic education, 65 students were divided into a control group, an experimental group and a structured teaching group; (ii) in the second cycle of basic education, 55 students were divided into an experimental group, an online virtual school and a control group. Results: (1) The SFA strategy is motivating, appealing, inexpensive, flexible and easy to implement; (2) learning the SFA strategy is easy and can be successfully taught in any classroom; (3) the performance of the students assigned to the experimental groups was significantly higher in both cycles compared to all the other groups; (4) the effect sizes were 0.87 in the first cycle and 0.88 in the second cycle. Conclusion: The SFA strategy effectively promotes the development of vocabulary, concept knowledge and text comprehension in school-age children, being more effective than regular teaching.

Keywords: semantics; teaching and learning strategies; semantic feature analysis (SFA); first and second cycles of basic education; inclusive schools

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1. Introduction

The acquisition and mastery of language have been topics of interest since ancient times due to the universality of language among humans [1,2]. Language is a fundamental communication system that includes symbols and rules for appropriate use [3]. It plays a crucial role in various aspects of life, such as school readiness, academic achievement, social skills, overall well-being and the capabilities of individuals and populations [4]. Through language, individuals can express themselves, share ideas, cooperate and symbolically represent reality [5–8]. It is important to note that factors such as language proficiency have been found to be positively related to vocabulary acquisition [9,10]. Therefore, it is essential to recognize the importance of the role of language, especially vocabulary, in the development of all types of learning, including school learning, in order to correct errors, guarantee better performance and stimulate effective growth [11–13].

Vocabulary knowledge is not only essential for social interaction but also a key factor in educational achievement [14–16]. There is a strong correlation between vocabulary knowledge and reading comprehension [17,18]. Students whose vocabulary knowledge is

low in the early years of schooling tend to have the most difficulty with reading comprehension as they progress through school, especially from the third year [16], a stage when texts begin to contain more abstract, subject-specific words that many students do not know [19]. It has been shown that the greater the number of difficult words in a text, the more difficult it is to understand. Therefore, effective reading comprehension requires an effective and deep knowledge of vocabulary and an understanding of most of the words that make up a text [20]. To this end, simply looking up definitions of words in the dictionary is not enough, as this alone will not contribute to a sufficient and effective increase in students' reading comprehension levels, as many of the words that appear in the definitions will end up being even more difficult to understand than the one they are looking for [21]. It is therefore crucial to support children's lexical and conceptual development through the implementation of research-based strategies [19,22].

Comprehension involves relating the previously acquired knowledge and experience stored in memory to the unfamiliar words contained in a text, i.e., the acquisition of new words and concepts must start from concepts that the learner has already mastered [23].

Therefore, it is important for teachers to implement the use of effective reading comprehension strategies and to measure their success, while at the same time, students need to check their use in order to become aware of how they are being used. At the same time, students need to monitor their use in order to become aware of the cognitive processes they are engaging in [24].

It is therefore extremely important to introduce research-based vocabulary comprehension strategies to students with and without special educational needs (SEN) in the classroom so that they become aware of the usefulness of a particular strategy before, during or after reading, thereby significantly reinforcing and increasing their interest and autonomy in learning theoretical concepts. Many of the commonly used strategies and approaches to teaching vocabulary to students with and without special educational needs (SEN) are not very effective in building the level of word knowledge that students need, such as (1) copying dictionary definitions; (2) providing word definitions for memorization; (3) explaining difficult words before silent reading [22]. Therefore, authors suggest that vocabulary should be taught through productive and effective approaches that optimize the learning of words and their meanings, such as (1) contextual analysis; (2) morphemic analysis; (3) semantic mapping; (4) generating examples and nonexamples of words; (5) semantic feature analysis (SFA) [22], which will be presented in more detail below.

In Portugal, as in other countries, the prevention of school failure and social exclusion involves effectively promoting the development of oral language since it is an essential tool for mental processes, as it has an undeniable influence on the way we speak, think and communicate [25].

This strategy not only allows students to learn how words relate to other words or unfamiliar concepts but also focuses students' attention on the features and meanings of words that make them unique, thus developing semantic precision. The semantic feature analysis (SFA) strategy has become a versatile and very useful strategy for developing and improving vocabulary and has been one of the most widely used and developed since the 1980s [26]. SFA has been widely and successfully used in vocabulary comprehension learning and oral language development [23]. It is used to increase, refine and reinforce students' vocabulary in a variety of instructional contexts: teaching or reviewing specific words and key concepts from different subject areas, text comprehension (before, during and after reading a text) and activities involving reading and writing texts. There is evidence that SFA is extremely useful for students who struggle with oral language words and concepts that involve complex and abstract ideas, whose implementation in the classroom sometimes begins with a brainstorming session to generate words related to a concept or keyword [27].

Therefore, it was important to carry out this study in Portugal, as in the USA, in order to demonstrate the effectiveness of this strategy in vocabulary development and in understanding theoretical concepts, as it is a strategy that has been widely reported in the

literature due to its enormous effectiveness and contribution to academic success at school age [26].

Semantic feature analysis [23] is one of the pedagogical strategies that has been shown by the most research to be effective in promoting the development of semantic accuracy in reading and writing [18,19,27,28]. It has been used successfully since the 1980s for vocabulary learning and development in a variety of classroom contexts: teaching or reviewing specific words and key concepts in different subjects, text comprehension (before, during and after reading a text) and activities involving reading and writing texts [23]. It also enables students to conceptualize new knowledge and relate it to their previous knowledge by involving them in discussions that stimulate their experiences to gain information about the meaning of words [23]. In this way, students are actively involved in learning the meanings of words, rather than being passive recipients of information, as they infuse new information into prior knowledge and build semantic categories by associating words and concepts [28,29]. As a result, they gain a deeper understanding of the words and consequently a more effective understanding of what they are reading [19].

The SFA strategy allows students to develop semantic precision in their reading and writing. When students look at the completed table, they can see that there are words with identical patterns of pluses (+) and minuses (−) and question marks (?). The class discussion about the table extends their knowledge of the words and helps students to understand that no two words are the same. This discussion component is fundamental to understanding the concepts.

The general procedures for implementing the SFA strategy are as follows [23].

How to implement semantic feature analysis (SFA)?

The implementation of the SFA strategy requires the construction of a double-entry chart (see Figure 1) based on a theme or concept. This is used to organize connections between words and to help analyze the similarities and differences between related concepts [23]. A seven-step process follows:

1. Choose a category: SFA diagrams can be constructed for most categories of words. However, it should be noted that when introducing students to the procedures of this strategy, it is best to choose more concrete and familiar categories, such as tools, animals or fruits. Once students are familiar with the strategy, more abstract topics can be used. The category “animal locomotion” has been chosen to illustrate the SFA procedure (see Figure 1).
2. Listing words related to the category: In the left column of the chart, the teacher writes three or four words that name concepts or objects related to the category. These words should be familiar to the students.
3. Listing and adding features: In the top row of the chart, the teacher writes three or four features that some of the words in the column have in common. The students should then be asked to suggest other features to be added to the table. As the list of features will be quite long for most of the categories, the teacher should enter only some of the features suggested by the students; the rest will be added later.
4. The teacher should guide the students through the chart and ask them to decide whether each word listed on the left has or does not have each of the features entered at the top of the chart. Although not all the features are dichotomous, the plus sign (+) is used to indicate that the word generally or essentially has a feature, while the minus sign (−) is used if it does not. If students are not sure whether a word has a certain feature, they should put a question mark (?), which will later help to focus the discussion. If there is no consensus, students should be guided to consult reference sources to clarify their doubts.
5. Adding more words or features: The teacher should ask the students to suggest other words that fit the category, as well as other features that apply to the listed words, which will be added to the SFA chart. Expanding the chart will help students to increase their vocabulary and develop their categorization skills. The more active students are in choosing the words and features to analyze, the more effective the

strategy will be. In most cases, there may not be enough space or time for students to make further additions to the chart. If this is the case, a time limit should be set, or the number of entries should be limited. Limiting the number of entries in the chart is an excellent way to help students to focus on the most important aspects of a topic.

6. Complete the chart: Students should complete the chart, in groups or individually, adding the plus sign (+), the minus sign (−) or a question mark to each added word/feature. The teacher should encourage students to explain how they have decided whether a particular feature applies to a word. This encourages them to think and helps them to review their prior knowledge as they relate the new information to it. Students should also be encouraged to use reference sources to check their answers.
7. Analyzing and discussing the chart: The teacher should encourage students to look carefully at the completed SFA chart and note the similarities and differences between the words in the category. The teacher should allow the students to discuss this type of comment on the items in the category, guiding them to make generalizations about the words in the category, as well as to see what makes each word unique, as the procedure is most effective when it is the students, not the teacher, who notice the similarities and differences.

Animals locomotion	Terrestrial locomotion	Aquatic locomotion	Aerial locomotion	On the ground, using legs	Toes only support	Foot protected by shell	Rear limbs −2	Wings	Wing membrane	Interdigital membrane	Very short limbs	No limbs	Fins	Pectoral fins	Patagium	Active flight	Gliding flight	Slithering	Walking	Jumping	Running	Swimming
Grasshopper	+	-	+	-	-	-	+	+	-	-	-	-	-	-	+	-	-	-	+	-	-
Frog	+	+	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	+
Bear	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Otter	+	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	+
Sardine	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+
Bat	-	-	+	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-
Rabbit	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Lizard	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-
Deer	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Snake	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
Whale	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+
Gull	+	+	+	+	-	-	-	+	-	+	-	-	-	-	+	-	-	+	-	-	+
Flying fish	-	+	+	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	+
Leopard	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Flying squirrel	+	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	+	-
Pigeon	+	-	+	+	-	-	-	+	-	-	-	-	-	-	+	-	-	+	-	-	-

Figure 1. Example of SFA chart strategy on the concept of animal locomotion.

These seven steps outline the basic procedure of the SFA strategy, and the authors also point out that the lesson can end once the students have analyzed and discussed the complete table, or it could serve as a tool to motivate further exploration and study, as many teachers have found that when students examine the table, they show an interest in learning more about the concepts [23].

Initially, the teacher has an important role in shaping the process by explaining to the students how to analyze the words and concepts through the features, focusing on the different relationships between words [23]. Once the students are familiar with the process, the teacher's role becomes that of a facilitator, merely guiding the analysis, discussion and conclusion of the diagram [8]. As the students become more familiar with the activity, they can play a more active role in planning the organization of the chart and in choosing the words and features to compare [23].

The steps presented are the basic procedure for using the SFA strategy in the classroom. The lesson can end once the students have examined and discussed the complete table, or it can act as a motivational tool for further exploration and study of the topic. Many teachers

have found that when students look at the table, they become interested in learning more about the concepts.

In the first lesson using the SFA strategy, the teacher plays a key role in modeling the process. They should explain to the students that they need to analyze the words or concepts starting from the features, focusing on the different relationships between the words. Once the students are familiar with the process, the teacher takes on a facilitating role, guiding only the discussion, conclusion and analysis of the table. As students become more familiar with the task, they become more active in choosing words and planning and organizing the table.

The aim of this study is to make the achievement of vocabulary acquisition and knowledge practices used in inclusive classrooms more efficient by applying a strategy considered effective in the international literature. No studies of SFA being used in Portuguese classrooms have been found to date. This is the first study on this topic. In Portugal, according to a search in academic databases, there is a lack of studies on the implementation of research-based strategies at school age. The fact that failure in basic education can affect children attending the first levels (specifically, the first and second cycles) motivated this study. In order to contribute to the development of this topic in Portugal, this research study was carried out in the Northern Region of Portugal in several schools selected according to convenience that agreed and gave their consent to participate in this study.

2. Materials and Methods

2.1. Purpose

The purpose of this study is to understand, describe and analyze the impact of implementing the semantic feature analysis (SFA) strategy on the acquisition and development of vocabulary and text comprehension in students with and without special educational needs that attend basic education in inclusive contexts in a quasi-experimental study.

Therefore, the main objectives of this study are:

(1) To adapt the SFA strategy to the European Portuguese school curriculum of the first and second cycles of basic education;
(2) To analyze and compare the performance of students assigned to all groups before and after the implementation of the SFA strategy;
(3) To analyze the impact of the SFA strategy on the students' vocabulary development;
(4) To analyze the impact of the SFA strategy on the students' text comprehension;
(5) To assess the level of satisfaction of the students after the implementation of the SFA strategy;
(6) To assess the level of satisfaction of the teachers after the implementation of the SFA strategy.

2.2. Variables of the Study

Explaining the variables and their relationships is fundamental in this type of research design [30]. The independent variable is identified as the dimension or characteristic that the researcher intentionally manipulates to know its effect on another variable—the dependent variable [30]. The dependent variable is defined as the characteristic that appears or changes when the independent variable is applied, eliminated or changed [30].

Thus, in this study, the independent variable was the teaching of the SFA strategy, and the dependent variable was the students' performance on the Knowledge Verification Checklist (administered in the pretest and post-test). The Knowledge Verification Checklist was developed by the authors of this paper to collect data on student performance and is described in detail in the Instruments section below.

2.3. Participants

The sample was one of convenience and consisted of selecting schools at which the first two authors of this text taught. All the directors of the selected schools agreed to participate in the study and gave their formal authorization. Both authors teach in the first and second

cycles of basic education in the north of Portugal. The sampling procedures involved the selection of three classes from each cycle in the schools where the first two authors taught, including students with and without special educational needs (SEN). These two cycles were chosen because they are two levels of education that are very important to academic achievement in language, writing and reading, which are important foundations for educational success. The sample consisted of a total of 120 students, including typically developing students and students with special educational needs. A total of 65 students from the first cycle and 55 students from the second cycle of basic education who attended inclusive schools in the North Region of Portugal were chosen.

The students in the first cycle of basic education, aged between 7 and 9 years, were divided into three groups: a control group (CG), a structured teaching group (STG) and an experimental group (EG) using the SFA strategy. In terms of their socio-demographic data, of the 65 first-cycle students, 34 (52.3%) were female, and 31 (47.7%) were male.

In the CG, which consisted of 18 students, the teacher taught vocabulary in the way it is usually taught in mainstream education, i.e., the vocabulary that students are required to learn according to the curriculum and that is included in students' textbooks is taught by memorizing definitions, looking them up in the dictionary and writing sentences in which these words are used.

The STG consisted of 17 students. In this group, the teacher taught the vocabulary studied on the basis of the textbooks and curricula adopted by the school and in accordance with the guidelines given by the researcher, namely that the teacher should use the strategies they considered relevant (e.g., dictionary search, word lists in textbooks).

The EG consisted of 30 students. In this group, the SFA strategy was used to teach vocabulary related to "animals" and text comprehension, always in a classroom context and with a large group. Table 1 presents the participants of the first cycle according to their socio-demographic variables.

Table 1. Distribution of the participants of the first cycle according to socio-demographic variables.

		CG (n = 18)		STG (n = 17)		EG (n = 30)	
		N	%	N	%	N	%
Gender	Male	7	38.9	11	64.7	13	43.3
	Female	11	61.1	6	35.3	17	56.7
Development condition	Typical development	17	94.4	15	88.23	28	93.3
	Special educational needs (SEN)	1	5.6	2	11.76	2	6.6
Age		M = 7.94 (SD = 0.416)		M = 8.18 (SD = 0.393)		M = 8.07 (SD = 0.254)	
Academic qualifications—mother	First cycle of basic education	2	11.1	3	17.6	2	6.7
	Second cycle of basic education	1	5.6	2	11.8	8	26.7
	Third cycle of basic education	2	11.1	7	41.2	9	30.0
	High school degree	9	50.0	5	29.4	9	30.0
	Bachelor	3	16.7	0	0.0	2	6.7
	Master	1	5.6	0	0.0	0	0.0
Academic qualifications—father	First cycle of basic education	3	16.7	1	5.9	5	16.7
	Second cycle of basic education	3	16.7	9	52.9	7	23.3
	Third cycle of basic education	1	5.6	2	11.8	7	23.3
	High school degree	9	50.0	4	23.5	10	33.3
	Bachelor	1	5.6	1	5.9	0	0.0
	Master	1	5.6	0	0.0	1	3.3

The students of the second cycle of basic education, aged between 10 and 13 years, were divided into three groups: the control group (CG), the Online Virtual School group (OVSG) and the experimental group (EG). According to the data collected, of the 55 students of the second cycle, 31 were male (56.4%), and 24 were female (43.6%). The EG was composed of twenty students. The OSVG, composed of nineteen students, was taught through the Online Virtual School, an e-learning platform designed for primary and secondary education, owned by a Portuguese publishing company [31]. On this platform, students watch videos on the topics they are studying and answer a series of questions. In the CG,

composed of sixteen students, the teaching methods used were in line with the teacher's usual teaching. The teacher's main working tools were textbooks, which contained not only formative texts but also some worksheets that the students had to complete after learning about the topic under study. Table 2 shows the participants of the second cycle according to their socio-demographic variables.

Table 2. Distribution of the participants of the second cycle according to socio-demographic variables.

		EG		OVSG		GC	
		N	%	N	%	N	%
Gender	Male	10	50	10	52.6	11	68.8
	Female	10	50	9	47.4	5	31.2
Development condition	Typical development	17	85	17	89.5	14	87.5
	Special educational needs	3	15	2	10.5	2	12.5
Age		M = 10.50 (SD = 0.513)		M = 10.37 (SD = 0.597)		M = 10.56 (SD = 0.892)	
Academic qualifications—father	First cycle of basic education	4	20.0	3	15.8	1	6.3
	Second cycle of basic education	7	35.0	2	10.5	2	12.5
	Third cycle of basic education	7	35.0	3	15.8	6	37.5
	High school degree	0	0	6	31.6	4	25.0
	Bachelor	0	0	0	0	1	6.3
	Master	1	5.0	5	26.3	2	12.5
	No father	1	5.0	0	0	0	0
Academic qualifications—mother	First cycle of basic education	3	15.0	2	10.5	1	6.3
	Second cycle of basic education	7	35.0	5	26.3	6	37.5
	Third cycle of basic education	2	10.0	1	5.3	6	37.5
	High school degree	7	35.0	4	21.1	1	6.3
	Bachelor	1	5.0	0	0	0	0
	Master	0	0	4	21.1	2	12.5
	No mother	0	0	3	15.8	0	0

The students with SEN (see Table 1) attending the first cycle included in the classroom that participated in this study had diagnoses of dyslexia (3 students), intellectual disability (1 student) and communication disorders (1 student). The students with SEN attending the second cycle (see Table 2) included in the classroom that participated in this study had diagnoses of dyslexia (1 student), intellectual disability (2 students) and communication disorders (4 students). This information was obtained from the students' school records. It is mandatory to have clinical, educational and psychological reports in a student's file. All the students had significant limitations in oral language (especially vocabulary and phonological awareness) and reading comprehension, which clearly justifies the need for vocabulary strategies to promote better performance in language and academic tasks that depend on oral language skills. The cognitive abilities of the students with dyslexia, intellectual disabilities and communication disorders were assessed by the school psychologist and showed that these students had sufficient competencies to understand the strategy in classroom activities without the need for adaptations. The diagnoses reported here were obtained through assessment by a multidisciplinary team (psychologist, therapist and teacher, and clinical teams when necessary) in the schools, using the recognized and established criteria [32].

2.4. Instruments

2.4.1. Knowledge Verification Checklist (KVC)

After analyzing the international literature and studies on the implementation of the SFA strategy, especially with children attending basic education [33,34], and after consulting the programs and curriculum objectives for the first and second cycles of basic education in Portugal, the instrument for collecting the data on the performance of the students participating in this study was developed by the authors of this paper and named the Knowledge Verification Checklist. The Knowledge Verification Checklist was then analyzed and validated internally by a panel of Portuguese specialists in language

development and reading (2 teachers and 1 speech therapist). The panel of specialists analyzed the Portuguese curriculum and analyzed all the questions included according to the curriculum content for both education cycles in Portugal and validated the checklists developed for this study. No adjustments or modifications were made. This panel also included a bilingual teacher who compared all of the tools in the original SFA strategy and the final checklists developed in Portuguese. No adjustments or modifications were made. After this process, the Knowledge Verification Checklist was then tested in a pilot study conducted with students from schools that did not participate in this study in order to verify its feasibility.

2.4.2. Knowledge Verification Checklist Pilot Study

In order to test the feasibility of the Knowledge Verification Checklist used in this study as an assessment tool in the pre- and post-test phases, a pilot study was conducted prior to the start of this study to analyze the following aspects of the Knowledge Verification Checklist for both cycles (since the content level and age are different): (1) participants' understanding of the instructions on the checklist, (2) difficulty in answering the questions, (3) level of attention/concentration, (4) average time taken to complete the checklist. This made it possible to check the conditions of subsequent applicability in the study, to detect and correct inconsistencies and to increase its validity [35].

For the first cycle, this pilot study was conducted with 15 students, 8 females and 7 males, who were not part of the sample.

The Knowledge Verification Checklist was administered in the classroom during the first half of the morning to ensure a calm, relaxed atmosphere without interruptions. It began with a clear and precise reading of the instructions. The students were then asked whether they understood what they had been told and were asked to read the text and answer the questions.

It was observed that the students remained motivated and focused during the checklist and had no doubts about understanding what was being asked of them in each of the questions.

Considering the analysis of the observations made during the application of the checklist in the pilot study and taking into account the comments and opinions of the students regarding the clarity of the questions and the language used, positive results were observed regarding the applicability of the Knowledge Verification Checklist, which was likely to be used as an assessment tool in this study.

However, it turned out that the time originally considered for the checklist, which was 45 min, was not sufficient for all the students who participated in the pilot study to complete it. Therefore, the authors decided to add an additional 15 min.

For the second cycle, this pilot study was conducted with 18 students, 10 males and 8 females, who were not participants in this research study, with the following criteria:

1. The participants' understanding of the questions and instructions;
2. The difficulties experienced in answering the questions;
3. The average time taken to complete the checklist;
4. The conditions of the environment in which the checklist was to be completed.

Before starting to use the checklist, the instructions were read and explained to all the students at the same time, after which they answered the questions.

Several conditions were taken into account in the application of the instrument, namely the physical conditions (lighting, acoustics, furniture), the material and application conditions (quality of printing, clarity and precision of the instructions, performance time and quality of the applicator) and the conditions of the subjects (physical well-being, fatigue, expectations) [30].

After observing and analyzing the results of the pilot study, it was determined that the time allotted (45 min) was not sufficient to complete the checklist in the second cycle either, so an additional 15 min would be needed to complete the task.

After conducting the pilot study for both educational levels, the validity of the checklist for data collection was established, and it was administered before and after the intervention (in the pre- and post-test phases) to all the groups assigned to this study, with 45 min, plus 15 min of tolerance. The Knowledge Verification Checklist was developed according to the Portuguese school curriculum for both cycles and was used as a tool to assess the students' performance in implementing the SFA strategy in the classroom, according to the curriculum content selected by teachers (one of the goals of the SAF is to enable teachers to select the content to work on with students) and described in this paper.

For the first cycle, the aim of the Knowledge Verification Checklist was to assess the students' knowledge in terms of understanding and using vocabulary/theoretical concepts related to the topic of "animals" in the context of the subjects of Portuguese and Environmental Studies in the third year of the first cycle. It consisted of an informative text and eight questions (multiple-choice, true/false, fill in the blanks, crossword, completion, association) with different levels of difficulty, divided into two parts: text comprehension (part I) and vocabulary use (part II).

For the second cycle, the aim of the Knowledge Verification Checklist was to assess the students' knowledge of vocabulary related to the topic of "diversity of animals" in the context of the Science subject in the fifth year of the second cycle. It consisted of 30 items (multiple-choice, true/false, relationship, fill in the gaps and crossword) divided into five questions and introduced by a short explanatory text.

2.4.3. SFA Strategy Charts

The purpose of this study is to help make the vocabulary acquisition and knowledge practices used in inclusive classrooms more effective by using strategies/practices that research has shown to be effective. The SFA process involves developing one or more diagrams to help students analyze the similarities and differences between related concepts. A topic, content or category is selected, and words related to that topic are listed in the left column of the chart. The SFA strategy charts were developed by the teachers/students in accordance with all the guidelines with the aim of knowing, describing and analyzing the impact of the strategy on the development of the vocabulary and understanding of the theoretical concepts by the students with and without SEN [23].

The SFA strategy charts were used to implement the SFA strategy in the classrooms selected for this study (see Figures 1 and 2 for some examples used in the study). These examples were translated from Portuguese into English.

	Reproduction of animals							Sexual dimorphism		Courtship communication display					Metamorphoses	
	Sexual	Asexual	Oviparous	Viviparous	Ovoviparous	Egg	Sperm	Exists	None	Sounds	Smells	Colours	Movements	Gifts	Yes	No
Cat	+			+		+	+		+	+			+			+
Peacock	+		+			+	+	+				+	+			+
Starfish		+							+							+
Shark	+				+	+	+		+	+						+
Frog	+		+			+	+		+	+					+	
Deer	+			+		+	+	+		+			+			+
Butterfly	+		+			+	+		+		+				+	
Pigeon	+		+			+	+		+	+	+		+			+
Fox	+			+		+	+		+		+					+

Figure 2. Example of SFA chart strategy on the concept of animal reproduction.

2.4.4. Student Satisfaction Questionnaire

A student satisfaction questionnaire was developed by the authors to be administered at the end of the intervention to the students in the SFA strategy instruction group to measure their level of satisfaction with the SFA strategy. This questionnaire consisted of nine items, to which the students answered only yes or no according to their opinion on the strategy they had learned.

2.4.5. Teacher Satisfaction Questionnaire

A teacher satisfaction questionnaire was also developed by the authors for the classroom teachers who were part of the SFA strategy teaching group to find out how satisfied they were with learning and implementing the SFA strategy, to be filled in at the end of the strategy implementation. It consisted of four questions. Question one consisted of a Likert scale, using which the teachers had to rate each of seven items from one to five: 1—Not at all satisfied, 2—Somewhat satisfied, 3—Satisfied, 4—Very satisfied, 5—Totally satisfied. Questions two, three and four required a yes or no response.

2.5. Procedures

This research study followed the rules of the Code of the Ethics Committee of the University of Minho and the approval of the Scientific Council of the University of Minho, after ensuring all aspects of the confidentiality and anonymity of the data resulting from the procedures adopted by the University of Minho.

In order to participate in the research, parents signed a consent form for the administration and/or use of the test data. All the school directors and teachers gave their authorization and full consent to participate in the study.

Implementation of the SFA Strategy (Pre-Test and Post-Test Phases)

The Knowledge Verification Checklist was applied in the pre-test phase to all the assigned groups of the sample, making sure that all the conditions were in place so that the students could complete it without constraints.

After the pre-test application, the implementation of the SFA strategy was carried out in both experimental groups for the first and second cycles. The aim was to acquire vocabulary and learn theoretical concepts. The implementation was carried out in ten sessions, with each session lasting between 45 and 60 min. Initially, the sessions were conducted by the researcher, who explained all the steps and procedures to be followed in the implementation of the strategy. The SFA charts used were first filled in by the students together with the researcher, then by the students in small groups/pairs and later individually.

The first charts contained all the information that needed to be known, and as the learning progressed, they contained less and less information until they were completely blank. At this stage, with the help of the researcher, the students wrote down the words/categories they wanted to know about and the characteristics they might have. The pupils then completed their charts individually, and at the end, they discussed the results. For the other groups, CG, STG (first cycle), CG and OVSG (second cycle), different methods were used. In the first cycle, the STG students continued to receive the mainstream teaching (dictionary search, memorizing definitions and writing sentences) normally used by the class teachers according to the national curriculum and carry out the activities set out in their textbooks. The CG group, on the other hand, learned vocabulary related to the theme "animals", as taught by the class teacher, by carrying out the activities set out in the textbooks and worksheets, making posters (examples and non-examples of words) and semantic diagrams and working on understanding and interpreting texts using different strategies (e.g., dictionary search, contextual analysis, morphological analysis).

In the second cycle, the CG students benefited from a mainstream class taught by the subject teacher using the textbook and the worksheets completed in it. The OVSG lessons used videos and descriptions retrieved from the Online Virtual School platform [31].

These students interactively answered questions on the topic studied through all the tasks available on the platform.

After the implementation of the SFA strategy and the intervention in the other groups, all the students completed the checklist (post-test application), following the same procedures as in the pre-test application. The purpose was to assess the performance of all the students after the interventions in terms of vocabulary/concept acquisition and comprehension and to understand the impact of the implementation of the SFA strategy.

3. Results

To process the data collected, the results were statistically analyzed using descriptive and inferential statistical models, with all the variables entered into and analyzed in Statistical Package for the Social Sciences (SPSS) software version 22.

3.1. Descriptive Analysis

In this section, the distribution of the results (mean, standard deviation, number of participants, maximum and minimum values) on the students' performance in the Knowledge Verification Checklist—KVC—(in the pre- and post-tests) is presented according to the groups assigned in the first cycle (see Table 3) and second cycle (see Table 4).

Table 3. Distribution of the results (mean, standard deviation, maximum and minimum values) on the students' performance in the KVC (in the pre- and post-test phases) according to the groups assigned in the first cycle.

	Groups	Age	N	*M*	*SD*	Minimum	Maximum
Pre-test	CG	7	2	78.00	2.121	76.50	79.50
		8	15	60.33	12.984	35.00	83.00
		9	1	75.50	.	75.50	75.50
	STG	8	14	57.71	10.894	26.50	68.50
		9	3	30.67	12.770	20.50	45.00
	EG	8	28	44.13	18.864	15.00	80.50
		9	2	53.25	27.224	34.00	72.50
Post-test	CG	7	2	83.00	3.536	80.50	85.50
		8	15	66.80	11.829	41.00	88.00
		9	1	77.50	.	77.50	77.50
	STG	8	14	77.07	13.565	36.00	92.50
		9	3	47.67	13.042	38.00	62.50
	EG	8	28	91.66	6.241	79.00	100.00
		9	2	95.75	6.010	91.50	100.00

Table 4. Distribution of the results (mean, standard deviation, maximum and minimum values) on the students' performance in the Knowledge Verification Checklist—KVC—(in the pre- and post-test phases) according to the groups assigned in the second cycle.

	Groups	Age	N	*M*	*SD*	Minimum	Maximum
Pre-test	OVSG	10	13	43.14	16.837	19.40	73.80
		11	5	29.52	13.701	21.40	53.60
		12	1	40.20	.	40.20	40.20
	CG	10	10	42.12	10.906	26.80	66.40
		11	4	54.30	11.779	41.20	69.40
		12	1	50.00	.	50.00	50.00
		13	1	24.40	.	24.40	24.40
	EG	10	13	46.60	11.313	24.20	58.60
		11	4	45.50	17.148	29.00	64.60
		12	3	49.73	6.185	44.60	56.60

Table 4. *Cont.*

	Groups	Age	N	*M*	*SD*	Minimum	Maximum
Post-test	OVSG	10	13	60.72	14.177	44.20	86.60
		11	5	50.00	18.467	27.20	72.40
		12	1	43.00	.	43.00	43.00
	CG	10	10	62.56	15.427	39.00	94.60
		11	4	66.05	10.524	59.00	81.40
		12	1	54.00	.	54.00	54.00
		13	1	47.20	.	47.20	47.20
	EG	10	13	80.26	13.891	42.60	100.00
		11	4	75.80	14.138	61.80	94.60
		12	3	86.27	8.085	81.40	95.60

On the basis of Table 5, which refers to the results obtained by the students with special educational needs (SEN) in the first cycle in the KVC in the pre- and post-test phases, it can be concluded that all the students who were exposed to different teaching situations evolved positively from the pre- to the post-test. However, it is worth noting that it was the students in the group where the SFA strategy (EG) was implemented who showed the greatest progress in their learning, as the results in the post-test were much higher than in the pre-test.

Table 5. Results obtained by students with SEN in the first cycle in the KVC in the pre- and post-test phases.

Groups	SEN Students	Pre-Test (%)	Post-Test (%)
CG	Student A	35.00	41.00
STG	Student B	20.50	38.00
	Student C	26.50	42.50
EG	Student D	24.00	88.00
	Student E	28.50	83.00

As can be seen in Table 6, all the SEN students improved in their KVC scores between the pre- and post-test phases. In general, it can be seen from Table 6 that the group that showed the greatest progress in the second cycle was the EG.

Table 6. Results obtained by students with SEN in the second cycle in the KVC in the pre- and post-test phases.

Groups	SEN Students	Pre-Test (%)	Post-Test (%)
OVSG	Student A	7.8	35.2
	Student B	40.22	43
CG	Student C	50	54
	Student D	24.4	47.2
EG	Student E	48	81.8
	Student F	44.6	81.4
	Student G	48	86.8

3.2. Inferential Analysis

Non-parametric tests were used to compare two independent groups (Mann–Whitney test), two paired groups (Wilcoxon test) and three or more independent groups (Kruskal–Wallis test) due to the non-normality of the data tested using the Kolmogorov–Smirnov yest in the post-test scores ($p \leq 0.001$). The homogeneity of the variables was tested using the Levene test based on the median for the variables age and gender, and it was concluded that the variances in both age ($p = 0.451$) and gender ($p = 0.864$) were homogeneous across the three different groups.

Mann–Whitney tests with Bonferroni correction were then used to analyze the differences between the two groups ($p = 0.05/3$ when comparing three groups). All the differences are reported with a significance level [36]. It is not very advantageous to calculate the effect size for the Kruskal–Wallis test, as it only gives the value of the overall effect [36]. We therefore followed [36]'s suggestion and calculated the effect size for each of the Mann–Whitney tests. We used the formula $r = Z/\sqrt{N}$ [36,37]. The value of Z corresponds to the z-score given in the SPSS output, and N corresponds to the total number of observations [36]. Mann–Whitney tests were used to analyze the differences between two groups. The Wilcoxon test was used to analyze the differences between two time points (e.g., pre-test and post-test). The same procedure as for the Mann–Whitney test was used to calculate the effect size for this test [36]. In the first cycle, the Kruskal–Wallis test indicated that the results obtained by the students in terms of their understanding of the text varied according to the group they were in (see Table 1). The Mann–Whitney tests with Bonferroni correction showed that there were statistically significant differences between the EG and the CG in the pre-test and post-test (pre-test: U = 115.50, $p = 0.001$, r = −0.48; post-test: U = 53.50, $p < 0.001$, r = −0.67) and between the EG and STG (pre-test: U = 140.50, $p = 0.011$, r = −0.37; post-test: U = 42.50, $p < 0.001$, r = −0.68), whereas the differences between the CG and STG were not statistically significant. Table 7 also shows a significant drop in the performance of the CG and STG groups in the post-test on "understanding the text". This could be due to the fact that the language demands increase throughout the school year, in the form of more activities requiring more advanced reading and, of course, more robust comprehension. Another hypothesis for these results is related to the possible presence in these classrooms of students who are at risk of developing language difficulties.

Table 7. Differences between the groups in relation to understanding the text in the pre- and post-tests.

	Control Group (*n* = 18)	**Structured Teaching Group (*n* = 17)**	**Experimental Group (*n* = 30)**	***H*(2)**
Pre-test	42.86	38.38	24.03	13.03 **
Post-test	22.31	19.09	47.30	32.20 ***

** $p < 0.01$ *** $p < 0.001$.

Regarding the use of vocabulary, statistically significant differences (see Table 6) were found in the pre-test and post-test between the EG and CG (pre-test: U = 159.50, $p = 0.018$, r = −0.34; post-test: U = 20.50, $p < 0.001$, r = −0.77) and between the EG and STG (pre-test: U = 72.50, $p = 0.007$, r = −0.45; post-test: U = 80.00, $p = 0.016$, r = −0.41). The EG and STG groups did not show statistically significant differences in the pre-test; however, differences were found after the implementation of the SFA strategy (U = 111.00, $p = 0.001$, r = −0.47). Table 8 shows a significant decrease in the performance of the CG group in the "use of vocabulary" of the post-test. Although the causal reason for these results is not known, it can be considered a red flag for teachers since it can be used to draw the attention of the teachers of the students assigned to the CG to possible weaknesses and difficulties that may occur in the classroom considering more traditional practices (with the use of the recommended materials) at the level of essential learning, such as vocabulary.

Table 8. Differences between the groups in relation to the use of vocabulary in the pre- and post-tests.

	Control Group (*n* = 18)	**Structured Teaching Group (*n* = 17)**	**Experimental Group (*n* = 30)**	***H*(2)**
Pre-test	43.61	27.59	29.70	8.05 *
Post-test	15.08	28.82	46.12	31.97 ***

* $p < 0.05$ *** $p < 0.001$.

The Wilcoxon test (see Table 9) showed that in the experimental group, there were no statistically significant differences between the pre-test and the post-test in terms of comprehension and vocabulary use, whose effect size was 0.87. In the control group (CG) and the structured teaching group (STG), statistically significant differences were found only in relation to the use of vocabulary, but compared to the EG, the students had better results.

Table 9. Comparison between the pre- and post-test results.

	Control Group (n = 18) Z	Structured Group (n = 17) Z	Experimental Group (n = 30) Z
Understanding the text	___	___	−4.78 ***
Use of vocabulary	−3.42 **	−3.63 ***	−4.79 ***

** $p < 0.01$ *** $p < 0.001$.

In the second cycle, the results showed that the students' performance in the pre-test did not vary as a function of the group they were in, H(2) = 4.25, $p = 0.119$; however, in the post-test, the Kruskal–Wallis test revealed statistically significant differences between the groups, H(2) = 20.08, $p < 0.001$ (see Table 10).

Table 10. Differences between the groups at post-test.

	Online Virtual School Group (OVSG) (N= 19)	Control Group (CG) (N= 16)	Experimental Group (EG) (N= 20)	H(2)
Post-test	18.92	23.00	40.63	20.08 ***

*** $p < 0.001$.

The Mann–Whitney tests with Bonferroni correction showed that there were statistically significant differences between the OVSG and EG groups (U = 48.50, $p < 0.001$, r = −0.64) and between the CG and EG groups (U = 49.00, $p < 0.001$, r = −0.59). However, the analysis showed that the differences between the OVSG and EG groups were not statistically significant (U = 121.00, $p = 0.305$).

We applied the Wilcoxon test to see whether the students' performance differed at the two assessment points and found an increase in the students' performance from the pre-test to the post-test (see Figure 3), Z = −3.92 $p < 0.001$, r = v.88, for the EG.

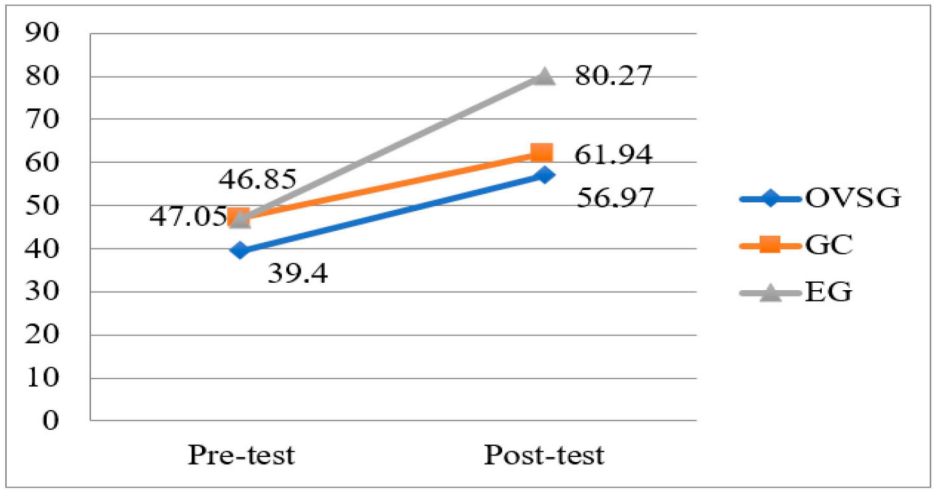

Figure 3. Comparison between the pre- and post-test results.

The results show that statistically significant differences were found between the pre-test and the post-test regarding the application of SFA. The experimental groups (EGs)

performed better in all the curricular contents selected by the teachers working with the students assigned to these groups. It is worth noting that the students with SEN in the group in which the SFA strategy (EG) was implemented showed the greatest progress in their learning, as the results in the post-test were much higher than in the pre-test. The results show that the SFA strategy was more effective than regular/traditional teaching in basic education in inclusive schools.

4. Discussion

Based on the objectives set for this study, the results are discussed in comparison with those obtained in the original study.

Five main objectives were outlined:

4.1. To Adapt and Apply the SFA Strategy to the European Portuguese Curriculum

Adapting the strategy to European Portuguese was easy. It followed the logic of the original strategy in a faithful and valid way according to the manual Semantic Features Analysis, classroom applications [23].

The entire school community involved in this study easily understood the strategy's objective.

The SFA strategy proved to be motivating, appealing, inexpensive and easy to learn. The teachers and students who took part in the study showed interest in, enthusiasm toward, motivation due to and satisfaction with the strategy. This strategy can be used in an inclusive context. It was taught to students with SEN, who understood its usefulness and responded positively to the challenge. It is a facilitating strategy that provides all the necessary support for these students to overcome the proposed challenges. It can be applied to all areas and levels of education. It is easy to replicate and implement.

The learning process involves rigorous procedures that are simple to follow.

4.2. To Analyze and Compare the Performance of All Groups before and after Applying the SFA Strategy

In line with previous research, an instrument was used to check and compare the results of the different groups at the two assessment moments [38]. This was developed based on the guidelines in the original study document [23].

As far as the results are concerned, no statistically significant differences were detected between the groups at the beginning of the use of the SFA strategy; however, after the strategy was implemented, it was possible to observe differences. The values increased significantly in the experimental groups, as was shown in a study of more than 1400 students in their fourth, fifth and sixth years of schooling, on which this research was based, where SFA was in fact the most effective strategy compared to other strategies like semantic maps and contextual analysis strategies [38].

Thus, the improvement in performance shown by the experimental groups in the area of vocabulary may have been influenced by learning the SFA strategy given that the students were able to activate their experiences and make associations with the concepts, as well as interact with the words and their meanings and compare and contrast words in order to discover the relationships between them. This information also corroborates data in which it was shown how much this strategy contributes to an increase in knowledge and understanding of vocabulary, as well as positively affecting reading and writing skills [23,39].

The results of the students with SEN in the experimental groups, compared to the students with SEN in the control groups, show that they became more skilled in terms of their vocabulary development and comprehension when they integrated activities from the SFA strategy, thus corroborating data that also prove this theory [40].

In this way, the data show that the SFA strategy is superior in terms of the acquisition and understanding of vocabulary and concepts compared to the strategies used by the natural sciences teachers in the other groups, thus agreeing with evidence [40] which concluded that students exposed to activities using the SFA strategy obtained better results than students who used semantic maps and contextual analysis strategies.

In this way, the data show that the SFA strategy has advantages in terms of the acquisition and understanding of vocabulary and concepts compared to others, such as semantic maps and contextual analysis strategies [23,41].

4.3. To Analyze the Impact of the SFA Strategy on Students' Vocabulary Development and Comprehension

The results show that the students benefited from using the SFA strategy. Thus, while in the pre-test, the results between the groups were not very different or statistically significant, in the post-test, the experimental groups showed high results that were quite different from the first application, resulting in the significant improvements observed in the results obtained [37,39,42,43].

The experimental groups showed differences over time in terms of the students' results. The Wilcoxon test showed an increase from the pre-test to the post-test, $Z = -3.92$ $p < 0.001$, $r = -0.88$.

There are no exact rules that tell us how large the effect size should be to be considered important or not, but we can follow some general guidelines [37]. Thus, an effect size of less than 0.30 means that the study is weak; greater than 0.30 and less than 0.70 means that the study presents a negligible difference; greater than 0.70 means that the study obtained very positive results.

Therefore, the effect size of this study indicates a value of 0.88, which shows that the implementation of the strategy was highly effective in Portugal. This evidences that this strategy is as effective in Portugal/Portuguese as in other countries and languages, with a high similarity in terms of the results and student achievement. Potential reasons for this can be pointed out in that the frame language is universal. The evidence suggests that there are universal aspects to semantic organization, which are independent of geography, environment or cultural background [44].

4.4. Evaluating the Degree of Student Satisfaction with the Strategy

Students feel happy, motivated and confident when learning with the SFA strategy in the classroom because it promotes a co-operative environment, especially during discussion, thus allowing them to be actively involved in learning words and concepts [23]. Similarly, all the students who took part in this research said they enjoyed learning with the SFA strategy and were interested in implementing it in other subjects. This satisfaction may be due to the fact that the strategy allowed them to acquire, get to know and understand vocabulary in an enjoyable and motivating way.

4.5. Evaluating the Teachers' Level of Satisfaction with the Strategy

By analyzing the answers to the questionnaire given by the teachers, it can be said that they were very satisfied with the results obtained from implementing the strategy and with the significant gains it brought in terms of learning vocabulary and concepts. The teachers' opinions corroborate previous evidence [23] which concluded that teachers are satisfied with the implementation of SFA since, as a versatile strategy for vocabulary development, it can be used to increase, reinforce and refine vocabulary in subject areas while facilitating collaboration between students and capturing their attention, motivation and interest.

Based on the objectives designed for this study, the results showed that the implementation of the SFA strategy in both experimental groups was responsible for the higher results of these groups in relation to the others in both cycles of basic education. The SFA strategy was more effective than the strategies implemented in the other groups of the sample, with the results indicating a real positive development between the pre-test and the post-test, whose effect size indicated a value of 0.87 for the first cycle and 0.88 for the second cycle. In fact, SFA is a useful and flexible strategy for vocabulary development, which can be used to increase, refine or reinforce vocabulary in certain subject areas or to teach specific words that represent key concepts for understanding the text being read [20,27,45].

The SFA strategy was found to be motivating, engaging, inexpensive and easy to learn. The teachers and students who participated in the study showed interest in, enthusiasm toward, motivation due to and satisfaction with the strategy.

The strategy can be used in an inclusive context. It was taught to students with SEN who were part of both experimental groups, who understood its usefulness and responded positively to the challenge. It is a facilitative strategy that provides all the necessary support for these students to overcome the challenges proposed.

It can be applied to all subjects and levels of education. It is easy to replicate and implement. The learning process involves rigorous procedures that are easy to follow.

At the end of the study, it was found that all the students enjoyed learning the SFA strategy, and the teachers were satisfied with its implementation and effectiveness, as stated by the authors of SFA [23], who show how much this strategy contributes to increasing vocabulary knowledge and understanding, as well as having a positive impact on reading and writing skills. Thus, the improvement in vocabulary performance shown by the experimental groups in this study may have been influenced by learning the SFA strategy, as the students with and without SEN were able to activate their experiences and make associations with the concepts, as well as interact with the words and their meanings and compare and contrast words to discover the relationships between them. The results of the students with SEN in the EG groups, compared to the students with SEN in the other groups, showed that they became more proficient in terms of their vocabulary development and comprehension when they integrated activities from the SFA strategy, which also proves the aim of this research study. Furthermore, there was evidence that all the students benefited from using the SFA strategy.

The results obtained from both cycles revealed a highly effective strategy for vocabulary acquisition, development and comprehension, which has been widely reported in the literature. Future studies may consider measuring the students' abilities and performance in writing and text comprehension in other subjects (different from the subjects analyzed in this study). This was not the aim of this study, but it could make a great contribution to the field. Also, professionals using the SFA strategy could analyze the word categories produced in the students' performance. This can help to understand the learning process of students in semantics, as well as to monitor their language development during the school years.

4.6. Future Research Directions

In the future, it would be beneficial to build on the work already undertaken and to provide more in-depth training for teachers in this area. Thus, it would be very productive if the strategy could be implemented by teachers in all schools, in all subjects and at all levels of education so that there is continuity in the learning and consolidation of the strategy by the students since it is a strategy that has been considered effective in the international literature for several decades. It would be appropriate to analyze the impact of the SFA strategy at the national level in order to obtain reference values for our student population. In this way, the strategy could be known and applied by teachers, following what happens in the USA, where this strategy is one of the most referred to in the literature as one of the most effective for students with learning and language difficulties.

5. Conclusions

This study reveals a relevant strategy for vocabulary acquisition, development and comprehension that has been mentioned in the literature. To date, there has been no known study of this strategy in Portugal, so this is a pioneering study in our country.

The results of the two studies lead us to conclude that the SFA strategy is motivating, appealing, inexpensive, flexible and easy to learn. It can be successfully taught in an inclusive classroom, in different subjects and to all school years.

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Institutional Review Board Statement: The study was conducted by the rules of the Code of the Ethics Committee of the University of Minho and the authorization of the Scientific Council of the University of Minho, after all aspects of confidentiality and anonymity of the data resulting from the procedures adopted by the University of Minho were ensured.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data is unavailable due to privacy or ethical restrictions.

Conflicts of Interest: The authors declare no conflicts of interest.

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