The effect of story grammars on creative self-efficacy and digital storytelling

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Abstract

Previous studies have proposed that the grammars may serve as a rule-based scaffolding to facilitate story comprehension in storytelling activities. Such scaffoldings may inform students of crucial story elements and possible transitions among different elements. However, how these scaffoldings may influence story creation/writing activities is still not very clear. This study aims to understand and explore the relationship among rule-based scaffoldings, creative self-efficacy and storytelling products. By gathering the stories developed by 53 sixth graders and their creative self-efficacy in a quasi-experiment setting, this study investigated whether providing these rule-based scaffoldings may influence their performance and creative self-efficacy. The results of this study indicated that with these rule-based scaffoldings, students produced better storytelling products in terms of content quality. However, the presence of story grammar rules also limited the students’ freedom of creative thinking, and thus reduced the creative self-efficacy level at the early stage of learning to create stories. Such findings support that the rule-based scaffolding may be more helpful in facilitating storytelling in the idea exploration phase than in the generation phase. Educators may need to be cautious regarding the time point at which rule-based scaffoldings would be most effectively integrated with learning activities.

Keywords

creative self-efficacy, multimedia, story grammar, storytelling.

Introduction

Storytelling has become an imperative pedagogical approach to effective learning. While telling a story, students not only have to initiate new ideas but to shape their own experiences, reflect how they fit into their society and construct meaning for themselves (Fusai, Saudelli, Marti, Decortis, & Rizzo, 2003; Madej, 2003). Such an activity may promote student motivation to learn as it stretches their imagination to create and display a story. Storytelling has therefore been applied in many subject domains. For instance, Alice (Kelleher, Pausch, & Kiesler, 2007) and Scratch (Monroy-Hernández & Resnick, 2008) used storytelling as the underlying scenario to promote student motivation to learn programming. POGO (Fusai et al., 2003) allows children to compose and tell stories by capturing/manipulating images, voice, videos and drawings through many types of physical proxies (e.g., cards augmented with tag technologies, touch panels and mat). Such physical proxies and multimedia may fulfil multiple pedagogical objectives such as expanding sensorial experience and imagination. Yang and Wu (2012) and Trushell, Maitland, and Burrell (2003)
employed storytelling as a means to promote language learning and examined how different types of interaction designs on computers may influence reading from the stories. Creating and telling stories plays an important role in teaching and learning and, in order to create and tell stories, students have to accomplish a number of things. They must collect materials, organize their own ideas and transform them into a logical sequence of story frames (Liu, Liu, Wang, Chen, & Su, 2012). Previous studies by Liu, Chen, Shih, Huang, and Liu (2011) and Druin and Fast (2002) indicate that children can only create simple stories that lack sophisticated logic flow. This is because the storytelling activity is a creativity process that requires students to initiate creative ideas and organize them into a logical sequence. Consequently, students may need scaffoldings with which to learn how to compose stories creatively and to express them in a logical flow.

Theories of creativity may shed light on how to provide scaffolding to help students learn to create and tell stories. Researchers have presented several ways to enhance creativity. For instance, the system perspectives of creativity by Csikszentmihalyi (1988) and Amiable (1983) indicate that, in order to be creative in a cognitive activity, the individual must acquire sufficient knowledge of the domain involved therein and must interact with that environment to pursue recognition. Such perspectives suggest that it is necessary for students to develop sufficient domain knowledge of the creative activity before they can produce creative work independently. Individuals need support that can help them structure the ideas they have into a sophisticated storyline (Acosta et al., 2004; El-Koumy, 1999; Nuutinen, Sutinen, Botha, & Kommers, 2010). Therefore, creative storytelling must occur concurrently with and in the presence of a certain level of familiarity with the domain knowledge of stories and their settings. For instance, to be able to create stories well and creatively, students should have the basic structure of the story in mind (Liu et al., 2011). Consequently, a critical issue in helping students to create stories is to provide effective forms of scaffolding that help them understand and exercise storytelling structures.

Computers are being used to facilitate storytelling activities in elementary schools to aid children in the development of creativity (Antle, 2003; Désilets & Paquet, 2005; Kara, Aydin, & Cagiltay, 2013; Madden, Chung, & Dawson, 2009). Computers may be applied to enhance and supply knowledge about stories while students are using them to create stories. Several forms of scaffolding have been applied to enhancing the performance of storytelling. The first form involves the use of graphical interfaces intended to increase students’ structural awareness of story design. For instance, previous studies such as Woven stories (Nuutinen et al., 2010), StoryMappers (Acosta et al., 2004) and visual knowledge management systems (Lukosch, Klebl, & Buttler, 2008) have developed story structure organizers to aid in visualizing the structure of stories using a form of concept map. Such graphical organizers may enhance students’ structural awareness of stories as the maps can be used to visualize the structure of ideas in a graph which can aid in organizing information and knowledge (Liu & Lee, 2013). However, the above organizers did not support the student creativity process by providing content suggestions to inform them of material that might be included in a story.

The second form of scaffolding for learning to create and tell stories is specifically content based. Several studies have developed systems with pre-defined content to be used as hints in helping students to develop story frames. For instance, the studies by Antle (2003) and Tsou, Wang, and Tzeng (2006) provided students with pre-defined content objects to help them develop stories. These approaches involved content-based scaffolding as they provided content hints for students. In the study by Liu et al. (2011), story elements such as wars, fighting and rewards were included in the graphical interface as hints to help students develop storylines. However, given highly explicit hints and pre-defined content objects, such an approach may well limit the diversity of stories students generate, as the hints are too detailed (Antle, 2003; Decortis & Rizzo, 2002). Such pre-defined settings provide support for storytelling at a detailed level rather than at the meta-cognitive level on which students more effectively glean the general underlying rules of story creation. Such detailed hints may limit the scope of students’ creative work as highly specific instruction may constrain creativity (Greenfield, Geber, Beagles-Roos, Farrar, & Gat, 1981).

Rule-based scaffoldings that provide only fundamental story development rules may be helpful in providing meta-cognitive level scaffolding. To facilitate the development of storylines, rule-based scaffoldings were
provided to help story creators develop storylines based on artificial intelligence techniques. Such a form of scaffolding may provide storytellers with possible story development paths based on story grammars at a meta-level. For instance, TALE-SPIN (Magon & Zaslove, 1990) used a set of story grammars to hint at possible story development lines. Specifically, these story grammars were presented as a set of rules for episode transitions to guide storytellers in the generation of ideas. For example, the story grammar may impose a rule indicating that after the background setting description of a story, an event may take place that causes a character to carry out any action. Such transition rules were used by the computer programs to influence the possible story development line. However, how students may use the story grammar as scaffolding in the creation of stories remains unclear.

In addition to being used by computers as a reasoning engine, story grammars may also be helpful for improving students’ story reading performance. The studies regarding story grammars demonstrated three main research directions. The first direction (e.g., Mandler & Johnson, 1977; Morrow, 1985; Rumelhart, 1975; Stein & Glenn, 1979; Thorndyke, 1977) aimed to clarify the structure of a well-formed story and how the structure may guide individuals to encode and retrieve information in the story. These studies asserted that a story contains settings, beginning event, actions and the attainment of the goal. According to Rumelhart’s (1975) grammars, a setting is a statement of time and place of a story and characters which describes the static proposition of the background of the story. An event is a change of the state of the story which may initiate certain actions to response to this change of state. The attainment of the goal is the consequence of the actions taken by characters related to goal of the characters. The studies by Rumelhart and El-Koumy (1999) have confirmed that increasing students’ understanding of story grammars may improve their comprehension of stories.

The second direction focused on the instruction of the story grammars aiming to enhance students’ comprehension of stories. Diverse strategies such as direct instruction of story structure (Fitzgerald & Spiegel, 1983), questioning and discussion on structure (Griffey, Zigmund, & Leinhardt, 1988; Morrow, 1985), story mapping (Baumann & Bergeron, 1993) and story structure analysis (Fagella-Luby, Schumaker, & Deshler, 2007) were shown to be effective strategies to improve story reading skills. However, how the story grammars may influence the story creation activity still remains unclear.

Therefore, the third direction regarding story grammars aims to investigate strategies to improve the story creation because of recent emphasis on creativity in education systems (Ellis, 2003). Previous studies proposed different strategies such as collaborative story creation (Nuutinen et al., 2010) and drawing as a planning activity (Caldwell & Moore, 1991) to facilitate story creation. Story grammars were also applied as a tool to enhance student awareness of the story structure when creating stories. For instance, the study by Fitzgerald and Teasley (1986) showed that instruction in story structure had a positive effect on organization in story creation. Liu et al. (2011) also proposed a mechanism that provided hints about different instances of story elements, such as wars and disaster as instance of events to facilitate story creation. It was found that such simple hints could help students develop more sophisticated stories.

However, the above studies mainly investigated the influence of story grammars on story quality. How these grammar rules may influence creativity process is still unclear. According to the general Geneplore creativity model (Finke, Ward, & Smith, 1992), individuals need to go through both idea generation phase and idea exploration phase during which the constraints regarding the quality of ideas were examined. On the one hand, the story grammar rules may inform students not only of indispensable story elements but also possible transitions among different elements to evaluate the quality of their stories during exploration phase. On the other hand, this approach may also introduce complex constraints that may impede the idea generation. Therefore, it is worthwhile to understand and explore how story grammars used as rule-based scaffolding may influence student learning in creative activities.

In recent years, researchers have begun to explore how confidence in creativity may influence creative activities. Creative self-efficacy has attracted significant attention in the literature due to the important role it plays in creative performance. Creative self-efficacy reflects how individuals view their own capabilities in the development of innovative products (Tierney & Farmer, 2002). Several studies such as those of Tierney and Farmer (2002) and Choi (2004) reveal that creative self-efficacy significantly affects creative performance.
In the study by Tierney and Farmer, a high correlation was found to exist between creative self-efficacy and creative performance. Furthermore, it has been demonstrated that creative self-efficacy explains creative performance better than does work self-efficacy. This might be because creative self-efficacy is largely responsible for mediating the effect of many factors, such as motivation and social influence on creative performance (Choi, 2004). Because creative self-efficacy plays an important role in creative works, the investigation of the relationship among rule-based scaffolding, creative self-efficacy and storytelling may help us understand how the above rule-based scaffoldings may be used in educational settings to enhance storytelling ability.

Currently, the influence of rule-based scaffoldings on the learning of storytelling remains unclear. On the one hand, story grammar rules may help students understand the structure of stories. On the other hand, too much explicit information may interfere with the individual creativity process (Greenfield et al., 1981). Complex relationships among the given information may be overwhelming for novices and interfere with their creative works (Chua & Iyengar, 2008). There is a risk that such story grammar rules may introduce complex constraints that could impede the development of creative ideas during storytelling. This study addresses this issue by focusing on how providing story grammars may influence the storytelling experience on computers. More specifically, this study aims to answer the following research questions:

◆ Q1: How providing story grammar rules may influence the quality of stories developed by students
◆ Q2: How providing story grammar rules may influence the structure of stories developed by students
◆ Q3: How providing story grammar rules may influence students’ creative self-efficacy

Method
Participants

Much of the literature has given special attention to the development in young children of creative thinking as associated with storytelling (Antle, 2003; Decortis & Rizzo, 2002; Druin & Fast, 2002). The current study purposes to observe whether supplying grammar rules will influence student storytelling activity. The participants were 53 sixth graders (12 years old) in an elementary school in northern Taiwan. They were monolingual students speaking Chinese and having common understanding about Chinese culture. They were chosen because they had adequate computer skills to deal with information technology – this school covered the application of information technologies such as computers and the Internet in a lesson per week from third grade onwards. However, none of the students had experienced any storytelling activity using computers or other technologies. Therefore, student reactions to and perceptions of these storytelling activities may well be helpful in understanding the research questions of this study.

Previous studies regarding the development of story grammars have confirmed that there were developmental differences related to story-structure knowledge. More specifically, Fagella-Luby et al. (2007) asserted that the story-structure knowledge may initially appear at the first-grade level and become well developed at the sixth-grade level for typical readers. In the study by Mandler and Johnson (1977), they indicated that the story developed by the first and fourth graders seems to place much weight on the outcomes of a story, but lacks characters’ attempts and reactions. Therefore, students older than these may have sufficient story-structure knowledge to understand story grammars but still could not apply it in a sophisticated manner. Moreover, prior studies regarding children’s creative performance indicated a fourth-grade slump phenomenon, indicating that children’s creativity performance decreased profoundly in the fourth grade (Plucker & Renzulli, 1999). Students in the late elementary grades show a longer general decline. This may be due to the socialization and the change in school climates. It is thus worthwhile to understand the influence of the story grammars on students in the late elementary grades in the story creation activities. Therefore, this study selected sixth graders as the participants.

Activity and procedure

A quasi-experimental design setting was created with one experimental group and one control group. The experimental group consisted of 26 students (male = 13, female = 13), whereas the control group was
composed of 27 students (male = 13, female = 14). One hour of activity took place weekly for a total of 8 consecutive weeks. Both the experimental and the control groups were given a brief orientation on the storytelling platform (described later), and the opportunity to practice storytelling and to become familiar with the platform during the first and second weeks. Additionally, all students were asked to fill out the creative self-efficacy survey (described later) for storytelling in the first class. Starting in the third week and continuing until the end of the eighth week, students were all engaged in storytelling upon a given topic: ‘saving the forest’.

The main purpose of this study was to understand the influence of the story grammar rules on the storytelling experience. Therefore, students in the experimental group were given structural scaffolding that provided story grammar rules (described later) immediately before starting a new frame. The storytelling platform did not display this structural scaffolding during the creation of stories for the control group. To understand the perceived confidence of the students in the storytelling activity, they were all asked to fill out the creative self-efficacy survey again after the storytelling activity. Two evaluators assessed the storytelling products according to a set of storytelling quality rubrics (described later) in order to determine and record the qualities of the stories developed by each of the students. The creative self-efficacy and story qualities were analysed with reference to the story grammar rules provided in order to reveal the influence the rules had had upon them.

The storytelling platform

In order to enable students to create stories freely in a digital environment, this study developed a storytelling platform on the iPad which consisted of an iPad storytelling application and web-based shared space. The iPad application enabled the students to draw (i.e., using pencil, colour picker, eraser, cleaner and stamp), to tell (i.e., using voice recorder and background music) and to frame (i.e., using new frame) digital stories (see Figure 1).

Applications supporting students in creating their stories freely within the iPad application included a pop-up structural scaffolding feature that presented story grammars involving transition rules among different types of story grammar elements (Figure 2). The scaffoldings informed story structure based specifically on Yazdani’s (1989) general state transition rules of stories. The rules were refined by Liu et al. (2011) to specify that an action may trigger an event and/or lead to a consequence within a certain setting according to Rumelhart’s (1975) story grammars. Such grammars resemble the rule starting from an onset followed by the complication and some actions towards a resolution (Bamberg, 2012). These rules were, however, not directly used to guide students in the storytelling activity. Instead, they only provided students with some assistance with the four elements of story grammars (i.e., settings, events, actions and consequences). This

![Figure 1 The iPad Storytelling Application](image1.png)

![Figure 2 The Structural Scaffolding](image2.png)
Study provided the rules of the story grammars to the students while they were creating stories with the application. Figure 2 shows the main story grammar rules in a graphical format. Each time students wanted to start creating a new story grammar element, the scaffolding pop-up appeared. Additionally, each element in the story grammar rules was represented as a button to initiate one of the four types of elements. Furthermore, different element types were colour coded – background settings (red), major events (yellow), role actions (green) and consequences of events (blue). After the students chose the element type, a system-generated count table would appear that displayed the statistical breakdown of the number of times each of the four story element types was displayed. It is hoped that such story grammar rules may help students remain aware of the structure of the stories they are creating.

During the process of creating stories with the iPad application, the students were able to upload their stories to a web-based sharing space and to view the stories created by others and posted there. This sharing feature exists both within the iPad application and the website. It should be noted that both the control and the experimental groups developed stories using the same application. The only difference was that the experimental group was provided with structural scaffoldings that hinted at the transition rules of stories whereas the control group was not. This study would collect and analyse the quality of the stories developed by the two groups and the confidence level detected during the storytelling activity in order to reveal the difference caused by the provision of story grammar rules.

**Storytelling performance rubrics**

One of the goals of this study was to explore how providing story grammar rules may influence student performance in the storytelling activity. The stories developed by the students contained a storyline that was presented with drawings and vocal narrations. Thus, a rubric that can thoroughly evaluate both story content quality and technical quality became necessary. Because of the fact that these stories were displayed as sequences of frames that contained drawings together with vocal narration, music and animations, the storytelling process was similar to that of producing a movie, but on a smaller scale. Therefore, this study adopted the set of rubrics devised by Liu et al. (2011) and based on movie production quality evaluation rubrics (Via, 2002) to evaluate the quality of stories developed by the students. The rubrics examined thoroughly the nine dimensions on which the content and technical quality were to be assessed. Five dimensions were used in the rubric for assessment of content quality: transitions/edits, planning/storyboarding, action/dialogue, accuracy of information and originality/creativity. Four dimensions were used in the rubric for assessment of technical quality: sound, drawing, camera usage and framing.

In order to determine the story quality developed by the two groups, all stories developed by the students were evaluated with these story rubrics by three raters, among them was one teacher from the elementary school. The evaluation may therefore reflect that practitioner’s view on storytelling. Each rater gave a score in each rubric item, a score of 5 the highest and 1 the lowest. The inter-rater reliability was analysed with a Pearson correlation, the analysis of which revealed a high correlation among the three raters across all nine dimensions ($0.79 < r < 0.91, p < 0.01$), which indicates that the rubrics and evaluation were adequately reliable. Additionally, the first five dimensions (transition/edits, planning/storyboarding, action/dialogue, accuracy of information and originality/creativity) were calculated together to represent the content quality of the overall performance, and the last four dimensions (sound, drawing, camera usage and framing) were summarized to indicate technical quality.

**Creative self-efficacy survey**

Previous literature has indicated that a higher level of creative self-efficacy may predict better quality of the performed task (Tierney & Farmer, 2002). However, it is not clear that providing story grammar rules would necessarily have any effect upon the participants’ perceptions of their creative self-efficacy. In other words, within the context of the learning of storytelling, would the story grammar rules influence the self-efficacy of participants in the production of their creative products? Creative self-efficacy reflects how individual students perceive their own abilities to create a creative product. In order to evaluate the students’ creative self-efficacy during the storytelling activity, this study adopted the creative self-efficacy questionnaire from a
series of previous works by Hung, Huang, and Lin (2008). This creative self-efficacy questionnaire contains question items measuring three dimensions of creative self-efficacy: self-efficacy in the produced product (CSE-Product), self-efficacy in creative thinking and strategy (CSE-Strategy), and self-efficacy in the individual’s reactions upon receiving significant feedback (CSE-Feedbacks).

The creative self-efficacy questionnaire was used because a portion of the questionnaire probes student confidence in the strategy for generating creative ideas in addition to the self-efficacy towards the produced product. Such a dimension should be included in the current study because students continually have to generate ideas, creative thoughts and strategies in order to identify obstacles, solve problems and eventually make all of the elements function together in the final story.

Furthermore, in this study, the students created their stories in a social context where they could share stories through the website, the iPad application platform or in a face-to-face manner in a classroom. The social-cognitive perspective of self-efficacy asserts that the perception about self may also depend on interpersonal contextual cues (Anderson & Chen, 2002). Therefore, the feedback coming from peers may influence the student’s confidence in creating a story. Although the current study did not intend to consider the potential influence of interpersonal interaction that might impact upon a student’s creative performance, these interactions among the students are clearly inevitable in an authentic learning community. There was, therefore, a need to consider the effect of dealing with the feedbacks (e.g., encouragement or discouragement) upon student confidence. Because the creative self-efficacy questionnaire devised by Hung et al. (2008) included creative self-efficacy in the reactions of one receiving feedbacks, this study adopted their questionnaire as the tool with which to determine the student’s creative self-efficacy associated with the storytelling activity.

Table 1 displays the dimension, purpose and sample questions of the questionnaire. For better alignment with the storytelling context, the current study revised the question items from the original questionnaire. After the revision, the creative self-efficacy questionnaire contained a total of 10 question items and was tested for its internal consistency with another 144 sixth graders from the same school that the participants of this study attended. Cronbach’s α reported acceptable internal consistencies in the CSE-Product (0.69), CSE-Strategy (0.79) and CSE-Feedback (0.77). The questionnaire contains 5-point Likert scale question items with 5 indicating strong agreement and 1 strong disagreement. The score in all the question items of a dimension were averaged to represent the students’ self-efficacy in the dimension. This questionnaire was filled out by the students twice: once before and once after the storytelling activity. It was hoped that the creative self-efficacy questionnaire modified specifically for the creative storytelling environment could produce a better understanding of the creative self-efficacy status of the students.

### Data analysis

The major purpose of this study was to investigate and compare, using an experimental group and a control group, the creative self-efficacy and the performance of

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Purpose</th>
<th>Sample questions</th>
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</thead>
<tbody>
<tr>
<td>CSE-Product</td>
<td>To understand students’ perceptions of the products they created</td>
<td>I believe my own story is special when compared to those of others.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I feel my story is ordinary and not different from those of others. (Reverse)</td>
</tr>
<tr>
<td>CSE-Strategy</td>
<td>To understand students’ perceptions of creative thinking and strategies</td>
<td>When a topic is assigned, I believe I can think of new ideas to create a good story.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I can ingeniously apply some ideas or use sources to make creative outcomes.</td>
</tr>
<tr>
<td>CSE-Feedback</td>
<td>To understand students’ reactions to potential negative feedback given by peers</td>
<td>I will abandon my ideas if my classmates or teacher criticize my story. (Reverse)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I feel fine if others do not appreciate my story.</td>
</tr>
</tbody>
</table>
storytelling as influenced specifically by providing and not providing story grammar rules. Thus, the current study used a t-test to determine whether there were differences between the two groups. Firstly, the storytelling performance of all the students was evaluated by the three raters using the aforementioned rubrics. To answer research question (Q1), the performance of the two groups was compared with the independent samples t-test. Secondly, to answer research question (Q2), this study also examined how student stories aligned with the elements of story structure (e.g., settings, events, actions and consequences). Such analysis may be helpful in understanding how the students used structural scaffolding in developing their works. Therefore, two coders reviewed each of the frames of all 53 stories together, and determined to which of the four elements of story structure each frame should belong. It was noted that in some cases, frames might convey more than one element based on its content. For example, a frame might have only described the background settings, whereas another frame might have depicted a major event, together with the background settings where the event occurred. When a combination of elements was seen and coders were in agreement, these frames were designated to be multiple fulfilment of elements.

To understand how providing story grammar rules may influence student’s creative self-efficacy (Q3), this study applied a two-way analysis of variance (ANOVA) with a repeated measures analysis of student’s creative self-efficacy before and after the storytelling activity. This is because this study involved one between-subjects factor (the provision of story grammar rules) in addition to a within-subjects factor (the time when creative self-efficacy was measured). This two-way ANOVA with a repeated measures analysis was applied in order to understand the interaction between providing the story grammar rules and time. Following up on the two-way ANOVA analysis, a t-test was applied to further understand the influence of the story grammar rules upon creative self-efficacy. More specifically, an independent samples t-test was used when there was a significant interaction between the between-subjects and within-subjects factors to analyse the creative self-efficacy between the two groups before and after the storytelling activity. Additionally, in order to understand whether there was a significant change in creative self-efficacy within both the experimental and control groups, a dependent samples t-test based on the results of the ANOVA analysis was also used to compare the differences in creative self-efficacy before and after the storytelling activity. By examining the creative self-efficacy of the two groups, it is hoped that this study may provide an understanding of the influence of structural scaffolding on the storytelling activity.

Results and findings

Storytelling performance

The first analysis focused on how providing story grammar rules influenced the quality of student storytelling. Table 2 displays the comparisons of the two groups across the nine rubrics. The results show that student storytelling products scored significantly differently in overall content quality, including the dimensions of transitions/edits and accuracy of information. In addition, the dimensions of action/dialogue and originality/creativity showed a nearly significant difference between the two groups. The experimental group demonstrated higher scores in quality of content. The two groups did not show a significant difference in the overall quality in the technical dimension. Only in drawing quality did the experimental group score differ significantly. The above results support the thesis that with this structural scaffolding, students will produce better creative storytelling products in terms of content quality.

Figure 3 shows one of the stories developed by the control group. The story does not demonstrate a clear development line that strictly follows the story grammars. Instead, many story plots interleaved without a logical flow. For instance, the student added another story background description (this was ever once a beautiful forest) after the second episode, indicating an event that the ducks and the elephants heard a sound of sawing when they were ready to fight. After he indicated another event that A-Pan was sawing trees, he did not relate this event to any further action that led to the end of the story.

Figure 4 displays one of the stories developed by the experimental group. The story depicts a clear transition following the story grammars given to students. In the first episode of this story, the student depicted the background setting of his story followed by an event indicating that two people were preparing tools to destroy...
the forest (episode 2). Then a character took actions to prevent an infringement of the forest from occurring (episode 3). At the end, the student ended up the story with a consequence of the actions (episode 4). Such a development of story may demonstrate a comprehensive logical flow explaining why the experimental group received a higher score in the dimension of transition and accuracy of information.

**Story structure**

This study further analysed the structure of the stories that students produced. Table 3 shows the statistics of the four story grammar elements produced by the two groups. It shows that the control group created more elements regarding setting, action and consequence of the story. In particular, the control group generated significantly more number of settings than the experimental group did ($t = -2.49, p < .05$). However, the stories developed by the experimental group depicted a greater number of events than did those of the control group. The difference was nearly significant ($t = -1.79, p = 0.08$). Such results may indicate that the two groups structured their stories in different ways.

According to the studies (Mandler & Johnson, 1977; Morrow, 1985; Rumelhart, 1975; Stein & Glenn, 1979; Thorndyke, 1977), well-formed stories include settings that describe time, place and characters, followed by a beginning event that allows characters to form a goal. Actions then are taken to attain the goal, and the attainment of the goal could be stated. The control group, who were not provided with the hints of grammars, seemed to engage more in generating more ideas regarding the settings of their stories. They may be more fluent in generating ideas associated with the given topic. On the contrary, the story grammars seemed to reduce the capability of the experimental group to generate ideas at the initial stage, and hence the experimental group produced significantly less number of settings in their stories. The experimental group proceeded to explore how their stories may satisfy story grammars, and thus they produced more number of events in their stories. As events function to evoke a desire in a character to achieve a goal or challenge in the characters world, events play a linking role between the settings and the goal of the character (Trabasso, Stein, & Johnson, 1981). Such results may indicate that the experimental group, who were provided with structural scaffolding, might be more aware of the basic structure of a story, while brainstorming on telling stories, and that they may therefore have attempted to elaborate their stories by adding more
events instead of generating more ideas. Such a result is consistent with the storytelling performance of the two groups, indicating that the experimental group demonstrated better performance in the dimension of accuracy of information as a result of the fact that the events were able to link the background and the actions and the consequences of a story.

Creative self-efficacy

This study analysed the student’s creative self-efficacy associated with a storytelling activity to reveal the influence of the structural scaffolding provided. Two-way ANOVA with repeated measures analysis taken was applied to understand the effect on creative self-efficacy of the different groups (with and without the rule-based scaffolding) and the time of measurements (pre-test, post-test). Table 4 presents the means and standard deviations for the control and experimental groups at pre-test and post-test stages. The result of repeated measures analysis showed no interaction effect between group and time of measurements upon the CSE-Product, $F(1, 51) = 1.21, p = 0.28$, and CSE-Feedback, $F(1, 51) = 1.90, p = .17$. However, the interaction of the CSE-Strategy was significant, $F(1, 51) = 5.88, p = 0.02$. In other words, providing rule-based scaffolding may have influenced student’s creative self-efficacy associated with the strategies involved in generating creative stories.

Independent samples $t$-tests were conducted in this study to follow up on significant interaction and to further understand the differences between the two groups before and after the storytelling activity. The two groups perceived a similar level of CSE-Strategy before the storytelling activity ($t = −0.77, p = 0.44$). After the storytelling activity, however, the experimental group perceived a significantly lower level of creative self-efficacy (mean = 2.96, $sd = 0.71$) than did the
control group (mean = 3.27, sd = 0.74) in the dimension of CSE-Strategy (t = −2.37, p = 0.02). These results indicate that providing story grammar rules had the effect of reducing the student’s overall creative self-efficacy and their confidence in the application of creative thinking and strategies. While outperforming the control group on the quality of story content, the experimental group showed a lower level of perception of their own ability to be creative, especially in creative thinking and strategy.

### Table 3. The Story Structure of the Stories Created by the Two Groups

<table>
<thead>
<tr>
<th>Element</th>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>Experimental</td>
<td>27</td>
<td>1.07</td>
<td>0.68</td>
<td>−2.49*</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Control</td>
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<td>1.28</td>
<td>−0.42</td>
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<td>0.65</td>
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<tr>
<td>Total</td>
<td>Experimental</td>
<td>27</td>
<td>4.48</td>
<td>1.55</td>
<td>−1.42</td>
<td>.16</td>
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<tr>
<td></td>
<td>Control</td>
<td>26</td>
<td>5.23</td>
<td>2.23</td>
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</tbody>
</table>

* p < .05.

### Table 4. Result of ANOVA Repeated Measures Analysis of Creative Self-Efficacy for Experimental Group (n = 27) and Control Group (n = 26) at Different Time

<table>
<thead>
<tr>
<th>Creative self-efficacy</th>
<th>Pre-</th>
<th>Post-</th>
<th>F(1, 51)</th>
<th>p</th>
</tr>
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<tr>
<td>CSE-Product</td>
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<tr>
<td>Experimental</td>
<td>3.10 (.44)</td>
<td>2.75 (.66)</td>
<td>1.21</td>
<td>.28</td>
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<td>Control</td>
<td>3.19 (.60)</td>
<td>3.04 (.65)</td>
<td></td>
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<tr>
<td>CSE-Strategy</td>
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<td></td>
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<tr>
<td>Experimental</td>
<td>3.40 (.42)</td>
<td>2.96 (.71)</td>
<td>5.88</td>
<td>.02</td>
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<td>Control</td>
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<td>3.27 (.74)</td>
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<td>CSE-Feedback</td>
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<td>Experimental</td>
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<td>3.27 (.60)</td>
<td>1.90</td>
<td>.17</td>
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<td>Control</td>
<td>3.75 (.81)</td>
<td>3.65 (.60)</td>
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</table>

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To obtain a clearer picture of the changes in student’s creative self-efficacy, this study further analysed the student’s CSE-Strategy before and after the storytelling activity by a dependent samples \( t \)-test within both groups. Student CSE-Strategy did not change significantly in the control group (\( t = -0.10, p = 0.93 \)). The results show that the control group did not perceive a significantly different level of CSE after the storytelling activity than they did before the activity in any of the three dimensions. In other words, after they experienced the storytelling activity in which story grammar rules were not provided, the students perceived a similar level of creative self-efficacy to that which they had perceived before the storytelling activity.

However, the students in the experimental group showed a significantly lower level of CSE-Strategy after the storytelling activity than before the activity (\( t = 3.48, p < 0.01 \)). The results are shown in Figure 5. These students exhibited a significant decrease in their level of creative self-efficacy associated with strategies to generate creative stories after they experienced the storytelling activity in which story grammar rules were provided.

The above results reflect that the presence of story grammar rules might have limited the students’ freedom of creative thinking, and thus reduced the creative self-efficacy level. Such a finding is consistent with the results of storytelling quality analysis which found that the experimental group had produced fewer frames but maintained a better quality than did the control group. Providing story grammar rules may influence student confidence in being creative when producing stories. Creating stories requires the creation of new ideas and the synthesis of these ideas into a storyline. However, the students seemed to be daunted by the rules of story grammars when they created new frames, and this might have repeatedly forced them to rethink their story plots. The scaffolding might have made students aware of the meaning and purpose of each frame they created. As a result, the story grammar rules may well promote storytelling performance, but creative self-efficacy might have been constrained by the structural scaffolding.

### Conclusion and implications

In a storytelling study, Druin and Fast (2002) framed the learning of abilities related to storytelling into learner, critic, inventor and design partner stages. It was found in the current study that those students who were not provided with any scaffolding (the control group) tended to create only plain stories composed only of settings and consequences and lacking elaborate transitions between events. Such a finding is consistent with the finding of Druin and Fast, indicating that students, when starting to take part in a creative activity, are more likely to play the role of learners who tend to learn from stories but could not recognize story quality, and assume the role of a critic, nor could they create new stories, assuming the role of an inventor. It is thus necessary to help students understand what constitutes a story and how to create one.
A previous study by Liu et al. (2011) provided instances of story grammar elements to students as hints. They found that when given such content-based hints, students could develop more elaborate stories than could those to whom they were not provided. Recipients of content-based hints also produced a greater number of frames. Instead of providing instances of elements, this study investigated how a set of rule-based story grammars may influence the acquisition of storytelling ability and aid students in creating stories. Such grammars differ from the content-based approach. By comparing the results of the current study and those of the previous study, light may be shed on how to provide scaffolding to assist storytelling. It was found that the students who were given the story grammar rules produced better storytelling products as far as content is concerned. Therefore, the rule-based approach and the content-based approach have similar effects in improving story content quality.

However, rule-based scaffolding also produced a side effect upon the generation of ideas in the storytelling activity. It was found in this study that the experimental group and the control group produced a similar number of story grammar elements. However, in the study by Liu et al. (2011), it was found that students produced a significantly larger number of story frames when given content-based scaffolding than without it. This contradiction reveals that rule-based scaffolding can not help students to generate ideas as effectively as can the content-based approach. This may be due to the rule-based form of story grammars that presents a richer and a higher level of information constraint than does the content-based form, as it contains transitions between story grammar elements. Previous study about creativity asserts that too explicit information may limit the generation of different ideas in a creative activity (Greenfield et al., 1981). Complex relationships among the given information were found to be overwhelming for those learners who did not have sufficient knowledge about the creative work and may limit their creative works (Chua & Iyengar, 2008). The findings of this study support these claims indicating that rule-based scaffolding may introduce a higher level of constraint than content-based scaffolding for the novice story creators, and thus may limit the development of the storyline.

The above influence of rule-based scaffolding was also revealed in the analysis of student’s creative self-efficacy. These students exhibited a significant decrease in their level of creative thinking and strategy when the rule-based scaffolding was provided. On the contrary, when the rule-based scaffolding was absent, such a decrease did not occur in all the three dimensions of creative self-efficacy after the storytelling activity. Previous studies by Tierney and Farmer (2002) and Choi (2004) indicate that creative self-efficacy correlated positively with creative performance. However, comparing storytelling performance and creative self-efficacy of the control and experimental groups found that the experimental group demonstrated a higher level of storytelling performance but a lower level of creative self-efficacy.

This contradiction of the findings of previous studies might result from the fact that the participants in this study were young children who were learning to create stories, whereas the participants of the previous studies were adult workers. The domain knowledge related to the creative activities they participated in may not be as sophisticated as that of adult workers. In other words, for those students learning in a domain, domain knowledge, creative self-efficacy and creative performance may all influence each other. The experimental group may be more familiar with the domain knowledge of storytelling because of the provision of rule-based scaffolding. They may therefore possess knowledge about stories and thus be able to develop stories better than the control group could. They may also understand the constraints of a story, and thus their creative self-efficacy may also be reduced.

In summary, the provision of rule-based scaffolding may help students improve storytelling quality. However, it may also reduce the creative self-efficacy of students at early stage of learning to create a story. The presence of such a reduction may call for a more sophisticated way to provide an appropriate form of scaffolding. The Geneplore model (Finke et al., 1992) may explain this issue. According to this model, creative activity should start with a generation phase in which individuals generate ideas in a free form followed by an exploration phase in which they explore the implications and constraints of these ideas. Although the provision of rule-based scaffolding may improve students’ knowledge and evaluation ability with storytelling, it may draw students’ attention to the constraints rather than to the generation of ideas. Therefore, the rule-based scaffolding may be more helpful in enhancing the
exploration phase than the generation phase. A future study may be necessary to investigate the time point at which rule-based scaffolding would be most effectively introduced. It may also be helpful to investigate how content-based and rule-based scaffodings may be provided to students at different stages of a creative activity to improve the quality and creative self-efficacy associated with the activity.

The results shown in this study demonstrated the influence of rule-based story grammars on the creation of stories. However, this study was still a small-scale investigation. Further work is needed to be undertaken with a larger sample to provide additional evidence. In particular, the subjects of this study were sixth graders. It would be interesting to see how the story grammars could influence the creation process of students in different ages. Furthermore, it should be noted that the results of this study were obtained after the creation of a single story ‘saving the forest’. Further studies are necessary to confirm whether the scaffolding has an effect on other stories and extends over time. In addition, this study only investigated students’ story creation experiences in an individual storytelling setting. It would be worthwhile to investigate the storytelling activities associated with a group of students. Gathering information on these issues through further studies can help obtain a thorough understanding of the rule-based scaffolding, and thereafter design a storytelling activity to enhance students’ story creation abilities.

Acknowledgement

This research was partially funded by the National Science Foundation under 101-2511-S-008-005-MY3 and 101-2511-S-008-006-MY2.

References


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