EFFECTS OF A VISUAL LITERACY PROGRAMME FOR THE IMPROVEMENT OF READING COMPREHENSION IN PRIMARY AND SECONDARY SCHOOL STUDENTS

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Abstract

With basis on previous research findings, a quasi-experimental longitudinal study was designed to analyse the effects of a visual literacy programme using images to improve reading comprehension. Pre-tests and post-tests were used for the recurring measurement of two homogeneous groups. The participants were 221 primary and secondary students in six schools within Andalusia and Madrid (Spain). The results indicated that visual literacy and, specifically, the reading and interpretation of connotative and symbolic images improve reading comprehension, especially at the global or macro-structural level, as well as literal and inferential reading, the comprehension of comparisons (similes) and metaphors, the ability to synthesize, and creativity. A moderate or large effect size was observed for all these variables. The effectiveness of the programme and the need for the planned, intentional use of images as pedagogical and didactic tools were confirmed.

Keywords: reading comprehension, visual literacy, intersemiotic interpretation, classroom activities, Spanish as L1

1. INTRODUCTION

Reading comprehension as a linguistic skill continues to be the subject of much research given the constant challenge it poses in a teacher's daily work and its importance for students' academic achievement at every educational stage. In this study, we investigated reading comprehension as it relates to the reading of images, also known as visual literacy. The presence of images in all areas of our daily lives necessitates the competence to read and correctly interpret them. Like verbal text, the reading of iconic text requires prior systematic preparation. For images, prior knowledge is needed of the elements that constitute the visual code and the way these elements are integrated into the coding of a message.

In the educational field, teachers must adapt to differences in how the 'page' and 'screen' generations learn to read (Turkle, 1995; Tyner, 2014). It is important to teach students how to read images, especially as presented in advertising, film, political propaganda, social networks, etc. Such teaching addresses the difference between 'looking', 'observing' and 'seeing' from many points of view to achieve critical visual literacy. In addition, the visual semiotic code can be used as a resource for improving creativity, language skills, and especially reading comprehension, which is the subject of this study.

Many researchers are promoting a new concept of literacy (or reading-writing) that includes new competencies such as television and computer literacy and digital and visual literacy (see, for example, Ervine, 2016; Amo, 2019; Anonymous, in press). Visual literacy is especially interesting in relation to language learning since the texts that students usually read on screen displays frequently combine words and images (Cope & Kalantzis, 2000).

Notably, in the Australian educational system, the National Assessment Programme Literacy and Numeracy (NAPLAN) measurement of reading skills includes the visual semiotic code; in other words, students' understanding of the relationships between text and images in multimodal texts is assessed (Martinec & Salway, 2005; Unsworth, 2006, 2008; Gladic & Cautín-Epifani, 2016).

For this study, we aim to explore the potential of images (not only in multimodal texts) for improving reading comprehension. We intend to empirically confirm that improving visual literacy will contribute to an overall improvement in reading comprehension.

2. THEORETICAL FRAMEWORK

One of the main concerns of teachers in general and especially teachers of native languages is their students' reading comprehension. Consequently, teachers devote considerable attention to texts with words, but they often ignore the images that accompany them (Villa, 2008).

Numerous studies have confirmed that the use of computer programs (Fletcher & Atkinson, 1972; Sotelo et al., 2012) and reading in hypermedia and interactive formats (Erçetin, 2003) contributes to higher performance compared to traditional methods. The use of hypermedia environments positively influences the identification of morphosyntactic elements and connotative meanings in images (Villa, 2008). Additionally, the use of sociosemiotic models is recommended (Kress, 1997; Kress, 2003; Kress & van Leeuwen, 2001; Farías & Araya, 2014) for critical analysis to explain the sociocultural and ideological motivations underlying the design and production of multimodal discourse (discursive production is understood as motivated social practice) (Kress et al., 2001).

In designing this research, we considered the previous study by Farías and Araya (2014), which analysed multimodal texts using two semiotic models and evaluated their possible role in discerning meaning. The first model, developed by Magariños (1991), is based on a visual reading that establishes nine types of relationships between form, existence, and value. Of these nine, three correspond to iconic referentiality and are represented in a denotative manner. Three others correspond to indexical referentiality and provide the means for their expression. The remaining three carry symbolic referents that are interpreted connotatively. The second model was developed by Kress and van Leeuwen (1996) and is used in discursive-semiotic approaches. This model proposes the segmentation of the visual space into different areas — the ideal, the real, the given and the new — in textual design. The results obtained by Farías and Araya (2014) indicate that in the case of multimodal texts, the Magariños model offers better opportunities for the exploration of signs and cultural meanings, while the model by Kress and van Leeuwen allows readers to delve deeper into the structure, organization and relationships between the text and images. These models enable the evaluation of the didactic possibilities that visual literacy presents for the development of new competencies, critical thinking and innovative pedagogical strategies in language teaching and learning.

According to Lotman (1978), text is a coherent set of signs and is defined as any form of communication that occurs within a certain sign system. From this broad point of view, which was further developed by later research on the semiotics of culture, the following are considered texts: a poem, a painting, a ballet, a theatrical performance, a military parade, a ceremony, a musical piece, and all the behavioural symbolic systems (Anonymous, 2013). Emphasis has been placed on the simultaneity of verbal and non-verbal codes in texts and intertexts (Moya-Guijarro, 2014; Anonymous, 2015) that require an intersystemic interpretation; that is, the use of multiple semiotic codes or different reading levels to interpret a message (Barthes, 1977). To all this, we must add the cultural references or myths that one acquires (Barthes, 2009) and the cultural context of the viewer, which is related to the subjectivity of perception as established by Panofsky (1955) in his iconological analysis method.

We considered the model by Sipe (1998), who investigated reading books that use more than one sign system and presented a theory of text/picture relations based on *transmediation*.

The fact that an image can have multiple readings or meanings is advantageous for visual literacy programmes, as it eliminates the fear of making mistakes. This "allows the students to not worry, to relax and to increase their class participation" (Foncubierta, 2013, p. 8).

Some authors have proposed the optimal characteristics of the images included in a visual literacy endeavour (see Goldstein, 2008):

- Familiarity (easy reading)
- Usability (relates to the students' own experience)
- Impact (higher than the conventional meaning)
- Multiple interpretations (a message that is not overly explicit)

It also should be noted that the communication skill of iconic reading greatly enhances literacy acquisition and is very useful in the field of foreign languages, especially for illiterate adult students and new readers (Llorente, 2014).

The mere presence of images in manuals does not guarantee the development of the competency to extract the meanings encoded in the image (for the characterization of multisemiotic written specialized texts, see Parodi, 2010). Language teachers usually have not received specific training in the use of images in the reading and writing processes. Consequently, our aim here is to summarize a proposal that supports the reading of iconic texts and the measurement of their effects on reading comprehension. Students must be able to discover the denotative and connotative meanings of an image. According to Villa (2008), the constitutive elements of an image are morphosyntactic and semantic. The morphosyntax of the image has three categories: morphological, dynamic, and scalar. Morphological elements include point, line, colour, shape, texture, and plane. Dynamic elements correspond to movement, rhythm, and tension. Scalar elements are dimension, scale, and proportion (for example, disproportions between objects or characters that have some connotative value) (Villa, 2008). These elements are read literally to obtain the denotative meaning of the image; by contrast, discovering the connotative meaning is a complex task that requires previous training regarding cultural referents such as the author's lifetime, the artistic movement, the context, the multiplicity of semiotic codes used to codify the message, the symbols (different symbolic systems have different cultural references in intercultural communication), the clothing, the gestures, the communicative purpose, etc. (Anonymous, 2013).

The most basic level of reading of an iconic sign is determining the denotative meaning of the image. The connotative message of an image, however, is usually symbolically and culturally encoded with spatial and temporal variants of the symbol (for example, a dragon or a knight in a novel about chivalry).

Iconic signs are conventional: they do not align with reality, and they do not possess the properties of what is represented. There are rules that govern their identification/representation and their recognition/interpretation; they transcribe an experience via a code. The signs of this code correspond to a specific historical, social and cultural era. Therefore, they have synchronic and diachronic characteristics.

The denotative and connotative meanings of an image complement each other to form a whole: a communicative message that is usually polysemic. Therefore, it is important to use the image as a pedagogical and didactic strategy in a planned and intentional way.

Visualization is a characteristic of inferential thinking that enhances memorization and motivation. It refers to the creation of images in our minds during reading and is the reader's internal cognitive response as well as a necessary condition for the comprehension of texts. According to Keene and Zimmerman (2007), readers spontaneously create mental images before, during and after reading. These created mental images are based on the reader's existing knowledge and experiences (Augustowsky, 2011, Gambrell & Jawitz, 1993).

According to De Koning and van der Schoot (2013), visualization can be a good comprehension strategy. Their research indicates that reading comprehension improves when visualization is applied in a methodical and organized manner and with the necessary training. Better results are observed in young children or children who have difficulty with reading comprehension. These authors describe two categories of visualization strategies:

1) internal (mental) or external visualization (with drawings, dolls, etc.); and
2) unimodal (only visual) or multimodal (visual in combination with other sensory modalities: auditory, kinaesthetic (movement), gustatory and olfactory).

Learning is related to different comfort zones that involve different sensory media in the processing of information. Foncubierta (2013, p. 1) states that "you learn what you feel, and, in this sense, the design of multisensory activities reveals to teachers a set of procedures with which to mobilize cognitive resources, combine affective content, and seek the physical involvement of students". Visual literacy and images heighten and maintain the student's attention since they create a safe and pleasant experience. They activate different ways of learning that are based on a variety of codes, not just linguistic ones. They combine different types of input: an input flood or flood of sensations (to direct the student's attention) and sensory input.

In our study we used mixed texts: linear and continuous (texts) and noncontinuous (pictures). For a future study, we plan to include text with graphic organizers with the intention of helping students learn more effectively from textbooks (Robinson, 1997) as a reading strategy to take advantage of its benefits didactically: graphic organizers "are conducive to assisting students in activating prior knowledge, gaining an insight into text structure, identifying as well as connecting the main ideas of a text resulting thus in better recall and retention of information" (Manoli & Papadopoulou, 2012, p. 7).

Other research confirms that "graphics are effective learning tools only when they allow readers to interpret and integrate information with minimum cognitive processing" (Vekiri, 2002, p. 1).

We begin with the hypothesis that visual literacy and images facilitate learning overall and particularly memorization, creativity, and imagination, in addition to reading comprehension.

3.   OBJECTIVES AND HYPOTHESIS

3.1.1   Overall objective

The overall objective is to evaluate the effects of an experimental programme (a proposed visual literacy programme) that uses images to improve reading comprehension.

3.2 Specific objectives

- Evaluate and compare the reading comprehension levels of the groups in the experiment (pre-test and post-test).
- Determine the degree of improvement in reading comprehension after the experiment or treatment (experimental group = EG) and compare it with that of the participants who did not receive the treatment (control group = CG).
- Study the effects of reading the denotative and connotative aspects of images on reading comprehension as well as creativity and expression, literal and inferential reading, the ability to synthesize and summarize, the understanding of comparisons and metaphors, and understanding at local micro-structural and global macro-structural levels.
- Improve students' ability to discriminate visually (for reading and overall images).
- Improve students' ability to decode (interpret) visual content (for connotative and critical reading).
- Improve students' ability to understand the manipulation of images (for example, in advertisements).

3.3 Hypotheses

The visual literacy programme will increase reading comprehension. In addition, the students in the EG who were subjected to the experimental treatment will have a better ability to read images with connotative meanings due to the treatment received compared to those in the CG.

4.   METHOD

In this study, we intend to determine whether there are significant differences in the pre-test and post-test scores of two groups: the EG and the CG. The pre-test and the post-test both measure the following quantitative variables:
1) Independent variables
    - a) group: qualitative independent variable (two levels: CG and EG)
    - b) test: qualitative independent variable (two levels: pre-test and post-test)
2) Dependent variables

The experimental treatment should influence the dependent variables and should indicate an improvement in the post-test results for these dependent variables:
1) Reading of the denotative level of images; reading of the connotative or symbolic level of images; literal reading; inferential reading; synthesis and summarization capacity; understanding of comparisons (similes); understanding of metaphors; understanding at the local level (micro-structural); understanding at the global level (macro-structural); and reading comprehension (overall rating).
2) Creativity and expression (style).

The first group of variables is scored as follows: 1 = fail; 2 = pass; 3 = above average; 4 = outstanding, except reading comprehension, which is scored from 0 to 10. Creativity and expression are scored as follows: 1 = bad; 2 = good; 3 = very good. All variables are measured in the pre-test and in the post-test. We must caution that our hypothesis indicates that there will be no significant change in the reading of the denotative level of the images because no specific training is usually needed to comprehend images at this level. However, specific training is needed for the other variables.

4.1 Participants

The participants were 221 primary and compulsory secondary education (*Educación Secundaria Obligatoria - ESO*) students: 72 students were in the sixth year of primary school, 73 were in the second year of ESO, and 76 were in the fourth year of ESO. Their ages ranged from 11 to 16 years, and most (mode) were 15 years old. The age differences were not significant and were within the class limits of x^2 = 37.130, p > .05 (p = .056). Regarding the gender variable, there were slightly more females (n = 119, 53.8%) than males (n = 102, 46.2%).

The 221 participants were divided into two groups: a CG (107 students, 44.4%) and an EG (114 students, 51.6%). Group/class assignment was random. Six schools located in two Spanish autonomous communities (Andalusia and Madrid) participated.

4.2 Instruments

Tasks were selected from two different tests to assess the students' ability to interpret connotative and symbolic images in different types of text and use this interpretation to understand the text: CLIP (Reading Comprehension Test for Primary Intervention) and CREA (Creative Intelligence Test).

There were two versions of the combined test (CLIP+CREA) for each grade level (A and B). Version A of the test was given before the application of the experimental treatment, while version B was given after the application. Both versions included four readings: two descriptive passages with pictures and two narrative passages with pictures. Different texts with images or only images, and five types of questions of a literal, local, global, inferential, and critical nature were used, followed by adaptations to the classification of Magliano, Millis, Ozuru and McNamara (2007). Creativity was measured through a task based on the CREA test. In this test, designed for individuals aged six years to adulthood, verbal creativity is related to the ability of the subject to develop questions from the supplied graphic material (Corbalán, Martínez, Donolo, Alonso, Tejerina & Limiñaña, 2003); the instruction of the test is: *I will present an illustration. Your task is to write down all the questions you can ask about what the picture represents. Try to ask as many questions as possible*.

The experimental treatment and the tests (A and B) were the same for each school stage. There were small modifications by school stage to consider the law that established the curriculum, in addition to the difference in age and in previous training.

The Spearman *rho* value confirmed the reliability of all tests (between 0.68 and 0.73). The validity of the construct was measured with a factorial analysis that confirmed that each test comprised a single factor.

4.3 Procedure

Data were collected in three phases: 1) pre-test: CG and EG were evaluated before the application of the treatment; 2) the treatment was applied to the EG; and 3) post-test: both groups were evaluated at the end of the experiment.

The experiment was administered by teachers at their respective schools with the collaboration of school administrators, who provided us with the student's anonymous academic results. Informed consent was also obtained from the families of the participating students. Student participation was voluntary, and the anonymity and confidentiality of the results obtained were guaranteed. Therefore, our study meets the ethical requirements for research with human beings.

The experimental treatment was provided during the 2020-2021 academic year in the in-person modality. At the beginning of the experiment, both groups were determined to be comparable in terms of first-quarter grades in the subject of Spanish Language and Literature. Homogeneity or homoscedasticity in the two groups was confirmed by means of Levene's test. The experiment was conducted in twenty

sessions during the second and third quarters and ended with another test to compare the results for both groups. The activities had different durations (10-20 minutes) and thus occupied only part of the 55-minute session. Six professors participated and subsequently acted as evaluators. The activities are described in a later section.

According to age and previous knowledge, some activities have been applied only in one of the educational stages or at only some grades (primary education or secondary education).

The construct of reading competence was defined, and, following Clifford and Cox (2014), we ensured a balance between the objective (non-literal comprehension), the selected fragment, and the reader's task for each item. Our study did not use multiple-choice questions because we accepted the results of a study by Rupp, Ferne and Choi (2006) that demonstrated that using multiple-choice questions to assess reading comprehension can alter the construct being tested, especially when the text is too difficult for the reader. This study revealed that readers stopped reading and switched to problem-solving strategies in an attempt to deduce the most likely answer among the choices provided.

The interest and motivation of the participants in the visual code-based activities were verified during our experimental treatment. In this regard, our results concur with numerous studies demonstrating improvements in the academic performance of students with verbal expression problems, reading and writing problems, or dyslexia, mild autism, etc. Visual codes also contribute to improvements in intellectual, affective, and aesthetic levels (see Moore, 2013; Foster-Cohen & Mirfin-Veitch, 2015; Cohen & Demchak, 2018). Students can read surreal texts, intertextuality, colour, line, metaphors, visual humour, etc. (Arizpe & Styles, 2002).

4.4 Data analysis

The study applied a quasi-experimental, repeated-measures design with a CG. The sample was not selected at random. Rather, the two groups were selected by teachers who collaborated with the study. The study was bifactorial with pre-test and post-test groups. Furthermore, this study was a longitudinal study that gathered data before, during and after an intervention period of 20 weeks.

A quantitative method was applied that used different analysis techniques: descriptive analysis, inferential analysis, Student's *t*-test, Spearman's correlation analysis, MANOVA and ANOVA. SPSS (version 24) was used to analyse the data.

5. CLASSROOM ACTIVITIES

In this section, we describe some activities specifically designed for our experimental programme. They worked in parallel with the tasks included in the CLIP and the CREA tests, which were combined and adapted for this research.

The students in the EG proposed the experiment title of 'A picture helps to read a thousand words'. The eight readings developed for the experiment (four readings in test A and four readings in B) have diverse content that includes descriptions, narrations of experiences, etc. They are accompanied by activities related to verbal and written expression, pictograms, summaries, and semantic and syntactic structures. The activities focused on the denotative meaning of images as well as the connotative and symbolic meanings. Most of the activities were performed by groups of three students, but there were also activities for individuals and pairs.

The following are some examples of activities regarding visual codes:

1) Comment on the information conveyed by the various images.
2) Examine an advertisement with no sound to see what images are presented in the advertisement and what they are associated with.
3) Take apart an advertisement and create a new one.
4) Create a graffiti drawing. To avoid drawing on a wall, use a tool on the internet called *LetterJames*, which enables the creation of graffiti from templates with background images. There is a character limit, so students (in groups or in pairs) must negotiate to determine the most appropriate slogan. The activity stimulates expression, synthesis, reflection and teamwork. Students who use the *Moodle* platform can share and comment on their idea in an online forum.
5) Select an image that illustrates the following exchange of qualities (adapted from Foncubierta, 2013):

   I'll trade you a gram of enthusiasm for a metre of your talent.
   Do you want to trade a pinch of your wishful thinking for a spoonful of my honesty?

6) Describe a landscape associated with a pleasant feeling, such as calm or joy, or a landscape associated with anxiety.
7) Make up a story with given illustrations (the polysemy of the word *chorizo* is also worked out through images, the children's story about the little mouse Pérez through the sign of Calle Arenal, 8 in Madrid, which bears his name). The students are asked to write their stories down and then tell them to their classmates.
8) Imagine a story, paying attention to the titles of the paintings. The following images, two paintings by Ignacio Pinazo, were proposed for this class activity: *Las calabazas* (Figure 1) and *Sancho leyendo el Quijote* (Figure 2).

Figure 1. Painting by Ignacio Pinazo, Las calabazas.
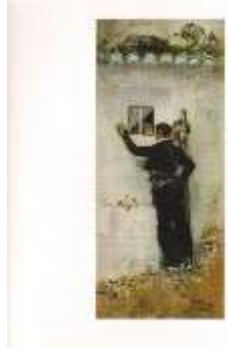
Figure 2. Painting by Ignacio Pinazo, Sancho leyendo El Quijote.

The aim of this activity is to show the students that comprehension and interpretation of an artistic work involves the decoding of many codes that go beyond a simple recognition of primary data. Intertextual transformations and transcoding are operations that one has to take into account to interpret the messages (Mendoza, 1993). One must learn to "read" images in the sense of making semiotic interpretations of the image.

What is interesting and complex in this activity lies in the relation of complementarity between the artistic text and its title. The title text strengthens the connotations and thus diminishes ambiguity and polysemy. Hence the need to make a semiological reading that combines the linguistic with the pictorial code—that is, to use the title of the painting as the key to its interpretation. Put another way, we need to know the Spanish idiom *dar calabazas a alguien* (*to give [someone] the brush-off*) and apply it to our reading of the first painting (Figure 1), in which a very interesting relationship of intertextuality and intermediality is created. Nothing is casual in an

artistic work; everything is created *ad hoc*. The whole artistic work is considered significant and everything in the work equates to a message. The verbal phrase *dar calabazas a alguien* (*to give [someone] the brush-off*) is polysemic. In the *Diccionario de la lengua española* [*Spanish Dictionary of the Royal Academy*] (Real Academia Española, 2021), the following meanings are given for *dar calabazas a alguien*: 1. 'fail someone in an exam'; and 2. 'snub or reject someone when being courted'. The latter meaning is the key to interpreting the painting *Las calabazas*.

The second painting (Figure 2) works with intertextuality, as well as the cultural key that lies in knowing the work by Cervantes (*Don Quixote* and its protagonists).

The activity is an example of how semiotic (macro-)competence acts as a regulating mechanism that requires the recipient to activate a series of inferences.

9)   Illustrate a written passage (read the text and choose images to illustrate it).
10) Write picture captions for the images presented by the teacher based on the information conveyed by the image.

Denotative and connotative reading of images with a high degree of polysemy and connotation.

Option 2. Each student selects a photo on the internet, and the other students must suggest possible captions for it.

This activity, in addition to building linguistic communication competency, exercises knowledge competency and interaction with the physical world through context recognition and awareness of the different levels of importance of the elements in an image (for example, see Figure 3).

Figure 3. Global warming (Xinyu Li, 2016).

Note. No copyright (CC PDM 1.0)

11) Write descriptions of a photo that would be appropriate for the following captions:

Málaga opens a zoo without bars or cages.

A horse looks at a policeman.

The singer has the face of a child killer.

The taboo has been broken.

12) Look for iconic information in different contexts; locate the information desk or services at an airport, etc.
13) Describe some people and then find images of what their bedrooms would look like.
14) Analyse cartoons.
15) Put images to the lyrics of a song.
16) Describe the portrait of a writer. This is an exercise in denotative meaning.
17) Discuss paintings by Dali.
18) Establish the structure of a text and choose images for the parts of the text.
19) In the sentence 'My father throws away the garbage', put the number 1 above the verb, number 2 above the subject, and number 3 above the direct object. Put numbers 4, 5 and 6 above other elements, if any, and define their syntactic function in the sentence.
20) Paintings with two people: What are they talking about? Imagine and write a story. Use the painting *Niños comiendo uvas y melón*, by Bartolomé Esteban Murillo.
21) Incomplete images (to exercise creativity):
    - a) Show the students a previously cropped image. Ask them to create a denotative description and guess what is in the portion that was cropped out. Last, show them the complete image.
    - b) Perform a similar activity for images with action: What happened before? What happens next?
22) Choose an appropriate image for this message: *Today, December 28, the TV1 news desk reminds you to turn the clocks ahead tomorrow.*
23) Think up a story about this image and then search the internet for the real story of the photo. Example: Find the history of the image in Figure 4 using the clues 'kiss', 'nurse', 'World War II' and then discuss it in class.

*Figure 4. Kissing the War Goodbye (Victor Jorgensen, 1945).*

Note. Copyright-free photograph (Wikimedia Commons)

6.   RESULTS AND DISCUSSION

The analysis of the independent samples performed before the experimental treatment allowed us to determine whether sufficient homogeneity was present and thus to conclude whether the post-test findings were due to the experimental treatment or to existing differences between the EG and the CG. A comparative analysis using Student's *t*-test indicated homogeneity between the EG and the CG (before treatment); that is, there were no statistically significant differences in reading comprehension ($t = -0.054$; $p > 0.05$). The homogeneity or homoscedasticity of the two groups before treatment was confirmed by Levene's test: equal variances are assumed, so H_0 is accepted ($p = 0.7$). In the two groups, similar yields were observed before treatment. The gender variable also did not present significant differences between males ($t = 0.086$; $p > 0.05$) and females ($t = -.167$; $p > 0.05$).

Student's *t*-test for independent samples (post-test, CG and EG) indicated that the students showed significantly lower academic achievement in reading comprehension before the treatment ($M = 6.65$; $SD = 1.28$) than after ($M = 7.69$, $SD = 1.24$; $t(219) = -6.118$; $p < 0.05$; $r = 0.38$), while the *r* value (strength) showed a moderate effect. Student's *t*-test for dependent samples (EG only, before and after treatment) indicated that the students showed significantly lower academic achievement in reading comprehension before the treatment ($M = 6.79$; $SD = 1.16$) than after the treatment ($SD = 1.222$; $t(113) = -11.926$; $p < 0.05$; $r = 0.75$). The *r* value (strength of the effect) indicates a large effect. The improvement in the students' scores is illustrated in Figure 5.

Figure 5. Reading comprehension: average pre-test and post-test scores.
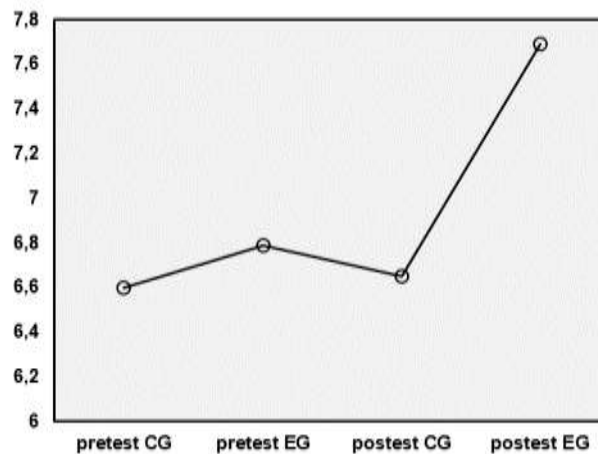
The EG's scores were higher than those of the CG. The statistical analysis indicated that this difference is statistically significant, so we can conclude that the experimental treatment of using visual code and visual literacy contributed to the improvement in reading comprehension results. Significant improvement was observed, especially in the global or macro-structural level of a text, the comprehension of comparisons (similes) and metaphors, the ability to synthesize and summarize, and the reading of the connotative level of the visual code. All these variables have a p value of less than 0.05. Creativity also increased (direct relationship: *rho* = 0.491 and significance of 0.000 at a significance level of 0.01). These data points were obtained using Spearman's correlation for the prediction of the results. The direct relationship means that an increase in the value of one variable also causes an increase in the other variable.

Our results for reading for connotative meaning are similar to those obtained by Taguchi, Gómez-Laich and Arrufat-Marques (2016), who studied the comprehension of indirect meaning and implicit intention among students of L2 Spanish using an original, computer-based, multimedia listening test that employed inferential processing. Their study assessed comprehension of three types of indirect meaning: indirect rejections, indirect opinions, and irony; irony turned out to be the most difficult type to understand.

Regarding the variables of expression and style, the results indicate that their values are within the limits of insignificance (*p* = 0.046). MANOVA (multivariate analysis of variance) including the individual ANOVAs was also performed; the MANOVA technique enables working with all the variables simultaneously. The Bartlett sphericity test (< 0.000) confirmed that MANOVA can be applied, and Box's M-test (*sig*. = 0.023) indicated that the covariance matrices were homogeneous.

A distribution that approximates normal was observed; that is, the assumption of normality is met. Table 1 provides three examples for the two groups: reading comprehension, inferential reading, and metaphor comprehension.

The effect size (*partial eta^2* = 0.317) for the independent variable (group) was moderate-to-large for all dependent variables, as indicated in Table 2. Effect size is interpreted as follows: small (r^2 of 0.016-0.06), moderate (r^2 of 0.06-0.15), and large ($r^2 > 0.15$).

The variety of techniques used in the data analysis confirmed that the independent variable (group) influenced all the dependent variables and produced significant differences. This confirms that the treatment produced improvements in all these reading comprehension variables.

7. LIMITATIONS OF THE RESEARCH AND OPPORTUNITIES FOR IMPROVEMENT

Although there were two groups (CG and EG) and six evaluators, one limitation that can be improved upon is the number of participants and the difficulty of ensuring that all the tests are sufficiently objective. In addition, follow-up post-tests after the post-test performed immediately after the experimental treatment were not included to confirm whether the acquired knowledge was maintained in the long term.

Table 1. Plots for reading comprehension, inferential reading and metaphor comprehension.
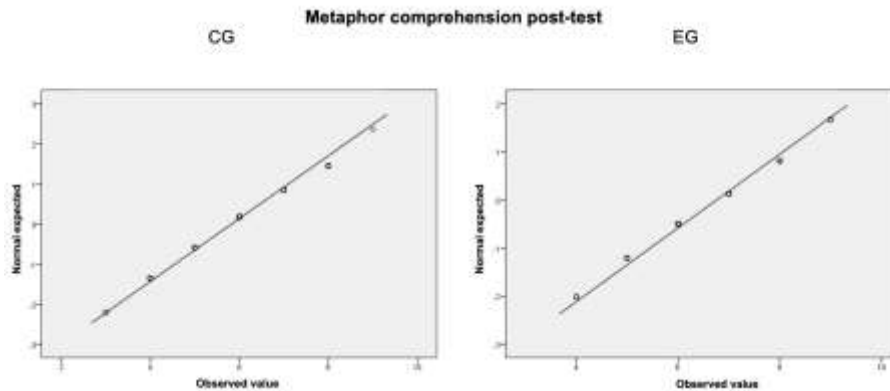
Metaphor comprehension post-test

CG

EG
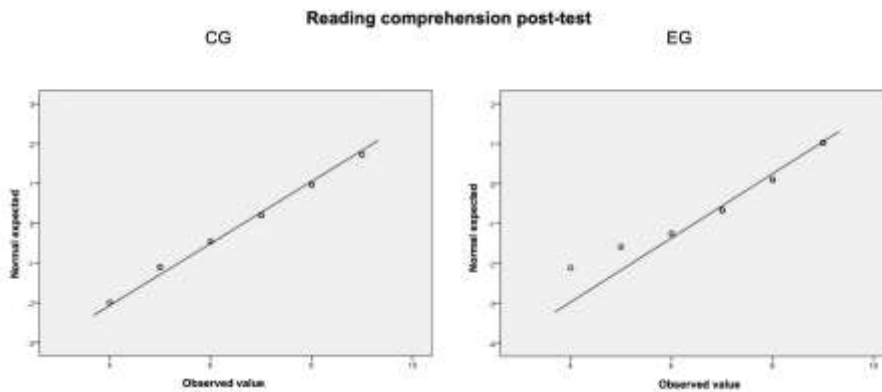
Table 2. Effect size

Dependent variables in the post-test	*Partial eta^2* (effect size)
Inferential reading	0.223
Ability to synthesize and summarize	0.145
Understanding of comparisons (similes)	0.206
Understanding of metaphors	0.116
Understanding at the local micro-structural level	0.232
Understanding at the global macro-structural level	0.250

8.   CONCLUSION

The consumption of text and visual messages has exploded due to the increasing availability of social networks. Therefore, incorporating images in the classroom and planning for their use in the didactic process can have numerous benefits for academic performance. Sometimes, visual stimuli or images can focus and hold a student's attention better than textual support. These images become input and, in addition, accelerate learning and memory retention. The youngest among us are bombarded by iconic language from television as soon as they are born. Later, street signs, video games, computers, etc. are added. Therefore, visual literacy is important for preparing children for the world they live in and for providing them with a capacity for reflection and critical thinking that will help them avoid being manipulated by media and advertising through the use of images.

This study suggests that visual literacy and, specifically, the reading and interpretation of connotative and symbolic images lead to improved reading comprehension, especially at the global or macro-structural level, in addition to improvements in literal and inferential reading, increased understanding of comparisons (similes) and metaphors, improvements in the capacity to synthesize and summarize, and greater creativity.

We do not propose that iconic texts should replace or outweigh verbal texts but rather suggest that their didactic potential should be taken advantage of because they are attractive to young people and because of their frequency in modern life. The quasi-experimental nature of this research ensures the validity and scientific rigour of the results. We also believe that its practical application will be useful for many teachers.

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