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Teaching People to Read Comics: The Impact of a Visual Literacy Intervention on Comprehension of Educational Comics

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Abstract

Evidence suggests that children's abilities to comprehend information can vary, which may lead to miscommunication and impact on future life outcomes. Previous research suggests that visual literacy interventions may be helpful for children who need to interpret visual sources of information. Recently there has been renewed interest in the potential of comics as assistive tools in pedagogical settings, which are a highly visual medium. However, no research has yet investigated whether a visual literacy intervention can assist children in their comprehension of comics. The current experiment set out to determine if a visual literacy intervention constructed around comics would improve comprehension of educational comics in primary school children. The study consisted of a pre- and post-intervention procedure. Previous comic reading experience was included as a variable. In each session, comprehension and inferential understanding was assessed. Both comprehension and inferential understanding improved following the comics literacy intervention. These results demonstrate that visual literacy instruction can enhance comprehension of educational comics. Findings can be applied to educational settings and have potential for improving educational outcomes.

Keywords: Visual literacy, Comics, Education, Comprehension, Primary School, Intervention.

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Introduction

As the proliferation of digital modalities makes visual sources of information increasingly prominent, the traditional notion of literacy in educational settings has evolved to encompass competencies in interpreting and reproducing the information these sources contain. The ability to understand, recall, and make inferences from visual as well as textual sources is integral to modern learning and communication. Comics are a medium that is fundamentally both visual and textual where several elements can be used simultaneously to establish understanding of the whole source. This multi-modal aspect of the medium means that they may be particularly useful for readers who might struggle when presented with text alone. Frey and Fisher (2008) suggest that comics are useful, not just for assisting struggling readers with their comprehension skills, but also for readers who are already meeting or exceeding expected levels. The improvement that comes from reading comics, relative to text, may be increased through the use of visual literacy instruction, which would make students better able to critically engage and gain knowledge from the material (Chai, 2019). However, comics are constructed very differently to prose, and have even been referred to as a unique language (Cohn, 2013a). While the use of literacy interventions is well supported in general (Slavin et al., 2011), little research has explored the effects that instruction on how to engage with comics could have on the recall of information or the inference of meaning and motivations. Consequently, the current study set out to assess the impact of a visual (comics) literacy intervention in children aged 7-11.

Visual literacy

Visual literacy is a learnt ability to critically consume visual sources of information (Avgerinou & Petterson, 2011) and visually literate individuals will demonstrate skills in processing, analysing, and evaluating visuals. Kędra (2018) identified a number of common competencies that appear across definitions of visual literacy, including interpretation, analysis and understanding, visual perception, evaluation, knowledge of grammar and syntax, and the ability to translate material from visual to verbal sources and vice versa.

The value of instruction in visual literacy is apparent in many aspects of modern society. Children now live immersed in visual culture, not only in the images in their surroundings but also by engaging with it through smartphones and tablets (Baylen & D'Alba, 2015). As such, multimodal literacies increasingly need to be taught and assessed differently to text alone (Bowen, 2017). Young people need to be able to critically engage with visual information they encounter in order to understand and interpret the intended communication. Without being visually literate, including the possession of a working vocabulary to describe their understanding, readers will consume visuals passively and without benefit (Emanuel & Challons-Lipton, 2013; Villamizar, 2018). In a study by Matusiak, Heinbach, Harper, and Bovee (2019)

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university students were asked to gather visual information for a task. Without critical prompting, they tended to select the first image they saw rather than the most useful. This shows that simply being immersed in a visually rich environment does not imply visual literacy. They suggest that instruction on interpreting the content and context of images is essential and that starting from a younger age using material that interests children can help to build a more rounded ability profile in preparation for academic work.

Visual literacy is a cognitive process that requires two separate pathways: one to deal with language and the other to deal with imagery. The dual coding model (Andrews et al., 2002) suggests that memory and understanding can be increased by combining these two pathways. Woolley (2010) discusses ways in which visual and verbal processes can be used in conjunction with one another to improve reading comprehension and Kozma (2001) describes how memory for verbal information, as well as making predictions and inferences, can be improved by the use of visual techniques to enrich mental associations. Seglem and Witte (2009) suggest that deficits in comprehension occur when an individual is unable to mentally visualise information. In sum, these authors suggest that literacy interventions that can target both pathways should increase the chances of good understanding and recollection of information.

While most of the work on the value of visual literacy has been theoretical (Brumberger, 2019), researchers have begun to carry out empirical studies to assess the impact of visual literacy interventions. For example, Kassim (2018) explored the dual pathway theory in regard to vocabulary in students of a second language. Their study used an experimental design (baseline, intervention, and two post-tests) and investigated the addition of a visual clue or “gloss” to tricky words accessed by hyperlink on a computer-based source. It was concluded that the addition of information via this second pathway increased word retention and recollection, both immediately after reading, and also in a delayed post-test. These results suggest that having the opportunity to access both pathways simultaneously led to the understanding and recall of more information. Additional supporting evidence for the use of visual literacy instruction in applied settings comes from Shivers, Levenson, and Tan (2017), who instructed primary aged children to create visual representations of classic texts and found that both critically engaged thinking and overall comprehension improved. Similarly, Brugar and Roberts (2017) provided teacher training in visual literacy and looked at the effect of this on comprehension in taught children aged five to eight. They concluded that professionally developing teachers to teach children to use images or “graphical devices” in non-fiction texts subsequently produced better outcomes for students’ comprehension.

Comics

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Comics are a medium in which both text and visuals are completely integrated. Comics are also particularly attractive for children. As such, comics are an ideal pedagogical tool. However, comics have not been uncritically accepted in this area. Some authors have noted that the medium suffers from the occasional presence of violence and unfortunate gender tropes (Garland et al., 2018), while others have suggested that comics produce passive picture gazers (Humphrey, 2014). This may explain why comics have heretofore been largely overlooked in the visual literacy literature.

McCloud and Lappan (1994) have considered which features of comics support reading comprehension, what makes comics beneficial to learning, and how to use comics in education. Comics engage readers with coordinated systems of visuals and text. Each brings novel information that has to be integrated to acquire the full intended meaning of the source as a whole. Groensteen (2007) discusses this synergy and describes how the panels, or “hyperframe”, and the network of panels, or “multiframe”, connect to one another as well as with the text and other features to form the narrative. Authors can modify each of these features to configure the desired meaning of the comic as a whole. Consequently, the system of comics is complex, but can present more information simultaneously than text alone (Rigaudet al., 2015). Standard comics follow a typical makeup of panels that contain both visual and textual information. Additional features can indicate information such as who is talking or character emotions (Bakis & Carter, 2014). They are predominantly structured to be read sequentially in the shape of a “Z” with the content of panels often directing the readers’ attention to the next, making it easier to follow the plot sequence (Cohn, 2013b; Cohn & Campbell, 2015). Even the space between panels (the gutter) has semantic value. Varied gutter sizes can represent altered time progression between panels and the space itself allows readers to make their own inferences of what might be happening in between panels (Wallner, 2019).

Comics have been identified as an asset to educational settings because the images are not merely representational or supplemental to the words but work interdependently with the content (Stafford, 2011). The duality of comics may be particularly advantageous in enhancing understanding of picture cues, context cues, and sequencing. Research has demonstrated that comics increase motivation to read and exposure to material (Aleixo & Norris, 2007), encourage creativity (Issa, 2018), increase comprehension and willingness to return to material (Ogier & Ghosh, 2018), and aid the development of analytical skills through the facilitation of the interaction with both text and imagery (Ásbjörnsson, 2018). Krusemark (2017) found that college level critical thinking was improved when using comics, while Aleixo and Sumner (2017) found that undergraduate students’ recall benefited when reading a biopsychology textbook in comic book form. Similarly, Hosler and Boomer (2011) found that using comics improved recall and comprehension of scientific learning in university students who had not majored in the subject, and that positive

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attitudes toward the subject increased overall. Aleixo and Sumner (2017) second Stafford's (2011) suggestion that the reason for these improvements is the presence of the supplemental information that the images provide in addition to the content of the text.

However, comics are a unique medium, and one must learn how to navigate and interpret a comics page (O'Neil, 2011). As such, to meet their full potential as an aid to comprehension (McVicker, 2007) and an educational tool, it is necessary to ensure that readers are familiar with the "language" of comics. Like visual literacy (Avgerinou & Pettersson, 2011), comics literacy is something that must be learnt (Groensteen, 2007). A review by Thompson (2008) considered comics-based visual literacy tutoring approaches to help reading comprehension. These approaches included prompting to make mental visualisations, getting children to create their own comics, and teaching them new vocabulary to describe the comics. All of these were considered to have a positive effect on children in a primary school setting. Harbi (2016) used comics in focus groups of primary aged children to start conversations about taking care of the environment and understanding diverse cultures. Using visual literacy skills such as questioning comics' features and describing visuals enabled them to grasp more abstract concepts included throughout the comic. The children were intellectually challenged whilst also feeling entertained.

The Current Study

Though some previous research has explored the effects of improving visual literacy and other research has looked at the effects of using comics on comprehension, no research has yet been done on whether a visual literacy intervention designed specifically for comics can aid comprehension of material. Teaching the representations of images and other non-text comic components is becoming increasingly important as content analysis of comics spanning the last eighty years has shown that the number of words in panels has diminished and many remain wordless (Cohn et al., 2017). As such, readers must rely more on the visual aspects of the comic to understand narratives. For the current study, we designed a comics-specific visual literacy intervention and used an experimental design to assess whether it raised comprehension scores in a sample of primary school children.

The visual literacy training materials are described in the materials section. They captured many of the features of comics discussed above (e.g., explaining the characteristic Z-shape flow of information) but also other features, including the style of balloon. Wallner (2017) indicated that there is a necessity for instruction in balloon iconography to enable students to decipher the representations of different volumes and tones of voices and distinguish between internal and external dialogues.

In line with similar previous research (e.g., Berkeley et al., 2011), comprehension was assessed via the ability of participants to recall information and to represent it in

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their own words as a summary. However, competent readers perform several cognitive techniques to achieve comprehension such as asking questions about what the source is aiming to communicate, determining the importance of new information, blending new information with previous knowledge, and making inferences. Therefore, to establish a more composite measure of comprehension, we also assessed more inferential understanding. These questions were developed in collaboration with primary school teachers to reflect standard national curriculum assessments.

It was predicted that students will achieve higher scores on both the comprehension summarisation test and the inferential understanding test following an intervention designed to improve comics visual literacy. In addition, we expected that students who are already visually literate in relation to comics (i.e., those with substantial prior experience of reading comics) will show higher comprehension than those who are not experienced comics readers. Finally, we expected the impact of the visual literacy intervention to be greatest in those with the least prior experience of comics (i.e., those with the lowest pre-existing level of comics visual literacy). As such, we had three hypotheses:

H1: A visual literacy intervention will improve the comprehension of educational comics.

H2: Those with more experience of reading comics will have higher comprehension scores after reading education comics.

H3: There will be an interaction between experience and the intervention whereby those with no previous experience will show more improvement following the intervention.

Method

Participants

There were 152 participants recruited from two primary schools in the north of England. 25 participants were absent at the second testing session, so were excluded from the analysis. Of the remaining 127 participants, 69 were male and 82 reported themselves as having prior experience of reading comics. The age range was 7-11 years old. Recruitment of participants was on a voluntary basis from one hundred schools in Hull and East Yorkshire who were initially contacted, two of which agreed for their students to take part. Both of these schools were in small villages within five miles of each other. Both also had mixed year group classes, containing children of white British origin except one young male who was of Polish origin. Socioeconomic status was very varied as both schools were the only primary in their areas with large catchment areas, though there was little disparity between

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the two. Teachers were contacted via the headteachers and agreed to allow students to participate within lesson time in order to normalise the study as much as possible.

Materials

Comics

Comics were selected from those created by Dekko Comics (<https://dekkocomics.com/>), a company that makes educational comics designed for children aged 6-12. Two matched comics were chosen: “Tracey Time in ‘Spartans’” (Stone, 2018a) and “Max Retrieving Information” (Stone, 2018b). The two were similar in art style and complexity of content. Both featured human protagonists, which allowed inferences to be made about body language, emotion, and expression. The page layout was also similar: chronologically sequenced panels containing the typical elements of a comic, such as speech bubbles, thought bubbles, and captions.

Visual Literacy Intervention

Two versions of the visual literacy intervention were developed, one that used examples from the Tracey comic and one that used examples from the Max comic. Apart from the examples used, however, the two versions of the intervention were identical. The intervention was developed through reference to Bakis and Carter (2014), and included details on balloon iconography (Jaffe, 2015), gutters (Thompson, 2008), and typical panel reading order (Cohn & Campbell, 2015). Gutters are particularly important as a space between panels where readers must make inferences about causal processes and predictions about what will follow (Wallner, 2019). The typical Z path for reading panels is also crucial as a norm that allows panel sequences to communicate chronologically consistent plots.

Comprehension Summarisation Test

The comprehension summarisation test (CST; Berkeley et al., 2011) is a four-item questionnaire designed to measure recall and understanding of a text. Respondents are asked to indicate what and who the comic is about (1 point), what is important about the main characters (1 point), to list important words and phrases (up to 2 points), and to summarise the material (up to 6 points) equalling a total possible score of 10 points. This scoring scheme was suggested by the original authors via personal communication.

Inferential Understanding Test

While the CST adequately assesses the ability to comprehend and summarise texts, it does not fully capture the ability to make more complex inferences about what is happening on the page. Accordingly, we created two matched inferential

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understanding tests (one for each comic) that were comprised of a further six questions. These questions more explicitly required respondents to make inferences about causal processes, motivations, and the nature of characters. Example items include “Why do you think Max helps Charlie?” and “How is Tracey feeling in the last panel?”. Questions were developed in collaboration with primary school teachers and designed to be similar to the kind of questions that students might encounter as part of their national curriculum assessment. Open ended questions were used, as these have been shown to better relate to inferential understanding (Ozuru et al., 2013). Respondents were asked to refer to specific evidence from the text in their answers to promote active, reflective, inference making. Each question was worth up to 3 points, resulting in a possible total score of 18 for each version of the test.

Procedure

Following initial school contact, opt-out consent forms were sent home to parents along with an information sheet describing the research. The research took place in class two weeks later. The first session involved students reading the first comic, after which they completed the comprehension summarisation test and relevant inferential understanding test. The specific comic (Tracey or Max) students read was counterbalanced across participants. All testing took place on a Thursday and a Friday. The second session took place at least one day later (e.g., on a Friday if session one took place on Thursday), and no more than seven days later (e.g., on a Thursday if session one took place on Thursday of the preceding week). In the second session, children were asked to read the visual literacy intervention materials and point out relevant sections of the comic to encourage active participation. The specific version of the intervention that children received was determined by the comic that they read in session one: they always received the intervention that related to the comic they had already read (so that the comic they were to read in session two remained novel). Immediately after going through the visual literacy intervention, students were asked to read the comic they had not yet read. Again, this was followed by the comprehension summarisation test and the relevant inferential understanding test.

Results

The dependent variables were participants’ total scores on the comprehension summarisation test and the inferential understanding test at time 1 and time 2. As is standard with tests of ability, missing responses were assumed to indicate a lack of awareness, so a score of zero was given where data for individual questions was missing. Thirteen students failed to complete the inferential understanding test. Apart from this there were no missing data. Prior to analysis, variables were checked for normality. There was one high outlier in the time 2 scores for the inferential understanding test. This score was replaced with a value one higher than the next highest score. All variables had acceptable levels of skew (values ranged from -.18

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to .47). Accordingly, we used parametric analysis. Descriptive statistics can be found in table 1.

Table 1.

Descriptive Statistics Separated by Comic and by Comic Reading Experience

		Max Comic	Tracey Comic	Prior Experience	Novice
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
CST	Time 1	4.66 (1.84)	3.30 (1.68)	4.18 (1.95)	3.48 (1.65)
	Time 2	5.84 (1.82)	5.04 (1.75)	5.78 (1.94)	4.73 (1.36)
IUT	Time 1	5.78 (4.00)	4.42 (2.90)	5.34 (4.00)	4.72 (2.55)
	Time 2	8.12 (3.05)	8.04 (2.96)	8.24 (2.99)	7.78 (3.01)

Note. CST: Comprehension Summarisation Test. IUT: Inferential Understanding Test

From the descriptive statistics, we can see that students with prior experience of reading comics got higher scores for each test at both points than novice students. It is also clear that students found the Tracey comic more difficult, as scores for this comic were lower for each test at both time points. This would be a confounding variable if all participants had received a particular comic at time 1 or at time 2. However, as the order in which the two comics were encountered was counterbalanced across participants, the difficulty of the comics was controlled for.

In order to confirm the appropriateness of the two inferential understanding tests that were created for this study (one relating to the Max comic; one to the Tracey comic), we investigated their structure using principal components analysis. We looked only at data from time 1 so that scores were uninfluenced by the intervention. For each test, we assumed that all items should load onto a single component (measuring inferential understanding), which they did. The internal reliability of each of these scales was very good (Max: .87; Tracey: .73). To assess the concurrent validity of the tests, we looked at the degree to which they correlated with the matching comprehension summarisation test. The correlations between these (across the two comics and two time points) ranged from .24 to .54, indicating an overall moderate correlation between the two tests. This seems appropriate for two tests which assess overlapping but distinct abilities (inferential understanding versus comprehension summarisation).

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Our main research question was whether memory for and comprehension of the comics improved following the visual literacy intervention. As there was no control group, it is possible that any improvement could be attributed to a practice effect. That is, participants could have improved not due to the intervention, but simply due to having read a different comic at time 1. However, we assumed that any such improvement would be substantially reduced in participants who already had experience of reading comics. Including prior experience with comics as another variable allows us to determine whether practice effects are a plausible explanation for improvement.

Analysis was carried out via two 2×2 mixed ANOVA with time (pre-intervention/post-intervention) as a repeated-measures variable and prior experience (yes/no) as a between-groups variable. The dependent variable for the first ANOVA was comprehension summarisation; the dependent variable for the second ANOVA was inferential understanding.

The first ANOVA showed that there was a main effect for time, $F(1,125) = 75.79$, $p < .001$, $\eta_p^2 = .38$, whereby participants' ability to comprehend and summarise the comic improved following the intervention. There was also a main effect for experience, $F(1,125) = 9.01$, $p = .003$, $\eta_p^2 = .07$, whereby more experienced readers did better than participants who did not have prior experience of reading comics. There was no interaction between time and experience ($\eta_p^2 = .01$).

The second ANOVA showed that there was a main effect for time, $F(1,112) = 69.03$, $p < .001$, $\eta_p^2 = .38$, whereby participants' inferential understanding of the comic improved following the intervention. There was no main effect for experience ($\eta_p^2 = .01$), nor was there an interaction between time and experience ($\eta_p^2 < .01$).

The partial eta squared value of .38 indicates a large effect size for time. In other words, participants' ability to comprehend, make inferences about, and recall information from the comics was much better following the intervention. On average, participants' comprehension summarisation scores improved by .78 of a standard deviation following the intervention, while their inferential understanding scores improved by .83 of a standard deviation.

Discussion

It was hypothesised that a visual literacy intervention based on comics would improve reading comprehension in primary school children. Consistent with this hypothesis, there were main effects for time in both comprehension summarisation and inferential understanding. This indicates significant improvement following the intervention. We also hypothesised that experience would be related to comprehension as those who are already expert comics readers should be better able to parse the information contained within the comics' pages. There was partial support for this hypothesis. Those who had pre-existing experience of reading

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comics did significantly better in terms of comprehension summarisation than those who had not. However, while mean scores for inferential understanding were consistently higher in the experienced group, this difference was not significant. Given that an obvious alternative explanation for the improvement over time is a generic practice effect (i.e., improving simply due to having read a comic, where they may not have read a comic before), the inclusion of prior experience as a variable was important. If improvements were simply due to exposure to a comic at time 1, then it would be expected that the experienced group, who have already been exposed to comics, would not show an improvement (or, any improvement would be smaller relative to the non-experienced group). In other words, the practice effect hypothesis assumes that there will be an interaction between experience and degree of improvement over time. As we did not observe any interaction between experience and time, it is likely that improvements were not simply due to exposure to comics at time 1 and thus that they were an authentic consequence of the intervention.

Many scholars have theorised about the value of comics in education (e.g., Frey & Fisher, 2008; McVicker, 2007; Thompson, 2008), and others have empirically demonstrated the way in which comics can aid recall, comprehension, and motivation (e.g., Ogier & Ghosh, 2018; Aleixo & Sumner, 2017; Hosler & Boomer, 2011). Simultaneously, authors have considered the ways in which visual literacy is crucial for successfully engaging with visual information (Brugar & Roberts, 2017; Woolley, 2010; Seglem & Witte, 2009). This study is the first to show that recall, comprehension, and inferential understanding of comics can be improved through relevant visual literacy training.

However, the study was not without limitations. While the study used a counterbalanced pre- and post-intervention experimental design, which allows us to have good confidence in our findings, the inclusion of a control condition would have allowed us to be more confident still. This would have entailed an additional condition in which students had to complete the comprehension tasks at both times but without an intervening intervention. For example, if the improvement we observed were fully due to a practice effect, then we would expect to see an improvement of similar magnitude in a control condition even in the absence of an intervention. While we have argued that the practice effect explanation is unlikely (due to the improvement observed in both experienced and novice comics readers alike), only the inclusion of a control condition would allow this explanation to be completely ruled out.

There were also inconsistencies in testing conditions. Such inconsistencies are hard to avoid when collecting data in real world contexts. For example, due to schools' time constraints, not all sessions were the same length of time apart. Instead, the gap between testing sessions ranged from one day to seven days. Participants may also have been affected by the time of day research was carried (e.g., before or after

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lunch, or at the end of the day), or by the close proximity to peers (as the activity and testing took place as a class-room activity). However, while all of the above might add noise to the findings, we do not believe them to be confounding variables (i.e., ones which would have systematically affected our results). There are also issues around generalisability. While the sample was diverse in terms of socioeconomic background, it was ethnically homogenous. As such, it is impossible to say whether the results would generalise to a sample that was not white British.

The findings of the current study have clear applied ramifications. Based on the growing empirical evidence of the pedagogical advantages that comics possess, we anticipate that they will be increasingly adopted in educational contexts. However, our findings suggest that a straightforward adoption of comics as education tools may be less effective than it could be. Educators should not assume that students will have the visual literacy skills that are needed to fully engage with comics. Instead, students should receive comics-specific visual literacy training prior to the use of comics materials in order to ensure that recall, comprehension, and inferential understanding is optimised. Such interventions would be very cheap to implement but could have enormous benefit.

The key outcomes looked at in this study were comprehension and inference making. Future work in this area should seek to establish whether the benefits we observed here generalise to groups who have specific deficits in these domains. This might include typically developing children with particularly poor comprehension and individuals with learning disabilities or special educational needs. Autistic children also show deficits in comprehension (Brown et al., 2013), possibly due to an inability to make empathetic inferences about characters' thoughts, feelings, and motivation (McIntyre et al., 2018; though there are challenges to this straightforward deficit model; Milton, 2012). Comics, supported by an effective comics literacy intervention that encompasses social and emotional understanding, may be particularly valuable for these populations.

The purpose of the current study was to assess the efficacy of a visual literacy intervention designed to increase comprehension and inferential understanding of comics. Specifically, we looked at its efficacy in the context of children aged 7-11 reading educational comics. We found that children improved significantly following the intervention. Comics are increasingly being recognised by researchers and educators as powerful tools to promote learning, which children are particularly motivated by and keen to engage with (e.g., Aleixo & Norris, 2007; Ogier & Ghosh, 2018). Adding anecdotal evidence to this, we found that children in the current study were enthusiastically asking to reread the comics after each testing session. Our study shows that, to be fully effective, comics should be used alongside training materials, such as the visual literacy intervention created for this study. This was the case, not just for those new to comics, but also for those who were experienced in

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reading comics. These findings are of particular relevance to schools, teachers, and parents who are interested in making use of comics as educational tools.

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