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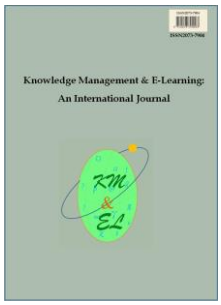

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Effects of a writing strategy on improving text production skills among primary school students

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Abstract: The purpose of this research was to analyze the effects of a writing strategy for text production among primary school students with different cognitive styles (CS) in the field dependence-independence (FDI) dimension. The writing strategy is based on collaborative work, autonomous work, and work integrating technology, which is referred to as ACOTEC. The study was developed with a population of 63 students distributed in two randomly formed groups: one control and one experimental group. The control group developed writing exercises guided by a conventional strategy following the writing teaching processes according to the institution's curriculum, while the experimental group adopted the ACOTEC strategy for the writing exercises. The results show the promising effects of the strategy on improving text production skills among primary school students with different CS in the FDI dimension.

Keywords: Primary school; Writing strategy; Cognitive style; Field dependence-independence; Technology integration

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1. Introduction

Education is a continuous process whose fundamental aim is the comprehensive education of individuals seeking to improve their performance in diverse scenarios in a competent manner (Zambrano, 2007). This has motivated researchers to carry out

research related to personality, learning styles, and the perceptions of the subject (Sternberg, Zhang, & Rayner, 2011). Likewise, this has positioned the student as an active subject of the learning process (Esteve, 2016; Duarte, 2003), acknowledging their characteristics to perceive, learn, and explain reality (Valadez Huizar, 2009). As a result, strategies have been implemented to favor the learning process considering subjects' differences.

Therefore, the strategies proposed to improve learning must be characterized by being dynamic, interactive, starring the novices themselves, and contributing to building new ways of thinking (Ruíz & Zambrano, 2014). Writing processes have potentialized cognitive skills to compare, synthesize, analyze, and conclude. All of this has provided students with basic knowledge, together with tools, allowing them to search for information to transform it into useful knowledge (Andaur, 2011).

It is essential to analyze the relationships between subjects' differences and writing processes. Some studies show analysis of novices' cognitive style (CS) in the dependence-independence (FDI) dimension and conclude that field-dependent students have legibility, organization, and clarity writing difficulties. Additionally, they exhibit little text production and weaknesses in recognizing relevant information (Berent, 1974). In contrast, independent field subjects exhibit legible, organized, clear writing, easily recognize important information, and analyze ideas before accepting them. In this context, the need arises to implement and evaluate pedagogical strategies favoring the writing skills of field-dependent students and thus match their text production competencies to those of independent field subjects.

We analyze the effect of a pedagogical strategy for text production on primary school students with different CS in the FDI dimension. The writing strategy referred to as ACOTEC was characterized by the combination of autonomous and collaborative work activities, as well as by integrating technologies to develop writing skills.

The aforementioned aspects allowed formulating the following research question: What effect does a pedagogical writing strategy based on autonomous work, collaborative work, and work integrating technologies have on developing text production skills among primary education students with different CS in the FDI dimension?

The following working hypotheses were also posited.

H0: The effectiveness of the ACOTEC strategy on the text production of field-dependent students can't be determined.

H1: By implementing the ACOTEC strategy, the field-dependent subjects in the experimental group are expected to significantly improve their text written production.

H2: The ACOTEC strategy has no effect on the field-dependent students' text writing production.

2. Conceptual framework

2.1. Writing process development

Writing is a complex and demanding process requiring the writer when producing the text to i) plan and set writing objectives, ii) structure a coherent and consistent writing model, and iii) organize and prioritize the ideas they wish to communicate (Cassany,

1999; Harris, Schmidt, & Graham, 1997). In this sense, writing is associated with reading processes, since according to Jolibert (2001), text production implies their reading, and consequently, their adjustment and improvement to produce new writings.

Therefore, start with writing exercises considering subjects' mental development stage, by writing their names, taking dictation of words, copying continuous texts, rewriting stories, dictating story fragments (Kaufman, Gallo, & Wuthnau, 2009), associating the image with the word, promoting the construction of short paragraphs until achieving a greater level of complexity; in synthesis, making use of all the strategies of writing education according to the level of schooling.

To that end, in children's basic primary education writing processes, four types of processing are considered; i) Semantic: which tends toward developing psycholinguistic skills, such as auditory association, visual association, categorization, and classification, ii) Phonological: which allows generating grapheme-phoneme representations and includes auditory comprehension, auditory integration, and auditory sequential memory, iii) Graphemic: the identification of graphemes or letters as a function of their visual characteristics, and iv) Orthographic: developing the access of phonology to semantics and vice versa, as well as motor expression skills, grammatical integration, and serialization.

Thus, Camargo (2015) considers writing must generate changes that help the student to discover, recall memories, evoke memories, and recover life experiences from an innate linking to subjects and their desires. Also, it must allow the writer to develop the pleasure generated in writing and be aware of the mental operations that favor completing the process and the difficulties that arise when they are not developed.

On the other hand, some studies have concluded that oral interpretation is better than written production in children, who may have problems and poor performance in writing. This is because of, among other reasons, the lack of feedback from their writing processes, forcing them to allocate most of their cognitive resources to managing and organizing low-level ideas, such as orthography and mechanical aspects of writing, instead of being oriented toward higher-level dimensions of written production, thus reducing their working memory capacity (Bourdin & Fayol, 1994).

In response to this, there are different models that enable textual production, favoring the development of higher-level mental operations, the use of these cognitive resources, and the development of their working memory. The most renowned model in this sense is that of Flower and Hayes (1981), which assumes the interrelation of three elements: i) the task's environment, ii) the writer's long-term memory, and iii) planning, producing, and reviewing processes; the latter constitute essential cognitive processes for a written and non-hierarchical task, and can also arise over and over again, as needed by the writer, contributing to quality written production.

On the other hand, at present, integrating Information and Communication Technologies (ICT) in text production through word processors, e-mail writing, and use of social media, preparing works of a different and diverse nature, has driven the implementation of strategies enabling subjects to approach writing through digital media (Cassany, 2000). ICT can also be used as supplementary tools for some sub-tasks of digital composition, integrating them into the writing process to respond to the subject's own needs, who interacts daily in the educational context.

To conclude, the basis of the writing process is that children, using their cognitive skills, find purposes to write, structure, and prioritize ideas they wish to express in

writing (Arias González, 2015), and strengthen the abilities required in text production. It is also important to use technological tools of various kinds to perform such task.

2.2. Cognitive style in the FDI dimension

In recent years, educational researchers' interest has focused on understanding how students learn (Rodríguez & Santiago, 2015). In this sense, studies have concluded that novices respond to learning tasks in different ways by using previous knowledge, diverse strategies, varied resources, and specific times. These characteristic features refer to *style*, defined as the set of traits of human beings that make them unique in comparison with others (Hederich Martínez, 2007).

From an educational psychology perspective, style is the set of regularities intrinsic to subjects that determine their behavior and is characterized by being: i) a differentiator, to the extent in which it establishes distinctive characteristics among individuals, ii) relatively stable in each individual, iii) to some extent, an integrator of the subject's different dimensions, and iv) neutral, in other words, that one style should not be valued, in absolute terms, over another (Hederich Martínez, 2007). In this field of knowledge, there are different types of styles, where CS stands out.

CS is the preferred or habitual way of using cognitive skills possessed by the subject in diverse situations and allow diversity in their responses (Hederich Martínez, Donado, & Uribe, 2011); therefore, they refer to the specific unconscious and automatic patterns through which individuals acquire knowledge.

Hederich Martínez (2013) delves into the CS referred to as FDI. To understand FDI is necessary to establish that subjects can be classified as Field Dependents (FD) or Field Independents (FI). FD characterizes by the tendency to perceive a phenomenon as a unitary whole without considering the different parts that make it up. On the contrary, FI consists of the ability to isolate a specific feature that is perceived as relevant from the context in which it is integrated.

Regarding FI subjects, studies have shown that they can easily concentrate on something, distinguish parts of a whole, and analyze separate elements without disturbing other variables. They are also recognized as independent, competitive, and self-confident individuals. Unfortunately, FI novices can have setbacks because they only focus on parts and details, ignoring their relation to the whole (Wu, 2018).

Wu (2018) also points out that FD individuals tend to be more sociable and empathetic, an inclination that leads them to perceive the feelings and thoughts of others more easily. However, in a situation where decision-making is necessary, they are less analytical and tend to perceive them as a whole, rather than as analyzable components. In the middle of these two tendencies are the subjects with an intermediate cognitive style that share characteristics of the two groups.

In conclusion, subjects' differences mark each individual's style to access and use knowledge. These differences can be studied under several CS, among which the FDI dimension stands out, whose characteristics determine a subject's performance in diverse areas of knowledge, their interpersonal relationships, or how to face and solve a problem. All of this has an impact on the design of pedagogical strategies that ensure, to a certain extent, achieving educational objectives and goals (Mendieta Ortiz & Ramírez Cano, 2015).

2.3. Relationship between cognitive style and text production

Text production is closely related to cognitive processes that accompany it, and therefore, to the CS that characterizes the subjects who conduct the writing exercise. In that sense, studies have analyzed the relationship between CS and text production, concluding that FI subjects show better results in reading and writing processes according to associated skills and previously established criteria (Davis, 1987; Duman & Çelik, 2012).

It has been suggested that FI subjects compared to FD ones can more easily identify linguistic units within meta-text structures, depending on the concrete skills and cognitive abilities associated with language, performing better in reading and writing processes, especially in the first years of schooling (Tinajero & Paramo, 1998).

Regarding the writing process, FI subjects have better levels of text production, based on recognizing useful elements and adequately using rules in writing. They also manifest more legible and understandable writing features than FD subjects, proper word fragmentation and sentence construction with meaning and greater capacity for contextualizing and identifying relevant text aspects, effective development of linguistic competencies, use of language in context, among other aspects (Ehrman & Leaver, 2003; Rezaee & Farahian, 2012).

FD subjects could significantly improve their writing processes if pedagogical strategies, tending to favor their learning process, are implemented in that area of performance (Davis, 1987; Nosratinia & Adibifar, 2014; Rincón & Hederich Martínez, 2008). The foregoing entails a challenge for the educator who is exhorted to promote methodological actions that strengthen cognitive skills to improve students' academic performance.

It is thus possible to conclude, in the first place, that subjects with individual differences require pedagogical and methodological strategies favoring the execution of diverse tasks considering their CS for text production. Secondly, we recognize the influence that pedagogical strategies have on subjects according to their CS. It is possible to indicate that FI subjects have a more favorable behavior in diverse contexts than FD subjects, insofar as the former develop another type of competencies that are favorable to their academic performance. Finally, this leads to the need of proposing, implementing, and evaluating pedagogical strategies with FD subjects that allow them a text production with high levels of quality.

2.4. Evaluation of text production

Writing processes in different educational settings are continuously evaluated to identify their evolution and the underlying difficulties for subjects when performing tasks of this nature (Calaforra Faubel, 2017). The evaluation of text production is a complex activity that requires evaluating the development process of cognitive operations and attitudes toward writing. In this sense, the student and the teacher play a fundamental role in the evaluation process. For their part, students can be peer reviewers of text production and provide feedback on their peers' writings. On the other hand, teachers guide the novice's work, form autonomous self-regulating and metacognitive behaviors, evaluate and co-evaluate the process completed (Cassany, 1993), considering clear criteria on text production, the dynamics intrinsic to early childhood education, and the contexts in which pedagogical work is developed.

Eguiluz Pacheco and De Vega Santos (2009) have proposed that written production can be evaluated considering four aspects: i) adjustment, ii) structure, iii)

grammar, and iv) vocabulary. During adjustment, the properties of the text are measured according to the communication situation proposed, adjusting it to the required length and the ends it intended to achieve.

The structure allows measuring the text's clarity about the presentation of ideas such as coherence, interrelation in the content, adequate use of connectors and punctuation marks. Grammar has three essential components that can be analyzed: orthography, morphology, and syntax. Finally, vocabulary evaluates the richness in the terminology used. it relates to the degree of production the individual has and the lexical resources they have.

In short, text production requires evaluation processes that consider aspects such as narrative structure, consistency, coherence, and literary resources (Kaufman, Gallo, & Wuthnau, 2009). The teacher uses templates or categories that allow evaluating certain production conditions, the review and adjustment of texts, according to their intentionality and students' stage of cognitive development and level of schooling to provide permanent assistance to novices.

3. Method

3.1. Participants

The study was conducted with a sample of 63 students, 39 females and 24 males, from a public primary school in Bogota, Colombia. Students were placed in two groups (control and experimental group) with 33 and 30 subjects, respectively. The age of the students ranged from 9 to 12 years old.

3.2. Variables

In this quantitative research, the control group developed writing exercises guided by a conventional strategy following the writing teaching processes according to the institution's own curriculum. The experimental group implemented an ACOTEC writing strategy. The study's independent variable corresponded to the ACOTEC writing strategy. The dependent variable was text production. An associated variable was included corresponding to cognitive styles in the FDI dimension.

3.3. Procedure

The ACOTEC strategy was implemented over three months. At the beginning of the study, the Embedded Figures Test (EFT) was applied to identify students' cognitive styles, with prior authorization from parents or legal guardians.

3.4. ACOTEC writing strategy

The implemented ACOTEC strategy was consolidated through a series of activities in three phases described below.

PHASE 1: Autonomous work

Based on different pedagogical activities associated with language, subject's appropriate new words, known vocabulary, and grammatical structures. They also apply basic characteristics in the written and oral construction of meaningful texts.

PHASE 2: Collaborative work

Teachers and students rewrite texts previously composed, and create new documents, seeking to strengthen written production. Simultaneously, they link intrinsic knowledge to grammar, orthography, and semantics. Likewise, they improve layout and content in text production.

PHASE 3: Integration of technologies

This phase aimed to strengthen the student's reading and writing skills, so in the end, students will improve their writing performance. Technological resources such as "the scratch program" were integrated into the activities, and a blog (https://odpacheco.blogspot.com) was created. These tools helped the involvement of parents during the writing activities

We also had the support of writers belonging to the "Organization of Colombian Authors". They offered tools for writing during the practice. Additionally, a radio show was recorded on "Radioscopia", a radio station. The show can be viewed at (https://youtu.be/4BDEE__XXZU). In the radio show, the experiences from these activities are told by students belonging to the experimental group and their parents. Finally, the written texts were transcribed into a word processer and sent to the teacher by e-mail.

3.5. Instruments

3.5.1. Embedded figures test

The Embedded Figures Test (EFT) is the instrument used to determine the CS in the FDI dimension, whose statistical analyses have shown excellent internal consistency with an adjusted Alpha value, according to the Spearman-Brown formula, of 0.94 (Hederich Martínez, 2007). In this test, the subject must discriminate a simple figure within the context of a complex one. The relationships found between figure unmasking tasks and auditory and sensory perception tests have allowed formulating the FDI dimension as CS. Regarding how FD subjects perceive, the perceptions are strongly dominated by the field's global organization and its parts are experienced as "diffused". Regarding how FI individuals perceive, the parts of the field are experienced as distinct in the organized whole (Fernhndez-Ballesteros & Macia-Antón, 1981).

3.5.2. Categories for the evaluation of text production

To assess student performance, we designed a category to objectively determining the characteristics of the text produced. This analytical-type instrument has 13 criteria, which are valued from 1 to 5.

These criteria evaluated students' texts in the following aspects: i) layout: title, cover page, orthography, and illustrations, ii) structure: characters, length, story elements, problem, solution, organization, and action, iii) originality and creativity of the text.

The score to each criterion is awarded as it fully, partially, or not meets. To that end, each text produced must be read and subsequently evaluated aspect by aspect. In the end, a score is issued, and it will be 13 points minimum, 65 points maximum, or a mean of 39 points.

3.5.3. Survey

To investigate parents' and students' perceptions about integrating technologies in the development of skills for text production, a survey was designed to determine the impact of these tools on the research.

4. Results

We analyzed: i) CS and its relationship with text production, ii) implementation of the ACOTEC strategy for text production, and iii) parents' and students' perceptions of the technology used to strengthen writing skills.

These assumptions were verified: i) normality of the dependent variables, ii) correlation of the dependent measures, and iii) homogeneity of the matrices between the groups (Hair, Black, Babin, Anderson, & Tatham, 2007).

The first one was verified using the Kolmogorov-Smirnov (K-S) test applied to the text production post-test, which indicated that the variable has a $Z = 0.613$; $p = 0.846$; satisfying the condition of normality. For the second assumption, Bartlett's test of sphericity was applied, obtaining a Chi = 21.357 and $p \leq 0.000$, satisfying the level of correlation between dependent variables. The third assumption was verified using Box's M test, it yielded an $F = 0.207$ and $p \leq 0.975$, which is why it is assumed that the variance/covariance matrices of the components of the dependent variables are equal. With the requirements met, an ANCOVA analysis is performed.

Table 1 shows CS and its relationship with text production. It shows the descriptive statistics of the experimental group, at a general level, for the pre-test and post-test of text production, according to CS in the FDI dimension.

Table 1
Pre and post-test of the text production in the experimental group

		Pre- test				Post- test			
	N	Mean	SD	Min	Max	Mean	SD	Min	Max
Field Dependent	8	26.50	5.014	19.00	33.00	35.125	6.957	25.00	48.00
Intermediate	17	26.70	4.454	19.00	37.00	35.764	6.077	28.00	50.00
Field Independent	5	25.60	4.774	23.00	34.00	33.600	6.188	23.00	38.00

Students of the experimental group, FD, Intermediate (IM), and FI obtained similar scores both in the pre and post-test. However, after implementing the ACOTEC strategy, all subjects improved their performance, first the IM, followed by the FD subjects, and finally the FI subjects. On the other hand, to compare the pre and post-test means of the experimental group in each CS, a paired *t*-Test was applied (Table 2).

Table 2 shows it is possible to establish the significance within each group according to their CS in the pre and post-test of text production. When contrasting the results within each group, it is clear that subjects significantly improved their text production processes, with a slight advantage of IM, followed by FD, and finally, FI. These results support the hypothesis that by implementing a pedagogical strategy based on autonomous work, collaborative work, and work integrating technologies, FD students are allowed to improve their text production; it is also evident that the three groups of subjects are favored by implementing this strategy.

Table 2
Paired t-test comparing pre-test and post-test according to cognitive style

	Related Differences								
	N	Mean	SD	Mean Standard Error	95% Confidence Interval for Difference		T	gl	Bilateral Sig.
					Upper	Lower			
Field Dependent	8	-8.625	5.655	1.999	-13.352	-3.897	-4.314	7	.004
Intermediate	17	-9.058	4.955	1.201	-11.606	-6.510	-7.537	16	.000
Field Independent	5	-6.666	6.055	2.472	-13.021	-.312	-2.697	5	.043

Fig. 1 shows the implementation of the ACOTEC strategy compared to the conventional text production strategy. Pre-test and post-test averages for each of group is described.

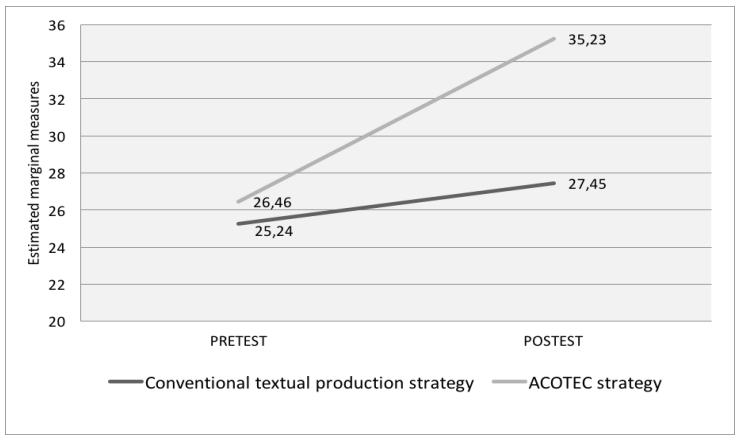

Fig. 1. Comparison among ACOTEC and conventional text production strategies

It is possible to see that the results of the pre-test in the two groups are similar in their averages. After implementing ACOTEC strategy, it is evident that the experimental group significantly improves its performance valued in the text production post-test. Fig. 2 and Table 3 show the results of each group according to its CS in the FDI dimension, in the application of the pre and post-test of text production.

We also compared the strategies through an ANCOVA (Table 4). The model explains 57% of the variance of learning achievement. As observed, the independent variable shows significant main effects on learning achievement. The covariable (initial test of text production) shows a significant learning association ($F = 32.137$; $p < .000$).

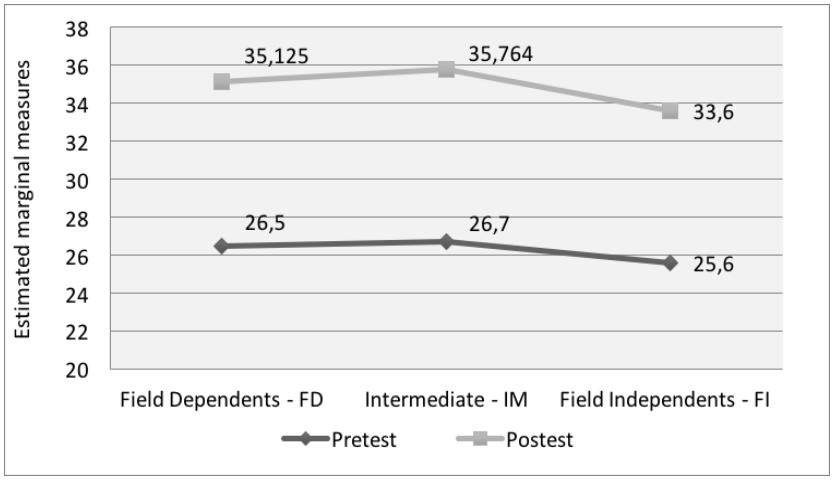

Fig. 2. Pre-test and post-test of text production

Table 3
Descriptive statistics of pre-test and post-test of two groups

		Pretest				Posttest			
Group	N	Mean	SD	Min	Max	Mean	SD	Min	Max
Control	33	25.24	5.202	17.00	39.00	27.45	4.815	15.00	36.00
Experimental	30	26.46	4.508	19.00	37.00	35.23	6.162	23.00	50.00

Table 4
ANCOVA comparing ACOTEC and conventional strategy to produce texts

Origin	Type III Sum of squares	gl	Quadratic mean	F	Sig.
Adjusted Model	1708.098[2]	6	284.683	14.676	.000
Intersection	339.874	1	339.874	17.521	.000
Pretest	623.405	1	623.405	32.137	.000
CS	92.851	2	46.426	2.393	.101
ACOTEC Strategy	526.366	1	526.366	27.134	.000
CS*Group	41.445	2	20.722	1.068	.351
Error	1086.315	56	19.398		
Total	63959.000	63			
Total adjusted	2794.413	62			

Concerning the main effects of the independent variable, the most significant effect is given by the presence of the ACOTEC strategy ($F = 27.134$; $p < 0.000$), since the results show that students who worked individually, collaboratively, and integrating technologies, showed much higher results than their peers who worked without the strategy.

We expect this analysis can help better understand the factors that can influence students' learning and performance based on their differences about their CS in the FDI dimension. The discussion remains open as to how to continue strengthening FD subjects in terms of text production. For now, the results presented allow us to observe a very promising future situation for all students regardless of their CS in text production, integrating autonomous work, collaborative work, and learning technologies for learning.

As for parents' and students' perceptions about integrating technologies into the development of skills for text production, students conclude that the use of technological tools is essential for learning in diverse subjects, as well as for the development of writing processes, particularly for text production.

On the other hand, tools such as blogs, links, and interactive games, the use of e-mail, and programs such as Word and scratch, strengthen cognitive skills such as analyzing, remembering, and synthesizing. This aspect is especially important in the field-dependent CS for its improved development and overall school performance.

For parents, integrating technologies into several subjects, as well as for the development of writing processes, and in particular, for text production, is essential for their children. However, tools such as blogs, links, interactive games, the use of e-mail, and programs such as Word and scratch; are not part of their everyday life, which is why it is a school challenge to continue integrating the family into its implementation and, therefore, especially benefit FD subjects from the strengthening of cognitive skills that positively impact their long-term academic performance.

5. Conclusion

The ACOTEC writing strategy based on individual work, collaborative work, and work integrating technologies for learning, has a significant effect on the development of text production skills in basic primary education students with different CS in the FDI dimension, favoring subject's characteristic features referred to their CS.

We concluded that the strategy improved subjects' text production, which is coherent with Rincón and Hederich Martínez (2008) and Duman and Çelik (2012), where the FI subjects tend to have performed better than their FD peers; however, when implementing the pedagogical strategy all subjects were favored in the development of competencies for text production. Therefore, hypothesis number one raised in the study is validated.

The design of this strategy provided a route for the teacher, as Rezaee and Farahian (2012) indicate, to have them carry out activities that answer questions such as 1) what to do? 2) why do it? 3) with what resources? 4) how to evaluate it? and 5) in what timeframe develop it? This contributes to the assistance of the text production process and having strategies to enrich their students' writing.

Based on the foregoing, it is possible to deduce that it is necessary to design, execute, and evaluate pedagogical strategies based on CS in the FDI dimension, oriented toward improving text production. To that end, the postulates of authors such as Flower

and Hayes (1981) and Hederich Martínez (2013) can be considered, who contribute theoretical-practical elements for the development of writing skills associated with CS in the FDI dimension of subjects in training.

The creation of a category of its own for the evaluation of text production, as part of a research process, to improve the quality of written production, allows the teacher to establish clear and defined criteria that value texts in their components (Calaforra Faubel, 2017). This helps assisting subjects' writing processes, as well as the achievement of the goals proposed.

It is worth mentioning that some studies have established a significant difference in favor of FI students with respect to FD (Davis,1987; Rezaee & Farahian, 2012; Ma, Sun, & Ma, 2014; Wu, 2018); FI students exhibited better levels of text production and adequate use of concepts for problem-solving, which contrasts with the results from the implementation of the ACOTEC strategy, which seems to be equal for all subjects regardless of their CS, which encourages the development of new research in this regard.

Language, writing, and reading Teachers must appropriate a new writing model enabling to improve text production processes, according to the students' level of schooling. Also, it is necessary to measure writing skills through autonomous and collaborative work that integrates learning technologies (Fu, Yang, & Huang, 2012). To do this, Teachers require training to build a new learning process, including an innovative style, increasing the development of high-level creative writing with precision, orthography, aesthetics, and critical thinking.

6. Recommendations

We strongly recommend increasing the length of the strategy to reach higher scores in text production, and especially to the appropriation of orthographic rules as part of the writing skills. Additionally, we suggest including pedagogical writing strategies in the class list that allow students to improve their academic performance, based on their differences and their own CS. We finally suggest guiding teachers training plans on CS, educational stylistic, and individual differences, which would contribute to understanding how subjects access knowledge, solve problems, use knowledge, and, therefore, to their improved school performance.

7. Limitations

The main limitation for this study was the parents' participation in Phase III, regarding the use of technologies (such as scratch, Word, e-mail, and blogs). Teachers should generate strategies to explain the use of the Internet and other technologies in the classroom. Also, they must facilitate the presence of parents and students in the classroom simultaneously and should offer technological training for parents and students.

Author Statement

The authors declare that there is no conflict of interest.

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