



From perception to creative writing: A multi-method pilot study of a visual literacy instructional approach

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ABSTRACT

Visual literacy is the set of skills used to ascertain meaning in visual stimuli (e.g., visual art, pictures, or abstract representations). We present a new visual-literacy based instructional approach—and its underlying theoretical model—in which museum educators introduced children and their teachers to works of art in a museum setting, then guided teachers to bring visual images and art objects into the classroom to present children with new visual experiences, increase their visual and verbal skills, and, ultimately, promote their development as writers. A set of three multi-method exploratory studies is then presented to examine key aspects of the instructional program: (a) observations of children's verbalizations in a group discussion of a work of art before and during exposure to the program; (b) examination of story-writing skill development in a pre-posttest control-study design; and (c) retrospective interview analysis, tracing the underlying thinking processes engaged during a visual-literacy based writing activity. Although the new instructional approach presented here is still under development, preliminary results show promise that visual-literacy practices may facilitate children's development of writing skills with regard to vocabulary, narrative structure and originality, through a better sense of observation and increased inferential thinking.

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Developmentally appropriate curriculum practices capitalize on what children bring to school from the world they have come to know through images, sounds, and symbols. This emphasizes the multimodal nature of communication, meaning-making, and the acquisition of literacy. Hence, researchers have studied for decades the role of visual images, drawing, and oral language in promoting children's literacy (Albers & Harste, 2007; Dyson, 1982, 1983, 1986, 2001; Harste, Leland, Grant, Chung, & Enyeart, 2007; Harste, Woodward, & Burke, 1984; Heath, 1983; Kendrick & McKay, 2004).

Building upon multiple theoretical and evidence-based premises of visual-literacy-based instruction (e.g., Burton, Horowitz, & Abeles, 2000; Calkins, 1986; Cowan & Albers, 2006; Ernst, 1997b; Housen, 1992; Short, Kauffman, & Kahn, 2000; Trainin, Andrzejczak, & Poldberg, 2005), here we explore the effects of a new instructional approach to literacy—based on the Perception, Interpretation, Expression (PIE) model of writing development (Tan et al., 2012)—that aims to improve writing skills by practicing visual literacy skills. After presenting the theoretical foundations of this instructional approach we report on a set of three exploratory studies designed to capture change under the influence of this instructional approach. These

studies use complementary methodologies, to tap into the major components of the model: verbalizations stimulated by an authentic work of art, written expression development, and the thinking processes that connect both modalities.

1. Implementing visual literacy in the classroom

1.1. Visual literacy and its use in teaching practices

1.1.1. Defining visual literacy and exploring its contribution to writing

Although there are many accepted definitions of visual literacy (Avgerinou & Ericson, 1997), it is often broadly defined as the ability to discern meaning in visual images (e.g., Yenawine, 1997). This can range from identifying or naming what is seen, to more complex activities, such as questioning, analyzing, categorizing, or interpreting. Hence, visual literacy calls upon many aspects of cognition, such as identification, analysis and inferencing (Yenawine, 1997), the practice of which may support the development of writing and creative outcomes at various levels of expertise (Flower & Hayes, 1981). Indeed, several lines of evidence have supported this connection between visual literacy and writing.

First, visual literacy is based on vision, the most dominant of all sensory systems in humans. More areas of the brain are devoted to visual processing than to any other sense, and visual areas develop

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sooner than other cerebral regions required for reading and higher-level thinking (Gogtay et al., 2004). Consequently, the development of visual skills may support other developing skills. For example, forming visual associations may help young readers to enhance their comprehension (Gernsbacher, Verner, & Faust, 1990), which is consistent with contemporary brain imaging findings (Speer, Reynolds, Swallow, & Zacks, 2009). By extension, it is likely that visual skills may nurture mental imagery, thereby enhancing writing descriptions or idea generation in creative writing work. In accordance with this idea our previous research showed that experts from various domain of interest (including professional writers, linguists, or teachers) tend to situate observation as the most important skill in the creative writing process (Barbot, Tan, Randi, Santa-Donato, & Grigorenko, in press).

Research also indicates that mental imagery allows writers to recall or create a mental representation of a setting, character, or event to facilitate written description, which in turn can create scenes and images in readers' minds, and arouse readers' visualization and imagination (e.g., Flower & Hayes, 1984; Sadoski, Kealy, Goetz, & Paivio, 1997; Zimmerman & Risemberg, 1997). Thus, the use of imagery in writing (the elements in a literary work used to evoke mental images) enhances the overall quality of writing, as extensively reviewed and empirically confirmed by Sadoski et al. (1997) and others (e.g., Berrian, Metzler, Kroll, & Clark-Meyers, 1979). Several studies have also underlined the increased originality of written compositions when the instruction for the writing task involves the use of imagery (Jampole, Konopak, Readence, & Moser, 1991; Long, Hiebert, Nules, & Lalik, 1985; Martindale, 1990; Short et al., 2000).

A final line of evidence for the case of visual literacy in writing and its development has focused on the mental processes underlying the transition between visual and verbal activities (e.g., looking and reading, drawing and writing). Dyson (1986), for example, proposes that drawing and talking are active parts of the process of becoming literate and learning the complex system of written language. This hypothesis is built upon Vygotsky's (1978) precept, according to which children learn to manipulate complex symbolic systems of expression (e.g., writing) based on earlier learned, less complex symbolic languages, such as gesture, speech, and drawing. It is also proposed that the "translation" or "transmediation" between two symbolic systems (such as verbal language and pictorial) results in the generation of new ideas as writers invent the connections between the two systems (Siegel, 1995; Suhor, 1984).

Research on the stages of writing development supports these observational studies of children transitioning between visual and verbal modes of communication to writing. According to one theory of writing development, the earliest developmental stage is "knowledge telling", that is, creating or retrieving what one wants to say (which could be in the form of a visual image) and then generating text to say it (Kellogg & Whiteford, 2012). There is evidence that teachers can support this stage in early childhood by encouraging children to say what they think and write what they say (Berninger, 2009; Berninger & Chanquoy, 2012).

1.1.2. Visual literacy in the writing curriculum

Because components of visual-literacy such as observation and the production of mental imagery are often described as significant contributors to creative writing, particularly within the theoretical context of multi-modal learning (Albers & Harste, 2007; Jampole et al., 1991; Long et al., 1985), it is not surprising that bridges between visual art and writing have been suggested. Whether grounded or not in research findings, incorporating the visual arts into classroom literacy instruction has been a popular instructional method among teachers (e.g., Danko-McGhee & Slutsky, 2007; Ehrenworth, 2003; Ernst, 1997a; Harste et al., 1984; Kress, 2000; Mulcahey, 2009; Olsen, 1992; Olshansky, 1994; Tooley, 2009; Whitin, 2002; Zoss, 2007). Some classroom teachers have embraced established programs, such as *Picturing-*

Writing (e.g., Olshansky, 1994), in which students mine their artwork for images, ideas and stories, using their artwork to inform their writing. Other teachers have developed lessons from personal experiences (e.g., Williams, 2007). For example, Ernst (1994, 1997b), an art and English teacher, combined the writers' workshop model with the artists' workshop model in her own art classes to help children connect their thinking processes with their art, and then locate and express the meaning in their own art in writing.

The generally conceived idea that art education enhances thinking and learning, and may therefore serve a prominent role in the school curriculum, traces back at least as far as Dewey (1934), and has been carried forward by scholars such as Eisner (2002) and Greene (2001). Burton et al. (2000) suggest that the interactive relationship between learning in the arts and learning in other subject areas can result in increased skills in meaning making and problem solving. Housen (1987, 1992) established five successive stages of esthetic development that focus on strategies for drawing meaning from works of art. In the "Accountive Stage", viewers are "storytellers," using their own knowledge, personal associations, and information from their senses to create a narrative understanding of a work of art. Based on Housen's work, Downey, Delamatre and Jones (2007) found a positive transfer of critical thinking skills from visual to written text, in response to a museum-school intervention. Generally, museum-school programs have been documented as an important means of linking learning in the arts with learning in "core" subject areas (Burchenal & Grohe, 2007; Catterall & Waldorf, 1999; Tan et al., 2012; Tishman, MacGillivray, & Palmer, 1999).

1.2. A visual literacy-based instructional approach to improve writing outcomes

Following the promise of visual-literacy-based instruction reviewed above along with a growing body of research on the role of visual literacy in children's writing development, we devised an innovative instructional approach through a partnership between museum educators at the Yale Center for British Art (YCBA) and classroom teachers in Connecticut. The main goal of this program was to develop writing skills—particularly vocabulary, narrative structure, and originality—through a combination of multiple "literacies." The conceptual grounding for the articulation of these multiple literacies is based on a theoretical model developed in related work (the PIE model; Tan et al., 2012). We now present the main principles of this model and its implementation through our instructional program.

1.2.1. The PIE model

The PIE model is grounded in the theoretical conception that writing skills develop through the combination and extension of multiple "literacies." Specifically, the PIE model integrates three basic lines of research evidence (reviewed above): that (a) visual literacy capitalizes on the dominance of vision as a form of perception; (b) mental imagery may facilitate written description, which in turn can activate readers' visualization and imagination (e.g., Flower & Hayes, 1984; Sadoski et al., 1997; Zimmerman & Risemberg, 1997); and (c) there are mental processes underlying the transition between visual and verbal activities (e.g., looking and reading, drawing and writing) that may result in the creation of new conceptual connections (Siegel, 1995; Suhor, 1984). The PIE model may then be integrated into literacy instruction based on the following principles: that (a) there are processes (cognitive, conative, linguistic) contributing to the relationship between visual, verbal, and written expression that may be targeted as catalysts of learning; (b) these processes (the key elements of the PIE model) can be improved using visual literacy-based instruction; and (c) the museum-school partnership model, as a new teaching context that locates art in literacy learning, can be an effective facilitator of writing development (Tan et al., 2012).

The PIE approach thus emphasizes the role of key thinking processes in the development of writing through visual literacy. Specifically, the skills learned in the context of visual literacy activities (e.g., observing, interpreting, and expressing ideas about works of art) can presumably transfer to written expression. We segmented this development of skills into three generally sequential but also naturally iterative phases, based on the cognitive and procedural flow of activity that a child engages in upon encountering a visual stimulus, leading to a written response: Perception, Interpretation, and Expression, each involving specific thinking processes—Perception (through observation and representation), spoken expression (increasing vocabulary through interpretation and explanation of what is perceived), and written expression (transforming orally expressed thoughts into writing to create a written product based on a visual stimulus).

1.2.2. *The PIE instructional approach*

During the 2009/2010 school-year, we implemented a PIE-based instructional approach with first and second grade students in a suburban K-3 school. Implementation was facilitated through a partnership between teachers of this school and the YCBA museum educators, who supported teachers as they integrated visual literacy activities into their language arts curriculum. Visual literacy activities were thus incorporated into classroom learning, in a weekly lesson focus. Participating teachers attended a summer institute at the YCBA to learn about the PIE model and its broader instructional context. Museum educators worked with classroom teachers to supplement the language arts program with visual literacy activities, and subsequently guided teachers in the design of their own visual literacy activities consistent with the PIE instructional approach. For example, teachers taught and reinforced vocabulary through children's observations of works of art, focusing on words to describe colors, location, direction, or facial expressions. In this activity, observation/perception becomes productive through oral description and discussion, and content generation results from what the children's observations make them think about. In contrast, other models posit the writing prompt as a cue for children to probe their memory for a relevant response (e.g., Bereiter & Scardamalia, 1987; McCutcheon, 2006).

Children were also encouraged to “narrate” or invent the story they “saw” in narrative paintings, prompting them to elaborate on the setting, characters, and actions the painting inspired. Ideas for writing were often generated by “reading a painting” to interpret the painting's images, then sketched in a pre-writing activity to help develop their ideas. The planning phase was thus carried out in an open-ended sketching activity based on but not limited to the stimulus. This offered them a second modality with which to articulate their plans, which for some may be difficult to express verbally (McCutcheon, 2006). Text generation and transcription occur as outlined in previous models (Berninger & Swanson, 1994), yet this visual literacy approach may result in richer, more original texts as each child's associative network has retrieved different material based on personal knowledge and experience, even while responding to the same stimulus.

2. Empirical evaluation of the PIE instructional approach

To estimate the progress observed through the influence of the described PIE instructional approach and set up the methodological tools needed for future extensions of this work, we conducted a multi-method exploratory study focusing on first and second grade students from four classes of the participating school. This group received ongoing lessons using visual literacy practices based on the PIE instructional approach described above, embedded in the children's language arts curriculum. Our overarching objective was to inform the extent to which targeted aspects of writing development were enhanced under the influence of our visual-literacy-based

instructional approach: Did the children increase their skills in observation and related vocabulary, and evidence-based inferencing skills? What processes helped them transition and be more creative as they moved from one form of literacy to another? And finally, did the visual-literacy based instruction result in better-structured, more original writings? To address these questions, three different methodological and analytical approaches were used in each of the exploratory studies reported here.

In the first study, we focused on the perception component of the PIE model by examining the quality of the verbalizations emerging from interactive class discussions of works of art in the museum setting (based on video corpuses), and we estimated the qualitative change in children's verbalizations over a span of three months of practice. This first approach aimed to capture the verbal “expertise” developed through the instructional program by the children as a group, with regard to perception, interpretation and creative elaboration upon a work of art. These skills are essential components of the PIE model; they support the transition between a visual stimulus and the writing outcome.

In the second exploratory study, we examined in depth the effect of the PIE instructional approach on the expressive writing outcomes of the children (here, originality and narrative structure of story writing) over a period of five months of training. We focused on narrative writing, as a genre familiar to children, whose elements (characters, settings, plots) may be discussed while looking at a painting (i.e., “What is happening here?”). We collected both “treatment” and “control” group children's writing samples on a pre-posttest study design, to estimate the amount of change in these targeted writing outcomes among the treatment group (PIE-based instructional approach) and the control group (traditional instructional approach). Although exploratory in nature, this study was intended to provide preliminary evidences of the incremental gain in writing skills, under the influence of our instructional approach.

In the third exploratory study, structured-interviews were conducted with a sub-sample of children directly after the writing exercise collected for the second study, enabling exploration of the underlying thinking processes engaged by the children during visual literacy and writing activities. In light of the PIE model, these thinking processes (including, for example, inferencing, selective combination, divergent and associative thinking) underlie the interpretive and associative action that enable children to generate unique, creative content for their writing, starting from a work of art. Thus, through these retrospective interview data, we sought to trace the processes used in the visual-literacy based writing task to better understand the mechanism by which the PIE instructional approach may improve creative writing outcomes.

Taken together, these three explorations conducted from multiple perspectives using varied methodologies inform our evaluation of the preliminary PIE-based instructional approach such that it can be improved in a targeted manner, and further support methodological tools that might be used in future research.

2.1. *Discussing a work of art in a museum setting*

2.1.1. *Overview of the first exploratory study*

Research evidence suggests that exposure to works of art through museum-based programs positively impacts the skills of “looking at art,” interpreting text, critical thinking and academic performance (e.g., Downey et al., 2007). To gain a closer look at the effect of our visual literacy based instructional approach, we examined the nature—and the change in nature—of the children's verbalizations that emerged from class discussions of a work of art in a museum setting. Specifically, we sought to estimate the qualitative change in the verbal productions of children involved in the PIE instructional approach. As the PIE program is designed to teach children to engage with a work of art through observation, in order to facilitate inference-based

interpretations leading to the production of original ideas, we expected to capture a change in the children's ability to "read a painting," increasing their descriptive skills and adding interpretive skills, as reflected in the children's verbalizations when questioned about a painting. To capture these qualitative changes across the study period (three months), we focused on the change in the use of qualitatively distinct categories of verbalization scored by trained coders for rubrics including both descriptive (e.g., concrete details, indicators of location) and interpretative (inferences, creative departures) levels of verbalization. A secondary objective of this exploratory study was to examine the relevance of the targeted categories of verbalization proposed to assess qualitative changes in children's verbalizations.

2.1.2. Method

2.1.2.1. Participants. The two first grade classes ($n = 44$; 43% boys and 57% girls) and two second grade classes ($n = 40$; with 36% boys and 64% girls) of the treatment group took part in this exploratory study. Three members of the research staff and a linguist scored the verbal corpus, which had been transcribed by two research assistants.

2.1.2.2. General procedure. During two visits of each classroom to the YCBA museum, we videotaped 15 min of each class engaged in an exercise involving a group discussion of a painting. Two paintings used for the activity were selected for their similar features (i.e., they were family portraits with landscape elements). Each of the four classes viewed and discussed a different painting at both observation occasions, and the order of the presentation of the paintings was counterbalanced across groups and observation occasions in order to control for possible "stimuli effects" (qualitatively different responses that each painting may have suggested).

For each session, labeled time 1 (T1) and time 2 (T2), the general procedure was standardized; that is, the same instructions and questions were addressed to the children at both time points. Specifically, the children spent about 1 min looking at the painting, then were asked three questions. The first solicited any general comments the children wanted to offer ("Let's talk about it"). The second addressed the descriptive level ("What do you notice?") to invite their observations. The third and last question addressed a more interpretive level ("What do you think is happening?") to elicit children's analyses of the content of the painting. Five to seven minutes to answer each question was allowed, so that all of the children who wanted to speak could have a chance to verbalize their observations and ideas. The entire class exercise was videotaped, and the verbal corpus transcribed as a list of uttered responses to each of the three questions.

The whole corpus, covering both T1 and T2, included a total of 312 utterances. Each utterance was then independently scored by the four raters (presented in a random order for each) for the number of "units" falling into five categories of verbalization¹: (a) concrete details (i.e. nouns—objects, people); (b) precise descriptive (i.e. adjectives); (c) indicators of location (i.e. prepositional phrases); (d) inferences made based on observable details; and (e) creative departures from the painting. For example, the utterance "There is a man with a black hat and a lady holding a baby. They are a family." would be scored four units for concrete details (man, hat, lady, and baby), one unit for precise descriptive (black), and one unit for observed-based inference (they are a family). Although this scoring method entailed ascertaining totals of

types of utterances, what we were interested were the differences in frequencies of the use of these qualitative types—descriptive, interpretative, and creative.

2.1.3. Results

2.1.3.1. Inter-rater reliability. Inter-rater reliability for the scoring of the five criteria (number of units counted by each rater for each of the 312 utterance, falling in each categories of verbalization) was high, with Cronbach's alpha coefficients ranging from .85 to .97 (concrete detail = .97; precise descriptive = .97; location = .91; observation based inferences = .85; creative departure = .94). Given this high reliability, the mean numbers of units identified by each rater were used to determine the final score within each category for each utterance.

2.1.3.2. Differences over time and grade. Distributions of the 852 resulting units across categories at T1 and T2 (i.e., total number of units counted) were then compared as a function of the grade level to estimate possible changes in the use of the five categories over time. Table 1 presents the number and percentage of units in each of the categories for both T1 and T2, as a function of the grade.

Chi-square statistics indicated that first grade students did not show significant differences in the use of the five categories between the two observation occasions ($\chi^2 = 3.0$, $df = 4$, $p = .56$). At both time points, first graders tended to use mainly the descriptive level in their verbalization, mainly citing concrete details (i.e. nouns). Although second grade students also mainly used the descriptive level over time, they showed a significant change in the use of the five categories over the study period ($\chi^2 = 17$, $df = 4$, $p = .002$), with a significant increase of precise descriptives (i.e., adjectives; with 14% at Time 1 and 24% at Time 2, $p = .022$) and observation-based inferences (8% at time 1 and 17% at time 2; $p = .008$), corresponding to a relative decrease in the use of the three other categories (analysis of relative change). Complementary analyses indicated a significant difference between grades on the use of some categories of verbalization across measurement occasions ($\chi^2 = 14.3$, $df = 4$, $p = .007$): second graders expressed a greater number of comments that were creative departures (11% vs. 3.2% in first grade; $p = .002$).

2.1.4. Discussion

This first study aimed to examine the development of children's expertise in observing and interpreting works of art through the PIE instructional approach, as reflected by their verbalizations in a group discussion of a work of art. These gallery sessions illustrated children's ability to look, express what they see, and ultimately express verbally what they think—an important step toward the generation of ideas and expressive writing (Berninger & Chanquoy, 2012). It also illustrated their development toward original "storytelling," as they interpreted paintings by combining what they knew with what they saw (Housen, 1987, 1992).

The methodology developed to examine this effect appeared satisfactory, since independent raters were able to identify the same qualities in the various children's answers to the task (reflected by high

Table 1
Number of unit and percentage of use of each category of verbalization for each time point and each grade.

Category of verbalization	Grade 1		Grade 2	
	T1	T2	T1	T2
Concrete detail	129 (52%)	124 (52%)	110 (51%)	65 (44%)
Precise descriptive	61 (25%)	51 (21%)	31 (14%)	35 (24%)
Location	31 (12%)	42 (17%)	29 (13%)	11 (8%)
Obs-based inference	19 (8%)	16 (7%)	17 (8%)	25 (17%)
Creative departure	9 (3%)	7 (3%)	29 (13%)	11 (8%)

Note. T1 = Time 1; T2 = Time 2; Obs-based inference = Observation-based inference.

¹ The criteria (categories of verbalizations) were defined as follows: Concrete elements (objects, people, etc.) repeated words are counted only once; Precise descriptive (generally denoted by an adjective, e.g., red, round, puffy); Location: Any indication of location (generally denoted by a prepositional phrase) within the setting of the painting (e.g., in the back, on the bottom of her skirt), or indicating the area within the framing of the painting (e.g., in the upper left corner); Observation Based Inference: An inference based on a detail that can be observed in the painting (e.g., he is helping them); Creative Departure: Statement that is a creative departure from the given picture, or is a creative extension that goes beyond what is depicted in the picture.

level of inter-rater reliability). Beyond expected grade differences in the tendency to produce creative departures in response to the task, the results indicated some evidence for qualitative changes in children's verbalizations (use of qualitatively distinct categories of utterances) emerging from discussions of works of art. In particular, we observed a significant increase in the use of precise descriptive and observation-based inferences in second graders. This effect could indicate an overall better sense of observation for this group, as a greater use of these distinct categories reflects a better focus on the details of the paintings, from which inferences could be made. However, no significant changes were observed for the group of first graders, suggesting several limits of this first empirical exploration of the PIE instructional approach.

Above all, the time difference between the two measurement occasions—three months—may not have been sufficient for a clear development of observation-based inference particularly for the younger participants (first graders). Furthermore, the difference in the pattern of results between first and second graders may reflect developmental differences in the abilities to learn and draw inferences based on observed evidence; thus, the PIE instructional approach may benefit from a more precisely tailored program to children's developmental stages. Finally, differences observed across grades may also reflect teachers' differences in their ability to implement the PIE instructional approach in their classroom, and this should be controlled in future studies.

As a whole, although the assessment method to capture change in the nature of the students' verbalization appears appropriate and the effects observed generally follow our expectations, it is not clear whether these effects were a direct consequence of the PIE instructional approach, instructor or sample effects, or a combination of these factors. This first exploratory study may benefit from future studies aiming to disentangle the sources of variation in the observed qualitative changes in children's verbalizations in response to the task (e.g., with the use of a control group, larger sample, and longer exposure time to the instructional program in the treatment group).

2.2. Story-writing skills development in response to the PIE instructional approach

2.2.1. Overview of the second exploratory study

This exploratory research aimed to preliminarily examine the effect of the PIE instructional approach on the writing quality, specifically the narrative structure and originality, of first and second grade students. To describe the development of these two targeted writing outcomes over a five-month interval, the data collection plan was conceived as a three-wave longitudinal design (only the first and the last measurement occasions were used in this study), which permitted an estimation of the amount of change throughout the study period (with a complementary baseline measure to calibrate for stimulus and initial level effects).

To disentangle the effects of the PIE instructional approach from those of more typical approaches, this study also involved a control group selected in a suburban school with demographics and writing performance on state tests similar to the treatment group. Both the "treatment" group and the "control" group used the same language arts program (Harcourt's *Story Town*). In the treatment group, this program was supplemented and adapted to incorporate visual literacy activities using the PIE instructional approach. In the control group, teachers used writing activities in the commercially published language arts program, such as asking students to think about a trip they had taken and write about what happened first, next, and last. Consistent with traditional writing instruction, these teachers taught their students to plan writing using graphic organizers, such as story maps. They also used pictures in the language arts program materials and assigned writing tasks such as writing a story that takes place in the setting of the picture. Unlike those who used the PIE instructional

approach, these teachers did not incorporate their activities in museum settings, nor did they ask students to routinely discuss and interpret visual information or use sketch time to think and generate ideas.

Both the treatment group and the control groups were involved in this study to compare the amount of change with and without the PIE instructional program. We were expecting to observe an increase over time in narrative quality and originality scores in both groups due to global developmental and instructional effects. However, we were also expecting a larger increase in the treatment group, as the PIE instructional approach was specifically designed to encourage improvements in these writing outcomes.

2.2.2. Method

2.2.2.1. Participants. Our sample consisted of 121 children from the four "treatment" classes—two 1st grade classes ($n=44$) and two 2nd grade classes ($n=40$)—and both "control" classes—one 1st grade ($n=16$) and one 2nd grade ($n=15$) class. The sample included 52% girls, with nearly the same percentage in each grade, and each group (treatment vs. control). Four teachers were involved in the scoring of the stories generated by the children.

2.2.2.2. Measures and general procedure. All students received a "baseline writing task" that was used to estimate their initial levels on the writing skills targeted by the PIE instructional approach (narrative structure and originality) and calibrate the data for future analyses. Following a verbal prompt, children had to write a story; the possibility of employing drawing as part of their planning stage was optional. The instruction to this baseline task was: "Think about a day when it snowed and there was no school. Write a story about what you did to have fun on a snowy day. The story could be about what you did by yourself or with friends or family. Make sure your story has a beginning, middle, and end. Use the cover sheet to plan your story, then, begin to write on the lined paper."

One week after the collection of this baseline writing sample—corresponding to the beginning of the administration of the PIE instructional program—we collected the first (T1) of a 3-wave longitudinal collection of writing samples using "visual prompts" (that is, reproductions of paintings as stimuli to create a written story). Subsequent writing sample collections occurred after nine weeks (T2) and 18 weeks (T3). To limit possible memory effects while maintaining the ability to compare performance over time, we used three different painting reproductions (A, B, and C) as stimuli. We counterbalanced the order of the stimuli across groups and observation occasions, while maintaining the same prompt instructions for all conditions (each class saw each of the three paintings but in a different order). This study design was employed for further calibration of the data, in order to disentangle developmental/instructional effects and stimuli (painting) effects. In each writing collection session, the instruction stated: "Think about the picture you have on your desk. Look at the picture carefully. Think about what might be happening in this picture. You will use your thoughts about the picture to help you make up your own story. Take time to plan your story. You may draw a picture, jot down your ideas, or make an outline. After you have planned your story, you may begin writing." Forty-five minutes were allotted for this task, and the children were encouraged to move on to the writing after 15 min of pre-writing, if they had not done so already.

2.2.2.3. General scoring method. After the data collection period (including all data points from baseline to T3), the writing samples were transcribed and word counts calculated to control some of our planned analyses for story length. We then combined the writings into four sets for blind scoring, as a function of the prompt used as stimulus (Baseline, Painting A, B or C), regardless of the measurement

occasion. Using the Consensual Assessment Technique (e.g., Amabile, 1982), the four judges (i.e. teachers), preliminarily trained using a pilot writing sample, assessed the writings for Narrative structure (*how well structural components have been used to make a cohesive, substantial story that includes a beginning, middle and end*) and Originality (*how unusual or unique the main idea/content of a story is, compared to those by the child's peers*) using a seven-point Likert scale. The scoring procedure was completely blind to the four judges, with all time points, classes and grades, treatment and control samples mixed and presented in a transcribed, typewritten form, identified only by randomly generated ID numbers.

Specifically, after multiple training sessions to improve the clarity of the scoring rubrics and the consensus between judges on a pilot sample, the four judges scored independently the complete Baseline set for both criteria in separate sets (independent scoring of both criteria). The scoring process was shortened for sets A to C in order to limit the judges' burden in scoring; each judge scored only half of the writings in each set for one criterion, and the other half for the other criterion. Thus, each writing sample was assessed by at least two judges for each criterion.

2.2.2.4. Data preparation and analyses. Because writing sets A to C involved the scoring of each product by only two raters, the Spearman–Brown prophecy formula was used to estimate an inter-rater reliability coefficient, based on the average correlation between all possible pairs of raters. The resulting inter-rater reliability coefficients were high to excellent, with Cronbach's alphas of .85 and .88 respectively for narrative structure and originality at baseline, and coefficients ranging from .92 to .95 for both criteria across sets. Complementary analyses indicated that judges showed an acceptable independence on their scoring of Narrative Structure and Originality, with correlations between both criteria ranging from .49 to .75.

Given the quality of the data, we created composite scores for Narrative Structure and Originality that were calibrated for two effects that might influence the planned analyses: (a) “rater” effect (individual differences in scoring in terms of severity and discrimination/use of the rating scale) and (b) “painting” effect (that is, variation in the way that the prompt used may have influenced children's responses and judges' scoring). Raters' individual differences in severity and discrimination were estimated on the baseline sample then standardized by transforming raw scores into z-scores for each rater. Means and standard deviations were further used to calibrate raters' scorings for sets A, B, and C (rater differences were assumed to be systematic and were calibrated using baseline scoring as a reference). Writing sample scores (for each set and criterion) were computed by averaging the individual raters' calibrated values. Similarly, “painting effects” were estimated by comparing mean differences between the baseline scores, and those obtained at the first measurement occasion (T1), separately for each set (A, B and C). Means and standard deviations estimated for each set were further used to calibrate the scores obtained for sets A, B and C across measurement occasion (the “painting” effects were assumed to be systematic across children and measurement occasions).

Data analyses focused on the relative amount of change observed between the beginning and the end of the study (i.e., T1 and T3).² Because difference scores are usually weak estimates of the amount of change (e.g., cumulated measurement errors), we estimated change at a latent level, using a structural equation modeling (SEM) framework (e.g., McArdle, 2009). According to the employed latent change

² To avoid any possible biases introduced by the interview procedure itself (cf. next exploratory study) that may influence children's writing performance, all analyses conducted in the present exploratory study excluded the post-treatment data (T3) of the children interviewed. T1 data were included as the interviews were conducted after the collection of T1 writing samples.

score (LCS) models, the part of the score at T3 that is not identical to the score at T1 is isolated and represents latent change (cf. McArdle & Nesselroade, 1994). Univariate LCS models were first tested separately for each writing outcome (Originality and Narrative), then integrated into a single multivariate change model, controlling for student Gender and Grade. Importantly, group differences were modeled using a Group variable with dummy codes (Control = 0, Treatment = 1) used as an observed predictor of both the “true” initial levels (free of measurement error) and latent change variables, and allowing us to estimate mean differences between groups based on standard regression parameters. The statistical significance between groups was further tested through constrained models assuming no difference over time and between groups (group variable regression paths, and LCS intercepts were set equal to 0). Parameters were estimated using Maximum Likelihood, and the fit of all models was assessed using the Chi-square test of fit, in addition to the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). Model comparisons between unconstrained models (allowing for group differences and change over time) and constrained models (imposing null differences) were evaluated with the Chi-square difference statistics test ($\Delta\chi^2$).

2.2.3. Results

Table 2 presents the fit index and difference statistics of the univariate LCS models. As indicated, the model testing for the hypothesis of null difference between groups and in the amount of change over time (intercept of the latent change factors) returned a poor fit in comparison to the unconstrained models ($\Delta\chi^2 p < .03$). The latter indicated acceptable fit, allowing the integration of both univariate models into a single multivariate model. Consistently, the multivariate constrained model returned a poor fit in comparison to the unconstrained version ($\Delta\chi^2 p < .03$), suggesting that group differences as well as change over time were statistically significant. Specifically, originality scores were estimated to increase on average by .169 ($p < .049$) and narrative structure scores were estimated to increase on average by .230 ($p < .008$) over the study period. Differences in the amounts of change between the control and the treatment groups were also significant, with an increased effect of the treatment group on both originality ($\beta = .146, p < .006$) and narrative structure ($\beta = .178, p < .002$). Based on the model parameters, we estimated the mean differences in the latent change between both groups, as depicted in Fig. 1.

2.2.4. Discussion

Results of this second exploratory study suggested an increased amount of change in targeted writing outcomes (originality and narrative structure) under the influence of the PIE instructional

Table 2
Fit parameters of the latent change models.

Model	Fit indices					
	χ^2	df	p	$\Delta\chi^2$	CFI	RMSEA
Univariate latent change						
Originality unconstrained	.14	1	.710	–	1	.000
Originality constrained ^a	8.90	4	.063	.03	.54	.104
Narrative unconstrained	1.16	1	.280	–	.99	.038
Narrative constrained ^a	12.62	4	.013	.01	.26	.137
Multivariate latent change						
Unconstrained	1.49	2	.473	–	1	.000
Constrained ^a	15.49	8	.050	.03	.95	.091

Note. χ^2 = Chi-square; df = degrees of freedom; p = p value of the Chi-square test; $\Delta\chi^2$ = p value of the Chi-square difference test; CFI = comparative fit index; RMSEA = root mean square error of approximation.

^a Model comparison using the “Unconstrained” model as baseline.

approach, as evidenced by significantly higher rates of change in the treatment group (receiving the PIE program) in comparison to the control group (matched for gender, grade and age). Thus, as a whole, our results suggest a positive effect of the PIE instructional approach on the development of the narrative quality and originality of the written work of children. These findings are in keeping with the notions that the interpretation of visual images (esthetic works) develops narrative understanding through storytelling (Housen, 1987, 1992), and that originality of writing increases when imagery is part of the writing task (Jampole et al., 1991; Long et al., 1985; Martindale, 1990; Short et al., 2000).

However, because this effect size was rather limited, we must point out some limitations of this preliminary examination. First, a longer exposure to the PIE program may have resulted in a larger effect in favor of the treatment group. Indeed, it is possible that the treatment participants may have only benefited slightly from the PIE program, due to the relatively limited exposure to the program (about five months). This exploratory study was also limited by the sample size, rather small. A larger sample size in a future study would result in higher statistical power, allowing for a more precise examination of the change occurring under the influence of the PIE instruction program as compared to the control group (e.g. taking into account differences in the curve of change between the control and the treatment group, as well as individual differences in the amount of change). Such a study would also benefit from a precise analysis of the effects of the PIE program for first and second graders, to better adjust it to children's developmental needs. Finally, post-follow up studies might also support the encouraging results of the present study by estimating whether the observed effects may be sustained over a long-term period.

Although this exploratory study was limited in some aspects (in particular due to the restricted sample size), our results suggest the promise of the PIE instructional program for the development of writing skills with respect to narrative structure and originality. Secondly, the usefulness and robustness of the scoring method and the data analytical approach demonstrated in this study offer an encouraging perspective for further analysis of change in response to the PIE instructional program.

2.3. Exploring and illustrating children's thinking processes from perception to expression

2.3.1. Overview of the third exploratory study

To better understand how visual literacy instruction may support children's writing, we conducted interviews with a subsample of children receiving the PIE visual literacy instruction, immediately following their participation in the writing exercises described in the second exploratory study (above). Early research has used "think-aloud" interviews to identify adults' cognitive processes during writing (Hayes & Flower, 1980) and subsequent research has demonstrated that interviews with children can provide information about children's thinking during writing. In particular, we were interested in identifying and exploring children's thinking processes during the PIE visual literacy based instructional approach for creative writing, as described in the previous exploratory study. That is, we sought to further understand the process by which children "move" their thinking, or transition, from "reading" a painting, to creating their own drawing (as a pre-writing activity), to writing a story. A better understanding of these thinking processes represents a complementary source of information which could help in re-framing and tailoring the PIE instructional approach to children's common ways of thinking. To this end, the retrospective interviews enabled children to reflect upon and describe the entire process in which they had just engaged, starting with observation of the work of art, continuing through sketching activities and "think time," and concluding with the expression of ideas in written form. We chose to conduct our

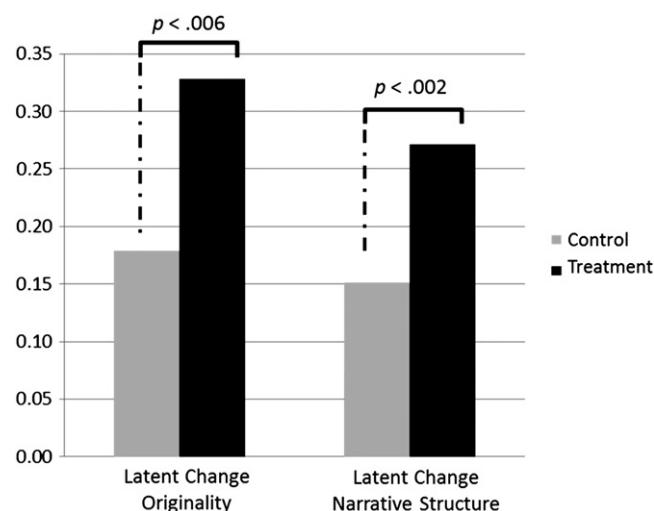


Fig. 1. Estimated T1–T3 latent change scores in originality and narrative structure as a function of the group.

interviews retrospectively so that children's thinking would not be interrupted during the writing exercises. This has been shown to be fairly reliable, particularly when only one episode (rather than several trials) needs to be recalled (Ericsson & Simon, 1984). While helping to develop the coding protocol of interview data for the current exploratory study and future studies, this initial interview analysis served to illustrate the thinking skills involved in the development of a written piece using a visual prompt as stimulus, and how children may use the PIE instructional approach to generate and organize ideas into a coherent narrative.

2.3.2. Method

2.3.2.1. Participants. The interviewed participants consisted of a subsample of the sample described in the previous exploratory study. Because the purpose of this interview study was to provide examples of how children who were instructed with the PIE program articulated their cognitive processes with respect to generating ideas and organizing their writing, the sample was purposeful. We asked teachers to nominate the students they thought to be most likely able to articulate their thinking. Specifically, each of the four teachers participating in the PIE visual literacy instructional approach identified four children (two boys and two girls), for a total of 16 children (8 first graders and 8 second graders) selected to participate in this exploratory interview study. Eight children in the control group were also interviewed, but data from this group are not analyzed here as the purpose of this first exploratory work is to illustrate how children receiving the PIE visual literacy instruction (i.e., treatment group) articulate their thinking process, in light of the PIE model of visual literacy instruction.³

³ Because the aim of this exploratory study was to identify and elaborate the thinking processes that children used when engaged in PIE visual literacy activities, only interview data from the visual literacy group were analyzed for the exploratory study reported here. Moreover, any comparisons between groups would be tentative at best, given the small sample size and exploratory nature of the study.

2.3.2.2. General procedure. Following the data collection plan described in the previous research study, participants were interviewed at each measurement occasion (T1, T2, T3). The retrospective interviews were conducted immediately after the writing task, individually with each participating student. Interviews were recorded in their entirety, then transcribed and coded for elements of the PIE visual literacy model, to identify the thinking processes children used as they observed and interpreted the painting, sketched their ideas (during prewriting), and wrote their stories. As previously pointed out, the subsample of participants involved in this interview research was dropped from the analyses of the writing development (previous exploratory study), to avoid possible confounding effects induced by this reinforced procedure (i.e., guiding the students' awareness of their thinking process within the PIE-based activity).

2.3.2.2.1. The retrospective interview. This semi-structured interview focused on the processes meant to be stimulated through the PIE instructional approach and was designed to trace students' thinking throughout the three "stages" of the writing activity: (a) perception, including observing and thinking about the visual, (b) interpretation, including generating and sketching ideas as a prewriting activity, and (c) writing the draft (crystallizing thoughts into written expression). Correspondingly, the interviewer asked the children (a) to describe the painting and tell what might be happening, (b) to talk about their own drawing (used as pre-writing activity), and (c) to read or retell their own original story, which was written in response to the task. The interview also included probing questions to elicit children's thinking, including the sources of their ideas through questions that prompted children to articulate which elements in the painting inspired the story (what thoughts came to mind as they viewed the painting), and whether or not the child "invented" story elements based on personal connections (what personal connections or associations came to mind as they observed, sketched, and wrote). We also asked questions about the children's planning processes. Specifically, children were asked to tell the story they sketched and describe how they generated and organized their ideas as they prepared to write their story.

2.3.2.2.2. Data preparation and coding. The interviews were audiotaped, transcribed, and coded in light of the PIE model (e.g., Tan et al., 2012), to illustrate the various underlying thinking processes children used as they observed and described what they saw (Perception), interpreted the art and sketched their ideas (Interpretation), and finally

translated their thoughts into written language (Expression). First, as children began the task by interpreting or "reading" a picture, the coding protocol focuses on the first stage of the PIE model (Perception) for evidence of related thinking processes (e.g., children described details they saw, involving observation, description, and vocabulary). Second, in the "Interpretation stage," the coding protocol focuses on how the painting reminded children of a personal event (e.g., involving associative thinking), or how they generated multiple interpretations (e.g., divergent thinking, evidence-based inferences). Finally, as children move toward the "Expression stage," through a kind of planning activity in which they sketched what to include in their stories, selecting and integrating ideas to construct their stories, the coding focused on how they selected and combined various elements (selective combination) and integrated story elements, such as characters and events, into a coherent, structured narrative.

An initial coding protocol of the interview data was developed based on a sample of interview transcripts analyzed by one of the authors and a research assistant. During the coding sessions, definitions of codes were developed and revised iteratively, and an "anchor set" of examples illustrating each process was established as a reference to facilitate further coding of interview data. Subsequent coding was done by a single coder, with periodic consultations with other coders familiar with the coding protocol. Because this study was exploratory and intended to provide illustrative data, no multiple-coding procedure was used. Rigor, however, was maintained through periodic discussions of the codes assigned with one or more coders familiar with the PIE model and the coding protocol.

2.3.3. Results

Interview data provided rich examples of children's thinking as they worked through the writing exercise, elaborated on elements of the PIE model, and confirmed the usefulness of this model to describe children's thinking. Table 3 presents a few examples to illustrate children's thinking processes through the three PIE phases.

Elements of the first PIE model stage (Perception) were identifiable in the interview corpus. In this stage, children often began describing what they noticed in the painting. They focused on different aspects of the painting, on details or on the whole scene. They used and practiced previously learned vocabulary to describe what they saw in the painting as well as to describe their own sketch. The instruction to describe the painting in detail may have evoked

Table 3
Examples of PIE processes in interview data, for each phase of the model.

Examples	
Perception	
Observation	"...the girl was walking, and the dog was walking on the bridge, and there's a lot of rocks and trees and a barn." (2nd grader)
Description	": This part here, there's a big tree that the dog is hiding under. The girl is walking up with a bag or something. Like, it's already nighttime over here; the sky is like really blue. There's a forest. And, there's no water. Uh, that porch up there leads to the house." (1st grader).
Vocabulary	"The people are carrying the crops." (2nd grader) "I studied very good at these two houses because I wanted to make sure I got like the triangle, and the square and the triangle and squares and rectangles." (1st grader)
Interpretation	
Evidence-based inference	"I think it's in the spring because um, in the summer you wouldn't be really wearing a long sleeve shirt, you'd just be wearing a short sleeve shirt, but in the spring sometimes, sometimes when there are storms you actually wear long sleeve." (2nd grader)
Associative thinking	"I was just sketching it and I was sort of thinking of Christmas because I was drawing those trees." (2nd grader)
Divergent thinking	"I thought there was a little girl going home and then she hears a noise up in the trees and she doesn't know what it was, and then it turns out it was, um, fairies, and there was a giant attacking their land, so um, they flew away up to fairyland, and when they were up at fairyland, the queen told her what was going on in a magical puddle." (1st grader)
Expression	
Integration	"(I knew I was ready to write) When I was drawing my pictures, ideas just started popping into my head, what I should write about, and how it would go along with the story." (2nd grader)
Selective combination	Student explains how she selected elements from the painting ("There's a dog on a wooden plank and there's a girl trying to get the dog") and recombined them with elements from her life and imagination to create her story: "Well, my dog Sparky is always looking in the woods. When we called him back, he was still there just looking." (2nd grader)
Narrative construction	"When I was drawing my picture I was really thinking about what my story was about, and I thought the main thing was what was gonna be the problem... that she couldn't find out the kinds of things she, the materials, she should make the see saw out of." (2nd grader)

vocabulary learned in other contexts, including content area vocabulary, such as *crops*, *triangles*, and *rectangles*. If so, then the visual literacy approach described here is a promising instructional strategy for helping children apply their knowledge across curricular areas.

When children were asked what story *might* be happening in the picture, they tended to generate multiple interpretations grounded on evidence (*evidence based inferences*), as they were taught to do through the PIE instructional approach. As illustrated in Table 3, three thinking processes were evident in children's discourse when describing their activity: *selective combination* (when the children combined details from different sources to generate a complementary element, leading to an original idea), *associative thinking* (when they made connections to personal experiences or prior knowledge) and *divergent thinking* (when children generated multiple ideas or multiple interpretations in answer to the question).

Finally, as children sketched, they began to develop ideas for their own story. The sketching and thinking (internal verbalizing) appeared to help them move from observation and thinking to written expression; children articulated this planning process, explaining how they integrated ideas generated during sketching and thinking into a coherent written narrative. Children also described how they engaged in elaborating their ideas by adding details based on elements observed in the painting. They articulated their knowledge of narrative elements and described how they planned to integrate those elements in constructing their own stories.

2.3.4. Discussion

In this qualitative exploratory study, our purpose was to illustrate the thinking processes children used “in action” during a PIE visual-literacy based task, and to suggest ways in which these processes may contribute to writing development. This exploratory work, although limited to some extent (e.g., small sample, no comparison between the “treatment” and “control” groups) suggests how the visual literacy activities used in the PIE instructional approach contribute to children's development as writers. The interview data began to uncover how children use certain thinking processes when they generate a writing piece from a visual stimulus. In these interviews, the students described the thoughts and ideas they had as they transitioned from looking to drawing to writing, which may be conceived as the movement from one symbolic system to another (Dyson, 1986; Suhor, 1984). These connections may have a powerful generative aspect, as new ideas and new meaning that are unique to each student are created in the connections that they make between the two sign systems (Siegel, 2006). Further research, with larger and more diverse samples, is needed to confirm these hypotheses. Additional research is also needed to compare the quality of children's writing as a function of their use of the various thinking processes engaged in the PIE visual-literacy activities.

3. General discussion and conclusion

Consistent with a growing body of evidence showing the promise of museum–school programs to link learning in the arts with “core” subject areas (Burchenal & Grohe, 2007; Catterall & Waldorf, 1999; Tan et al., 2012; Tishman et al., 1999), the data presented in this article support the promise of a new visual literacy model and instructional framework—the PIE model—as an innovative approach to supporting children's writing development. The combination of methodological approaches (observation of a group discussion of a work of art, longitudinal development of writing skills through a sampling of story-writing pieces, and process-oriented retrospective interviews following a visual literacy based writing activity) provide a broad picture of the key components of the PIE model and its premise as an innovative visual literacy program. Indeed, this exploratory work supports the potential strength of the PIE model as a comprehensive theoretical framework in which to develop and refine

additional visual literacy instructional activities that promote children's creative writing. These exploratory studies not only confirm the appropriateness of the PIE framework to develop visual literacy based instructions aiming to improve writing and thinking outcomes, but also demonstrate that intervention studies may benefit from multi-method investigations.

Recognizing the importance of talking as the “substance of written language” (Dyson, 1983), our first exploratory study explored a change in the quality of verbalizations of the children involved in the PIE instructional program, within the context of a group discussion of a work of art. Practicing close observation in the museum—which can also be implemented in the classroom—children learnt to notice details and articulate them using precise language; they also developed the skill of interpreting meaning based on what they see. Consequently, although limited to a group of 2nd grade students, results suggested that, after a short exposure to the program, children showed an overall better sense of observation, resulting in an increased ability to make inferences, a key process for writing (e.g., Flower & Hayes, 1981).

In the second exploratory study (writing samples), several pieces of evidence suggested that children taught using the PIE instructional approach showed greater development in their writings' narrative structure and originality, as compared to a control group. Although preliminary, this result confirms that the use of imagery in writing instruction increases the originality of written compositions (e.g., Jampole et al., 1991; Long et al., 1985; Martindale, 1990). A longer exposure to the program may result in even more rapid progress in these writing skills.

Finally, the analysis of interview data collected after a typical PIE writing activity offered some illustration of the use and articulation of the thinking processes involved in a visual literacy based writing activity, using the PIE framework. For example, the retrospective interviews showed that the act of sketching as pre-writing adds a visual element to writing, relating to observation and the subsequent interpretation of what has been observed, that leads to a number of possible processes that contribute to writing, including the generation of ideas for stories, planning of characters and plot, as well as other creative processes that will make each child's story unique. We argue that education ought to train these creative writing skills, lest children's writing development stagnate at what Kellogg and Whiteford (2012) described as the “knowledge telling” stage and seldom reach the “knowledge transformation” stage, where ideas are transformed or changed. This study suggested promise for further research, to actualize the dynamic by which visual literacy contributes to writing (e.g., Sadoski et al., 1997) and, ultimately, to optimize the use of visual literacy as a powerful tool in writing instruction.

As a whole, these sets of evidence offer encouraging support for the development and refinement of the PIE instructional program, and for the relevance of the methodological approaches in further studies using this model. Such studies should focus on the possible differential effects in response to the PIE program, as a function of teachers' implementations of the program, students' grade levels, and other developmental differences. A focus on the delivery of the program is indeed also needed. Not only might general mechanisms for the delivery of the intervention be better outlined for more flexible application of the instructional approach across classrooms, but teacher education and professional development might be better designed to encourage the long-term use of visual literacy approaches toward a possible variety of curricular goals.

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