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The effect of digital storytelling on visual memory and writing skills

Hatice Çıralı Sarıca*, Yasemin Koçak Usluel

Hacettepe University, Department of Computer Education and Instructional Technology 06800, Beytepe, Ankara, Turkey

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ABSTRACT

The aim of this study is to determine the effect of digital storytelling on the visual memory capacity and writing skills of students. A total of 59 s grade primary school students participated in the current study. The randomized pretest - posttest control group design was used in the study. Students in the experimental groups completed the process through digital storytelling. The research was conducted over 13 weeks. The "Benton Visual Retention Test" and "Composition (Written Narrative) Evaluation Scale" were applied as pretest and posttest. In order to test whether there was an improvement within groups and to see if there were differences between groups, the hypotheses were tested using the t-test and obtaining gain scores. As a result, the findings showed a significant improvement in terms of the visual memory capacity and writing skills of students in both experimental and control groups, and the average gain scores were higher in the experimental group. Findings further demonstrated that digital storytelling created a significant difference in the writing skills of students. However, no statistically significant difference was observed between groups although the gain score averages of the experimental group students were higher in terms of visual memory capacity.

1. Introduction

Digital Storytelling (DST) emerged from the integration of multi-media and storytelling in order to meet the various needs of individuals, such as communication and self-expression, and to facilitate teaching and improve skills. Since it is a dynamic tool, DST can be used for different purposes in different contexts and be created either personally or within groups. It has been demonstrated that DST provides opportunities for the improvement of students' skills including problem solving, cooperative learning, motivation, achievement and critical thinking, within the context of formal education (Belet & Dal, 2010; Frazel, 2010; Hung, Hwang, & Huang, 2012; Malita & Martin, 2010; Ohler, 2013; Yang & Wu, 2012). Moreover, researchers have reported that students can improve their literacy (digital, global, technological, visual, informational) and other academic skills by participating in the process of designing, creating and presenting their own DST (Hung, Hwang, & Huang; Frazel, 2010; Malita & Martin, 2010; Ohler, 2013; Robin, 2008; Skinner & Hagood, 2008; Yuksel, Robin, & McNeil, 2011). It has been suggested for teachers to employ DST within their teaching practice to help make abstract or difficult concepts more understandable and to facilitate discussion on certain issues (Ohler, 2013; Robin, 2008). Digital stories can either be created by the students themselves or teachers can use the ones created by others.

* Corresponding author.
E-mail addresses: haticecirali@hacettepe.edu.tr (H.Ç. Sarıca), kocak@hacettepe.edu.tr (Y.K. Usluel).

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Another important factor in the learning process is the way in which information is preserved and remembered. Memory plays a crucial role in the process of retaining, and when necessary, recalling information (Demir, 2011; Terry, 2009). As individuals actively participate in the writing based DST process, their memories are affected. Previous studies have also indicated that storytelling, including digital storytelling, can effectively impact memory (Aina, 1999; Drevenstedt & Bellezza, 1993; Ricci & Beal, 2002).

With that said, the following section explains the relationship between digital storytelling, visual memory and writing skills comprehensively.

1.1. DST and visual memory capacity (VMC)

Memory is the process of retaining and remembering events and past experiences. (Hudmon, 2006, p. 12). Memory has numerous functions and has been classified or named in various ways (e.g. sensory memory, working memory, long-term memory, visual memory, visual short-term memory, spatial short-term memory, iconic memory, photographic memory, episodic memory and semantic memory) (Solso, Maclin, & Maclin, 2007; Terry, 2009). Visual memory is the ability to recall or remember images, scenes, words or other information presented visually (Binder, Hirokowa, & Windhorst, 2009).

Within educational context, it is required that a student be able to visualize a stimulus in his mind without receiving any help. If such skill of student has not improved, he may have difficulty in placing visual stimulants during several operations (e.g. remembering general view of words in reading and writing, sequencing the letters) (González-Alvarez, González-Alvarez, & Bermejo, 2010). It is also stated in the relevant literature that visual memory is associated with academic success (Kulp, Edwards, & Mitchell, 2002), reading performance (Lyle, 1968), and written arithmetic performance (Solan, 1987). In this regard, the development of visual memory is important. Memory capacity develops from infancy to early adulthood (Terry, 2009). The preservation and recalling of information in the memory can be increased, through various associations, with the usage of memory strengthening tools (Solso et al., 2007). Acronyms, acrostics, key words and storytelling are among various methods used for strengthening the memory (Solso et al., 2007; Terry, 2009). On the other hand, stories also influence memory, and the storytelling process facilitates cognitive changes (Schank & Abelson, 1995). In the DST process, individuals play an active role. Gallets (2005) study, which examined the effects of storytelling and story reading on the memory of first and second grade primary school students, found that the students in the group where stories were told were more engaged in the process, their thinking and imaginative skills were more developed and their mental processes played a more active role. All of these were a consequence of the improvement of their ability to recollect and an increased level of impact on their memory. According to Aina (1999), this can be explained by the fact that storytelling requires more imagination in comparison to story reading.Thus, it can possible to stipulate that digital storytelling process where visuals are created, drawings are performed, individuals have an active may be efficient in visual memory capacity.

1.2. DST and writing skills (WSs)

Writing is one of the most complex cognitive activities and involves a great number of cognitive components (Olive, 2004). In writing, ideas are extracted from long-term memory during the planning process of the transcript, and reorganized if necessary. Used as a method of communication to talk about ourselves and interact with others, writing expresses our feelings, thoughts, experiences, etc. through a required set of symbols and signs (Akyol, 2000; Sever, 2004)., Individuals discover their own thoughts and the ideas they really wish to express in the creation of their stories through the process of writing (Miller, 2010). The initial stage of DST involves story/scenario writing, while the other subsequent stages are shaped in accordance with the story that is being written. Simply stated, writing is an important part of the process of creating digital stories (Lambert, 2013; Miller, 2010; Ohler, 2013; Robin, 2008). According to Ohler (2013), DST:

- Is based on writing. While writing may not be the final product of a digital story, it is the most important part of the process;
- Contains authentic writing, through which the writing skills of students can be developed in a unique and satisfying manner;
- Forms bridges to traditional writing. Students handle many different curricular or extra-curricular issues in a creative and explanatory manner and then synthesize them before effectively performing the first stage in developing digital stories.
- Requires deep thinking, which is an important aspect of the writing process, as stories embody one's own reflections in the intermutual relationship between the writing process and thinking.

With DST, students are able to learn the art of writing a good story, how text and art can be integrated and how technology can be used creatively (Miller, 2010). In addition, when students are fully engaged in the writing process, they embrace their stories and participate in the digital story creation process more effectively by developing a good scenario (Xu, Park, & Baek, 2011).

Previous studies have shown that DST develops students' writing skills and can be used as an effective learning tool, particularly in computer-assisted language acquisition. (Abdollahpour & Maleki, 2012; Bumgarner, 2012; Campbell, 2012; Chuang, Kuo, Chiang, Su, & Chang, 2013; Kuo, Chiang, Lin, Cao, & Yen, 2012; Xu et al., 2011; Yoon, 2012).

The literature on DST examines several different cognitive structures (Fig. 1). The interrelationships of these structures are provided below in Fig. 1, using the nomological network developed by Cronbach and Meehl (1955). The trial version of the Inspiration 9.2 program was employed for the formation of this network. The bidirectional arrows in the figure indicate a relation between structures, and the one-directional arrows indicate that one structure has an effect on another structure.

More specifically, Fig. 1 shows that writing skill, memory and digital storytelling are interconnected with one another. Although DST has an obvious effect on many structures, a remarkably small number of studies conducted on DST have examined its impact on cognitive structures, such as perception or memory. In the literature, there is only one study that examined the effect of DST on memory and no studies conducted to examine its effect on visual memory. In light of this conspicuous absence of research on these particular cognitive structures in relation to DST, this study would serve to fill this void in the literature. Moreover, while numerous studies have examined the effect of DST on writing skill, each study reviewed has discussed the implementation process, the tools used and the context in a different manner. This study willfurther contribute to the literature by examining writing skills within a context different from those used in other studies, namely an educational context. The results of this original study will add valuable data to the current store of knowledge on the use of digital stories.

Fig. 1. Nomological network related to previous research.

2. Purpose of the study

The aim of this study is to determine the effect of DST on the VMC and WSs of students. For this purpose, the research aims to investigate the following research questions:

1) What is the effect of DST on students' VMC?
a) After DST, has the VMC of the groups developed significantly?
b) Is the difference created by DST in the experimental group's VMC significantly greater than the difference created in the control group?
2) What is the effect of DST on students' WSs?
a) After DST, has the WSs of the groups developed significantly?
b) Is the difference created by DST in the experimental group's WSs significantly greater than the difference created in the control group?

3. Method

3.1. Research design

In this study, a randomized pre-test/post-test control group design was used (Fraenkel, Wallen, & Hyun; 2012).

3.2. Participants

The participants were 59 s grade primary school students enrolled in the "Journey of Myself" education program of the "Educational Volunteers Foundation of Turkey (TEGV)" during the fall semester of 2013–2014. TEGV is a non-profit organization aiming to contribute, with the support of its volunteers, to the formal education of children between the ages of 7–16 through the administration of various educational programs and activities.

The experimental group consisted of 29 students and the control group included 30 students. The experimental and control groups were formed randomly. Since each classroom had a maximum capacity of 15 students, two classes for the experimental group and two classes for the control group were formed, and the students were randomly assigned to either of the two groups. After the experimental and control groups were determined, the equivalence of the experimental and control groups were examined within the same group and between the groups in terms of visual memory capacity.

3.3. Data collection tools

3.3.1. Benton visual retention test

The Benton Visual Retention Test (BVRT) was used to determine the visual short-term memory capacity of the students. Developed by Arthur Lester Benton in 1945, the test was published in 1946, with some changes being made to the original test in 1955, 1963 and 1974 (Sivan, 1992). The test can be applied to both children and adults. It has three alternative drawing-based forms, which are prepared on equal levels (C, D, E). In this study, Form C was used since there is no difference between the forms and this form was readily available to the researcher. There are 10 cards/designs on Form C, with each card featuring one or more geometrical shape(s). The level of difficulty of the cards gradually increases. Four different alternative methods of administration (A, B, C, D) are applied for these forms (C, D, E). Furthermore, there are differences between the methods such as the waiting duration before showing the cards and/or drawing the shapes. Each card is shown for 10 s in Administration A and for 5 s in Administration B, after which the individuals are expected to draw the shapes. In Administration C, they are asked to draw at the time they see the cards. According to Administration D, each card is shown for 10 s, followed by a 15 s waiting period after the card is withdrawn (Sivan, 1992). Administration D was used in this study because it was more suitable for the students' short-term visual memory. After the waiting time, the child was asked to draw the shape or shapes that appeared on the shown card. Each card earns a point if it is correctly replicated (maximum score = 10). Detailed information about the administration and scoring may be accessed from the BVRT Handbook (5th edition) (Sivan, 1992).

The test was administered individually to each student by the researcher. The practical training of the test was provided by a faculty member, who is an expert in the area of Neuropsychological Measurement, from Psychology Department in a public university in Turkey. Additionally, supervision was given on test administration and scoring throughout the process.

3.3.2. Composition (Written Narrative) evaluation scale

In the study, the students were asked "Can you write a story about the job you would like to do in the future?" in order to measure their WSs. To evaluate students' WSs, the "Composition (Written Narrative) Evaluation Scale" developed by Sever (2004) was used with permission. The scale includes three sub-dimensions which are, external structure, inner structure, and, language and narrative. This study evaluated students' WSs using 14 items and 43 points (external structure: 3 items, 8 points; inner structure: 4 items, 16 points; and language and narrative: 7 items, 19 points).

3.4. Implementation process

The research was conducted over a period of 13 weeks. The participant attended TEGV as part of an extracurricular social activity class during school hours. The activity duration for each group was 90 min per week. Each group attended TEGV on different days for the same duration of time. Activities in each group were carried out in the presence of the researcher and an education volunteer. The researcher previously attended a 'Communication Training' to be an education volunteer.

The "Journey to Myself" education program, under which this study was conducted, is one of TEGV's standard activities. The Journey to Myself activity consists of four separate programs for grades 2–3, 4–5, 6–7 and another one solely for eighth grade students. The program prepared for grades 2–3 deals with subjects such as "knowing oneself, recognizing emotions, communication skills, friendship and roles and responsibilities" (Taner, Özdemir, & Özgür, 2013). The main target of the program is "to have children acquire individual awareness and to develop their social skills" (Taner et al., 2013). In addition, the children are expected to prepare a project (e.g. involving a poster, poem, slideshow, newspaper, story) and to present it at the end of the term.

The researcher and the education volunteer used the "Journey to Myself for Second and Third Grades Volunteer Book" in the administration of the classes. The book consists of various activity suggestions to be performed on a weekly basis. In the implementation process, one or more of the activities from the book were selected each week by the researcher and the education volunteer to be performed in the classes. From the fourth week on, the students in the control group were asked to prepare posters on "My World" and "Here is My Life" themes using printed materials; while the students in the experimental group were asked to prepare digital stories about themselves on the same themes.

3.4.1. Experimental group

In this study, the DST process started in the fourth week of the implementation process within the experimental group. Initially, DST was explained to students accompanied with examples. Afterwards, each student created their own individual digital story with the help of the researcher and the education volunteer. At this point, it is important to note that digital stories can be prepared in many ways, such as using mobile applications (e.g. Animoto Video Maker, Com-Phone Story Maker, iMovie, Magisto, Storkit, Toontastic, Viddy, Voice Thread, etc.), web-based tools (e.g. Animoto, Powtoon, Myna, Storyjumper, etc.) and desktop software (e.g. Microsoft Photo Story 3, Adobe Premiere Elements 11, Windows Movie Maker, Scratch, Storytelling Alice, Moglue Builder, etc.) including text, sound, images or videos. Some of these applications and software were used in this study.

In the creation of digital stories, Ohler (2013) five-stage digital story creation process was used:

1) In the first stage, the planning of the story, students stated the subject matter they wished to write about and explained what they wished to include in their stories. After each student's explanation, the other students, the researcher and the education volunteer shared their views on the story. After the narrations, the students were given an A4 paper and asked to write their stories (Fig. 2).
   During the sixth week, the researcher and the students reviewed the stories which had been written in the fifth week. The students' stories were written line by line, one after another, in an ordered manner, by the researcher, and activity sheets were created (Fig. 3) to facilitate students' progress during this process. The students were asked to write down any parts they needed to add or remove.The activity sheet was designed as four columns: the first column was for numbering to identify the order of sentences; the second column was where the students' stories were written line by line, and if the students wished to add a sentence, they were asked to write that sentence in the third column, after the story sentence contained on that line; the fourth column was for visuals to be used in the narration to support the digital story (this column was not used until the latter weeks). The students were told about what kind of visuals they could use in their digital stories and then were asked what they would like to use and do. In the seventh week, the students ordered the sentences on the paper and reviewed the flow of the stories.
2) Pre-production activities, which formed the second stage of creating digital stories, were initiated in the sixth week. The preferences of the students were asked on visuals they wished to use to support their stories, and they were given time

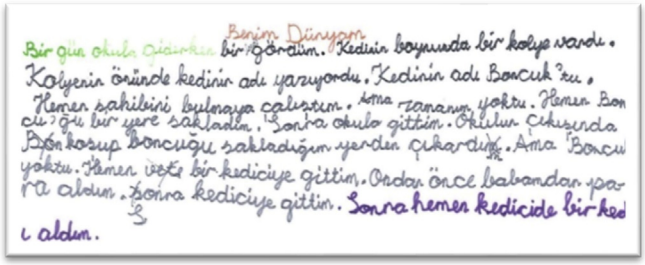

Fig. 2. Fifth Week: Story writing example in experimental group.

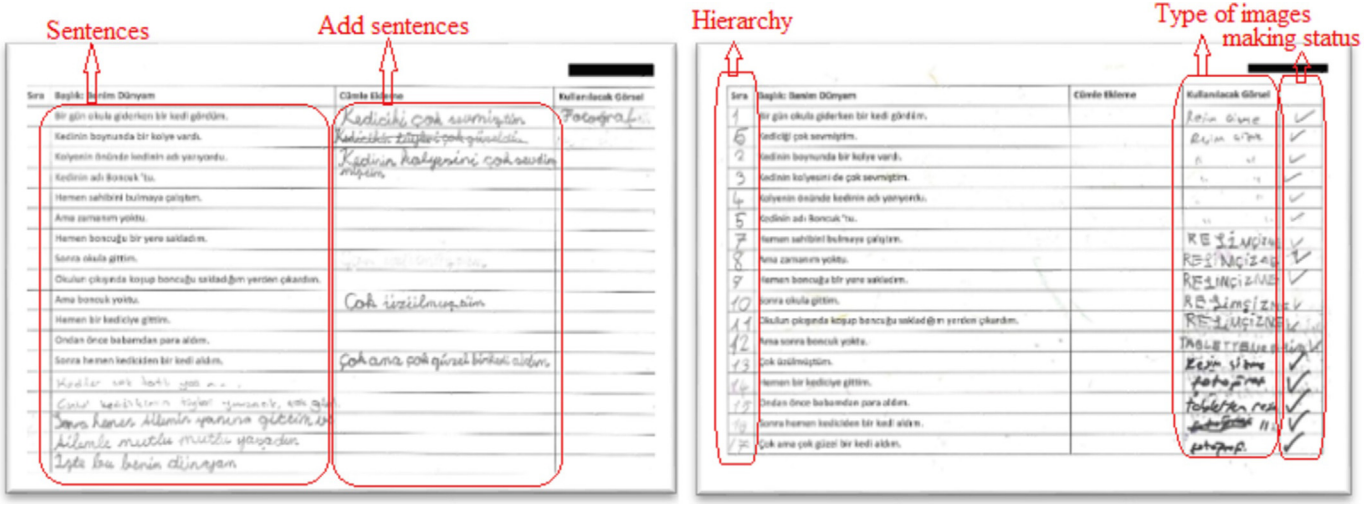

Fig. 3. Sixth and Seventh Weeks: The Experimental groups' ordering of the flow of the story and the visuals to be used on the study paper.

until the following week to decide. In the seventh week, the drawings and pictures about the stories were made on the paper. Additionally, in the seventh week, the students were divided into groups of their own choice. The groups were provided with tablet PCs with standard interfaces to allow them to paint pictures, do drawings and take photographs and videos. The groups consisted of three or four students, each student in the group used the tablet PC for three weeks, taking turns. KidsDoodle, Rainbow Doodle and Animated Paint applications were used for drawings. The drawing activity continued in the eighth and ninth weeks (Fig. 4). The students wrote down the sentences in their stories that supported their selection of visuals in the fourth column of the activity sheet (Fig. 3).

Fig. 4. Samples of visuals drawn by the experimental group by hand and using tablets within the context of the stories.

In addition, the researcher took the students' photographs for some of the narrations in the stories. In the eighth and ninth weeks, the drawings and visuals were prepared, and the students' voice recordings of their stories were completed using Audacity, an open source software program, on the researcher's computer. In the eleventh week, music pieces were selected for the students' digital stories. The students listened to pieces using Microsoft Photo Story.

3) During the production process, decisions were made on which software the digital stories would be developed, as there were many programs to choose from for their creation. After various programs were analyzed, the decision was made to use “Microsoft Photo Story” and “Movie Maker” programs, which are both user friendly and free. Due to the inadequate infrastructure at the institution where the study was conducted and insufficient weekly activity time, voice recordings of the students and integration of visuals were performed by the researcher.
4) The post-production stage included final review and printout, if necessary, of the digital stories, and the digital stories were organized by the researcher. All stories were structured in the same manner (e.g. with an introduction, title). Digital stories of all students were then copied on to CDs to be given to school teachers and TEGV administration.
5) The delivery stage, the final stage of digital story creation, included performance of the students' digital stories at TEGV in the presence of other students, TEGV administration, school teachers and parents which was staged at the end of the semester.Eventually, the CDs were delivered to the audience.

At the end of the implementation process, it was found that students enjoyed themselves in digital story creation process, they found it enjoyable to use tablets and that it was more preferred to use tablets instead of paper-pencil in obtaining visuals as a result of the observations made during the process and informal interviews with the students.

3.4.2. Control group

In the control group, no activities related to the DST were conducted. Both the control and experimental groups studied the “My World” subject. However, the students in the control group were asked to prepare a poster at the end of the process. At the beginning, a discussion was held with the students to decide on what kind of posters they wanted to prepare on the topics they had chosen and the type of materials they wanted to use to support it. In the following weeks, they moved on to prepare the contents they had planned to include in the posters, and they wrote texts related to their topics. No story patterns were considered in the stage of writing. In the final weeks, the pictures were drawn, the printed materials were affixed to the posters, designs were made and the posters were finalized. The posters prepared were exhibited to other students at TEGV, the TEGV administration, school teachers and parents at the end of the semester. Finally, they were handed over to the students.

3.5. Data analysis

In order to test whether or not there was any improvement in the groups and/or any differences between the groups, hypotheses were tested using t-test by means of obtaining gain scores. The gain score, which is calculated by deducting the pre-test scores from the post-test scores, shows the development of that variable.

In addition, the impact size (η^2) was calculated to show how much of the total variance was explained by DST, to interpret how effective it was in the process and to compare the strength of the relationship between groups (Büyüköztürk, 2011). With the eta-square values being ".01", ".06", ".14" and ".20", the effect size is shown to be "small", "medium", "large" and "very large, respectively" (Cohen, 1988).

For all analyses, the significance level was set at .05. SPSS 17.0 (Statistical Package for the Social Sciences) software was used for the analysis of data.

4. Results and discussion

4.1. Findings related to the first sub-problem

The first sub-problem of the study, expressed as "What is the effect of DST on the VMC of second grade students?" was examined under two headings.

4.1.1. Has the groups' VMC developed significantly after DST?

In order to answer the research question, the following hypotheses belonging to the experimental and control groups were tested:

(μ_E = the gain score average of the experimental group, μ_C = the gain score average of the control group)

$$H_0 : \mu_E = 0, \quad H_0 : \mu_C = 0$$
$$H_1 : \mu_E > 0, \quad H_1 : \mu_C > 0$$

Table 1
Hypothesis test results related to the development of the groups in terms of VMC.

Group	N	Pre-test score average	Post-test score average	Gain score average	ss	sd	t
Control	30	3.43	4.23	0.80	1.54	29	2.84
Experimental	29	3.52	5.00	1.48	2.10	28	3.81

($t_{29,\ .05} = 1.70$) ($t_{28,\ .05} = 1.70$).

Table 1 shows that there was significant development at the .05 level for both the experimental and the control groups regarding the students' VMC (3.81 > 1.70, that is $t_H > t_{29,\ 0.05}$ and 2.84 > 1.70, thus $t_H > t_{28,\ 0.05}$).

Gallets (2005) states that many cognitive processes enter into the picture when the individual changes from the passive receiver state into the active state. When an individual becomes active, the individual's judgment, thinking and interpretation skills come into play, and information is expressed after a form of blending thought and interpretation. In this study, the students were allowed to have active roles in the DST process, which contributed to their VMC development.

4.1.2. Is the difference created by DST on the experimental group's VMC significantly higher than the difference observed in the control group?

The research question was tested using the hypothesis below:

$$H_0 : \mu_E - \mu_C = 0$$
$$H_1 : \mu_E - \mu_C > 0$$

Table 2
The hypothesis test results related to the comparison of difference score averages of the two groups in terms of VMC through the independent groups t test.

	Group	N	Gain score average	ss	sd	t
VMC	Control	30	0.80	1.54	57	1.42
	Experimental	29	1.48	2.10		

($t_{57,\ .05} = 1.68$).

An analysis of Table 2 showed that the H_0 hypothesis was not rejected at the .05 significance level and DST did not create a significant difference in the students' VMC (1.42 < 1.68, that is $t_H < t_{57,\ .05}$).

No significant difference was found to the advantage of the experimental group in terms of VMC in the comparison of the experimental and control groups. However, compared to the poster, the DST developed the students' visual memory to a greater degree (see Table 1). It could be argued that conducting activities in which the control group students interacted with

visuals had an effect on the insignificance of the difference. Perhaps conducting an activity that would include less interaction with visuals could reveal a different result and yield a difference in favor of the experimental group.

Cognitive structures, such as the memory, take a long time to develop (Terry, 2009). It can be argued that the length of this process could influence the lack of difference found between the groups. Furthermore, the relatively young age of the students could have been an influential factor in the absence of this difference. Terry (2009) states that the development of memory capacity begins in infancy and continues through early adulthood. As people grow older, their thinking style change, and information is coded in different ways. While memories are coded in sensory and motor dimensions during infancy, they become verbalized as children grow up. Therefore, schemes change as one gets older. When we wish to recall an event or information, memories cannot be recalled due to differences in schemes and coding style. At young ages, the memory capacity is small, since the preservation of information in memory and the detailing of information and its integration with new information is limited. For instance, adults have a memory space of 7 ± 2 items, while this is much lower for children. Thus, memory capacity increases in parallel with age, a phenomenon that can be explained with the study conducted by Gül (2006). In his study, Gül analyzed the visual memory differences of a group of children aged 8–9 in the concrete operational stage and a group of children aged 12–13 in the formal operational stage. The results of the study indicated that the VMC of the children in the formal operational stage was significantly higher.

4.2. Findings related to the second sub-problem

The second sub-problem of the study, expressed as "What is the effect of DST on the students' WSs?" is detailed under two headings.

4.2.1. Has the WSs of the groups after DST developed at a significant level?

In order to answer this research question, the following hypothesis related to the experimental and control groups was tested:

$$H_0 : \mu_E = 0, \quad H_0 : \mu_C = 0$$
$$H_1 : \mu_E > 0, \quad H_1 : \mu_C > 0$$

Table 3 shows a significant development at the .05 significance level in both the experimental and the control groups regarding the students' WSs ($3.68 > 1.70$, that is $t_H > t_{29,\ 0.05}$ and $6.39 > 1.70$ thus $t_H > t_{28,\ 0.05}$). In addition, Fig. 5 reveals that this development is mainly to the advantage of the experimental group. Whether or not this difference is statistically significant was tested with the next hypothesis.

Table 3
Hypothesis test results of the groups in relation to the their WS development.

Group	N	Pre-test score average	Post-test score average	Gain score average	ss	sd	t
Control	30	20.93	24.03	3.10	4.61	28	3.68
Experimental	29	21.59	29.14	7.55	6.37	29	6.39

($t_{29,\ .05} = 1.70$) ($t_{28,\ .05} = 1.70$).

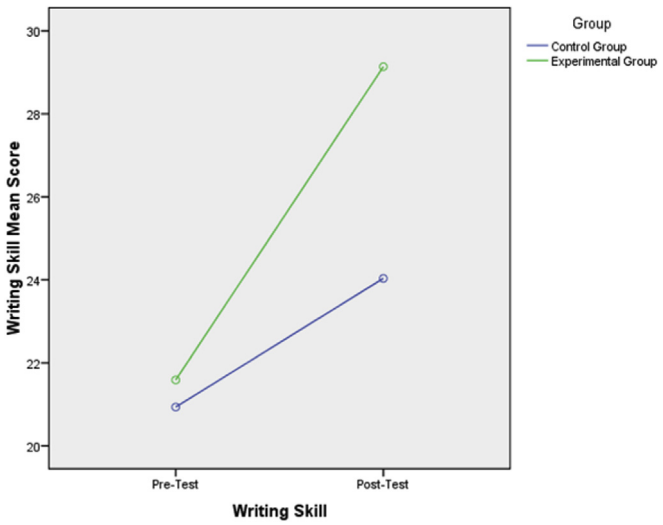

Fig. 5. The groups' development in terms of writing skills.

4.2.2. Is the difference created by DST on the experimental group's WSs significantly higher than the difference which emerged in the control group?

The research question was tested with the following hypothesis:

$$H_0: \mu_E - \mu_C = 0$$
$$H_1: \mu_E - \mu_C > 0$$

Table 4
The results of the hypothesis test in relation to the comparison of the two groups' differences score averages through the independent group's t test.

	Group	N	Gain score average	ss	sd	t	η^2
WS	Control	30	3.10	4.61	57	3.07	0.14
	Experimental	29	7.55	6.37			

($t_{57,\ .05} = 1.68$).

An analysis of Table 4 revealed that DST created a significant difference in the students' WSs ($3.07 > 1.68$, that is $t_H > t_{57,\ 0.05}$). Furthermore, DST was demonstrated to have a major effect on the WSs when the eta-square value was considered ($\eta^2 = .14$).

This finding features certain similarities with the findings of similar studies in the literature (Abdollahpour & Maleki, 2012; Campbell, 2012; Chuang et al., 2013; Kuo et al., 2012; Miller, 2010; Xu et al., 2011). The results suggest that the active role of the students throughout the DST and the scenario writing process was influential in the greater degree of development in the experimental group since students were engaged with writing and revising their scenarios during the DST process for three weeks and shaped their stories using the scenarios afterwards. On the other hand, according to Kellogg (2008), WSs make use of our three basic cognitive systems, namely; memory, thinking, and language, and factors such as maturation, education and teaching may also be effective in the development of WSs. Kellogg (2008) explains the development of WSs in three steps. Since the first of these stages, information narration, involves children below the age of 10, this study's research group may be evaluated at this stage. In the first stage, the writer generally writes what they know and what they want to say. Children, in particular, may begin to notice that there are thoughts different from theirs in the world. It could therefore be stated that the students acquire awareness about themselves and the events taking place around them through DST and that they form relationships between events. This growth has a positive effect on the development of the students' WSs.

On the other hand, students' writing their stories within DST implementation process was handled distinctly than the studies in literature. That is to say; activity sheets were produced by the researcher after students wrote their first studies and in the following weeks students could perform operations such as adding, removing or changing the flow of the story. This way, the students have repeatedly reviewed their stories. As for the control group, no such practice took place. Thus, the use of activity sheets in this manner in DST process has had an impact on the development of writing skill of students more in the experimental group.

5. Conclusion

During the writing-based DST process, individuals play an active role, whereby their memories are affected. Guided by this premise, this study looked at the effect of DST on second grade students' VMC and WSs.

In terms of VMC:

- There was an increase in both the experimental group and the control group after the implementation process.
- When the results of the experimental and the control groups were compared, no statistically significant difference was observed to the advantage of the experimental group. However, while the difference was not statistically significant, the difference between the results of the control group and the experimental group show that the experimental students' visual memory capacity to a greater degree.

The results of this study advance the argument that DST is effective on the development of cognitive structures, which were originally believed to develop over a long period of time. Therefore, the study reveals the contribution of DST on the development of visual memory, which has a positive impact on the preservation and the recalling of information and skills acquired during the learning process.

In terms of WSs:

- here was an improvement in both the experimental group and the control group after the implementation process.
- It was found that there was a statistically significant difference in the WSs of the experimental group students in comparison to WSs in the control group.

While this development observed in the WSs of the DST students serves as a powerful tool in terms of the students' ability to express themselves, it may also contribute to their performance and the transmission of their knowledge in the learning processes.

TEGV is an institution that is based solely on the service of volunteers. Community Service Practices (CSP) can be performed in a variety of ways through individuals or through various foundations and organizations. CSP involves various activities aimed at providing people with awareness, sensitivity, solidarity, effective communication skills and social responsibility awareness of human rights and environmental issues. These activities intend to support scientific, critical and creative thinking, as well as to foster self-esteem and motivate learning, research, analysis and development (Tezbaşaran, 2009). In this respect, this study can be used as a positive example of the studies which can be carried out with CSP and how sustainability can be provided.

To conclude, students benefit from the instructional use of DST. Therefore, the results of the study may be used in similar studies examining the effect of DST on students' various skills as well as in other studies analyzing cognitive structures in terms of DST.

Possible suggestions, which could be made based on these results, are provided below:

- This study has observed that DST contributes to the VMC and WSs of second grade primary school students. In future studies, research can be conducted with samples that include students of different age levels to benefit the literature on the development of memory with age.
- DST can be used in various different lessons.
- Regarding the sustainability of community service practices, DST training can be provided to the individuals who are responsible for providing education in institutions, and through this training the sustainability of the applications can be ensured.
- In this study, the students developed their own digital story. However, digital stories can be developed as a group as well. In future studies, research that analyzes how digital stories can be developed as a group and the role of the student's cooperative learning processes can be conducted.
- Digital stories can be developed using a wide range of tools. In this study, various mobile drawing applications and desktop software were used for the creation of digital stories. In further studies, digital stories can be created individually or collaboratively, interactively or non-interactively, through web-based tools and/or through different mobile applications and/or different desktop software.

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