Concept Maps For Creative Development

by

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Abstract

This research is based on the premise that creative application of narrative elements requires organization and problem solving skills, hypothesizing that skills taught to support organization will improve creative development. Creativity was defined as “aesthetic appeal” pertaining to the dimensions of novelty, interest, clarity and the ability to understand. In this experimental design, undergraduate education students (n= 28) were randomly assigned to either concept map planning or text planning for the production of digital photo stories. The highest scoring photo stories were novel, interesting, clear, and able to be understood. The older participants scored higher for each of the dimensions, yet the concept map group was younger than the comparison group. Using age and concept map experience as covariates, a multivariate effect was found, and the concept map group produced photo stories with significantly higher clarity. These results suggest that the use of concept maps for planning aids aspects of creative development, and results in clearer creative communication. In terms of participants’ experience, feedback was positive for the use of concept map planning. These results suggest there is support for further investigation of using concept mapping for creative development. It is recommended that this study be replicated with a larger sample size.
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Chapter 1: Introduction

1.1 Rationale

Current technology allows students to communicate through audiovisual media in ways that were not available 20 years ago. Smartphones, laptops, tablets and other portable media allow for sharing of audiovisual stories readily and regularly. These stories are easily consumable, but are not necessarily clear in communicating novel content that is interesting. This research compared two methods for planning photo stories, measuring novelty, clarity, interest, and ability to understand, to rate the relative effectiveness of each method.

Photo stories are a form of digital storytelling in which an author develops a story, records narration and combines it with various types of multimedia (images/text), sound effects and/or music (Robin, 2008). Storytelling as a form of communication helps students to make sense of their world (Bruner, 1990), but “as a cognitive process, writing may be difficult for students who, for various reasons, lack the abilities required to carry out a writing task” (Boscolo, Gelati & Galvan, 2012, p. 29). With plans written as a “linear outline, you can only express one ordering of ideas. There is no means to indicate the other, potentially fruitful, connections and arrangements” (Sharples, 2002, p. 76). Concept maps are a type of graphic organizer displaying hierarchically arranged ideas and concepts, using nodes joined by linking words to form propositions. Digital concept maps are flexible in their arrangement, easily changed and rearranged, use cross-links to connect ideas and are inherently nonlinear in their arrangement (Cañas, Coffey, Hoffman & Novak (2003).
Although concept mapping has been extensively researched, the use of concept maps for the development of narrative plans has had very little empirical investigation. The almost 40 years of concept map research in the published literature have focused primarily on the use of concept maps in the sciences and found concept mapping to be an effective tool for knowledge organization, clarification, and retention (Nesbit & Adesope, 2006; Cañas, et al., 2003; Rice, Ryan, & Samson, 1998; Vecchia & Pedroni, 2007). Within a small number of studies, concept maps have been demonstrated to be effective as an advance planner for narrative development (Straubel, 2006) and as a planning tool for film production (Hsu & Chang, 2009).

The purpose of my study was to explore the use of two types of scaffolding to support the development of narrative plans. Digital concept maps allow for the flexible arrangement of ideas, therefore allowing participants to adapt narrative structures and map the overall narrative outlines. One treatment group received a concept map template, which displayed the basic connections between concepts, thus allowing participants to populate and rearrange the concept map with their own narrative ideas. The other treatment group received a text-based template, listing the basic concepts, allowing for linear arrangement of ideas. This research explored how the use of concept maps to order narrative ideas related to the creativity demonstrated in photo story productions.

1.2 Theoretical Framework: Creativity

The Oxford dictionary describes creativity as “the use of the imagination or original ideas, especially in the production of an artistic work,” among the synonyms are inventiveness, imagination, innovation, originality, inspiration, and vision. Interpretation of
these traits is subjective, but all are considered positive traits for an individual to possess (Seligman & Csikszentmihalyi, 2000). Csikszentmihalyi and Epstein stated “we should be providing every child with the skills he or she needs to express creativity throughout his or her life” (1999, p. 60). Epstein (1999) linked his view of creativity to novel behavior with his Generative Theory. Empirically supported, Generative Theory began with complex behavioral experiments with pigeons (Epstein, 1985), demonstrating that a wide range of human-like novel performances resulted from specific training. Epstein’s research continued with human participants, and “when presented with a problem, novel behaviors were the result of an orderly and dynamic competition among previously established behaviors” (Epstein, 1999, p. 765). Where Generative Theory focuses on behaviors, the current study was framed through a constructivist lens, focusing instead on the cognitive aspects of creativity.

Constructivism is a theory of learning, in which learners construct meaning by assimilating new knowledge into existing cognitive structures. “By and large human knowledge, and the criteria and methods we use in our inquiries, are all constructed” (Phillips, 1995, p. 5). This research is based on the understanding that “if existing cognitive structure is clear, stable, and suitably organized, it facilitates the learning and retention of new subject matter. If it is unstable, ambiguous, disorganized, or chaotically organized, it inhibits learning” (Ausubel, 1963 p. 217). Concept maps have a theoretical basis in Ausubel’s Assimilation Learning theory and constructivist epistemology (Cañas et al., 2003). Joseph Novak, who was instrumental in the development of concept maps, referred to creativity as “the ability to come up with new ideas, a process which requires the balance
and application of three essential aspects of intelligence; creative, analytical and practical” (Novak, 2010, p. 84). Although there are many factors involved, for the purpose of this research creativity was defined as being represented in products that hold aesthetic appeal (Silvia & Berg, 2011). In this study aesthetic appeal pertains to the dimensions of novelty (originality), complexity (interest), clarity, and the ability to understand on the part of the viewer.

1.3 Research Questions

It is the hypothesis of this study that skills taught to support organization will improve creative development. A key concern for this study is determining whether concept mapping can: expand thinking, giving greater rise to narrative possibilities; and stimulate creativity.

1. Is there a significant difference in creativity between photo stories produced using text-based plans or concept map plans?

2. What are the relationships between planning method, pre-test variables (age, gender, concept map experience, video editing experience, self-reported creativity, creative achievement), and photo story creativity?

3. Does taking pre-test variables into account make a significant difference to the Photo Story Creativity between groups?
Chapter 2: Literature Review

2.1 Concept Maps

Concept maps are graphic tools that allow learners to present, relate, and communicate conceptual knowledge and build on existing cognitive structures or schemata (Novak & Gowin, 1984). They display concepts joined by linking words to form propositions, have hierarchical structure, and demonstrate the importance of the relationships between each of the concepts and propositions (Ford, Canas, & Coffey, 1996). The construction of a concept map requires a learner to draw on schemas in long-term memory, to handle new information and place it within existing cognitive structures. Concept maps are more complex than graphic organizers such as mind maps or storyboards in that they display propositions with a node-link assembly (Novak & Cañas, 2004). The concept map example (Figure 1) displays principles of concept attainment as described in Novak (2010), describing concept attainment as assimilation of knowledge acquired through experiences, involving comparison, reflection and abstraction, requiring ordering and clarification to form a conceptual hierarchy. Cañas et al. (2003) summarized the multiple uses of concept maps. In the educational context, concept maps have been demonstrated as effective learning tools for three main purposes:

- To support learning: concept mapping to display prior knowledge, as a constructive learning activity either individually or in groups;
- As an assessment tool: reliability and validity of concept maps for assessment, and methods for scoring; and
Figure 1. Concept Map example displaying the hierarchical arrangement of the principles of concept attainment as described in Novak (2010)

- For organizing and presenting information: advance planning, organizing key concepts and connecting ideas, given ahead of new instruction.

Cañas et al. (2003) made limited reference to the use of concept maps for creativity, but referred to Plotnick (1997):

Drawing a concept map can be compared to participating in a brainstorming session. As one puts ideas down on paper without criticism, the ideas become clearer and the mind becomes free to receive new ideas. These new ideas may be linked to ideas already on the paper, and they may also trigger new associations leading to new ideas (Plotnick, 1997, p. 3).

2.1.1 Concept maps and creativity.

Creating a narrative plan is similar to the process of creative writing. In using concept maps for literary analysis and transforming them for creative writing with plot
nodes that focus on character choices, Straubel (2006) suggested “moving from teacher-generated to student-completed scaffold maps helps students to imagine new characters and new plots” (p. 7). Hsu and Chang (2009) studied the relationship between concept mapping and creative performance in film. The correlation between creativity (film score) and concept map scores was $r = .400$ ($p < .05$), but the research design did not compare the effects of concept mapping with more linear film planning methods. However, Hsu and Chang (2009) did not provide details about the assessment measures. Results for only 10 of the 36 films were shown as percentages, and 5 markers were unanimous in their ratings of the 36 films, which is unusual for five separate raters, who “used their own discernment to assess the films’ creativity” (Hsu & Chang 2009, p. 28). The conclusions in Hsu and Chang (2009) generalized the capability for concept map scores to predict creative performance in digital film production, but little evidence was provided in terms of reliability. To gauge the effectiveness of concept mapping as an intervention, creative performance using concept map plans would need to be compared to a control condition.

2.1.2 Comparing concept maps with other methods for learning.

“Concept mapping appears to compare very favorably with teaching methods where learners have diffuse responsibility for task completion” (Nesbitit & Adesope, 2006, p. 431). Concept maps have been constructed to foster learning by either organizing knowledge as an advance planner, displaying students’ knowledge about a given topic, or “as a creative activity, (or) used as a planning tool, or as an alternative to essay writing” (Cañas et al., 2003 p. 22). When comparing concept mapping with other instructional activities, effects can vary depending on the type of control treatment. For example, Nesbit
and Adesope (2006) found significant effect sizes for comparing concept mapping with lecture and discussion \((d = .74)\), with lecture alone \((d = .68)\), with studying a text \((d = .39)\), or with studying an outline or list \((d = .28)\). Nesbit and Adesope’s (2006) comprehensive meta-analysis also reported sizable effects for concept mapping in language-based areas. The humanities, law, and social studies domains yielded large mean effect sizes \((d = 1.27)\) suggesting “that concept mapping offers greater benefit in subject areas that are more saturated with verbal knowledge” (Nesbit & Adesope, 2006, p. 428). These compare with the use of concept maps for learning in biological science \((d = .28)\) or physical sciences \((d = .52)\), suggesting concept map use for learning in language-based areas was more than twice as effective as for the sciences.

### 2.1.3 Concept mapping for learning in ill-structured domains.

Photo story planning is problematic in nature, because as in any ill-structured domain, there is a dearth of defined solutions (Spiro, Collins, & Ramchandran, 2007). In ill-structured domains “each case or example of knowledge application typically involves the simultaneous interactive involvement of multiple, wide-application conceptual structures (multiple schemas, perspectives, organizational principles)” (Spiro, Feltovich, & Coulson, 1992, p. 92). Solving problems in ill-structured domains requires interaction between a range of cognitive components “such as propositional information, concepts, rules, and principles, structural knowledge, inferencing skills, and metacognitive skills” (Jonassen, 1997, p. 65). This complex interaction of components can overwhelm the cognitive resources of a novice learner (Paas, Renkl & Sweller, 2003). In the process of moving from a novice toward expert, learners develop mental models, connecting concepts
and ideas (Daley, 1999). Novices acquire new information, and assimilate it within their existing cognitive structure. Concept maps can provide structure for these mental models providing the framework as they “strive to sort it all out” (Daley, 1999 p. 138).

2.1.4 Concept maps and prior knowledge.

Amadieu et al. (2009) studied the effects of prior knowledge and concept map structure on disorientation. High and low prior knowledge learners (determined by a median split on a standardized test) both gained more conceptual knowledge from the hierarchical concept map, compared with the network map, but low prior knowledge learners experienced higher disorientation during learning with the network concept map. The authors hypothesized that “the high prior knowledge learners, having at their disposal mental models, would be able to cope with the lower degree of structure provided by the network map, without getting disoriented” (Amadieu et al., 2009, p. 379).

On the other hand, Kalyuga (2007) suggested that if learners with high prior knowledge were to be offered alternative instruction to a task that they were practiced in doing, they may be reluctant to engage, and actually perform more poorly than less experienced learners. “The expertise reversal effect is associated with imbalances between learner organized knowledge base and provided instructional guidance” (Kalyuga, 2007, p. 534). If research participants with high photo story prior knowledge were to be introduced to highly structured concept map planning when they were accustomed to using written plans, there may be an expertise reversal effect, because “instructional techniques that are effective with novices can lose their effectiveness and even become ineffective when used with more experienced learners” (Paas, et al., 2003, p. 3). The result of this could negate
possible benefits of concept map planning for photo story production.

2.1.5 Controlling for group differences in concept map research.

In experimental research differences in characteristics like prior knowledge might make the effect between groups difficult to detect. Multivariate analysis of covariance (MANCOVA) can be applied to control for group differences in studies with more than one outcome measure. Sung, Chang and Huang (2008) used MANCOVA “to study how students in different groups with different abilities differ in the various dependent variables, and control for differences in reading ability” (Sung et al., 2008, p. 1562). They found that in the control group, students of high reading ability performed better than those with low reading ability in summarizing narrative articles. Accounting for covariance reduces error, making an intervention effect more detectable, but does not always correctly account for all of the differences between groups. “Other confounds, due to undetected or misinterpreted overlap of pretreatment differences and grouping factor, are commonly neglected” (Miller & Chapman, 2001 p. 40). If there are significant pre-treatment differences between the groups, MANCOVA will be applied in the current study to reduce error, more accurately measuring the effect of concept mapping for creative development in photo story production.

2.2 Measuring Creativity

Measuring creativity focuses primarily on specific cognitive processes such as: thinking divergently, making associations, constructing and combining broad categories, or working on many ideas simultaneously. They [Creativity tests] also measure non-cognitive aspects of creativity such as
motivation (e.g., impulse expression, desire for novelty, risk-taking), and facilitatory personal properties like flexibility, tolerance for independence, or positive attitudes to differentness (Cropley, 2000, p. 72).

Two well-known instruments for rating creativity and creative products are the Torrance Tests of Creative Thinking (TTCT), initially published in 1966 and since revised (Torrance, 1999), and the Creative Product Semantic Scale (Besemer & O'Quin, 1987). The validity of these tests and others has been questioned with the suggestion that they may be measuring IQ rather than creativity. Carroll (1993) argued that cognitive tests do not measure a separate Creativity ability but rather Broad Retrieval (Fluency). Also questioned is “the tests’ ability to predict achievements in real life” (Cropley 2000, p. 78).

The goal in this research is to determine if a particular planning method has an effect on the creativity demonstrated in the product. To do so it will be necessary to measure the creative products. However, the outcome may well depend on the creativity of the individual. In measuring a pre-disposition for creative achievement, the Creative Achievement Questionnaire (CAQ), Carson, Peterson, and Higgins (2005) suggested that the most reliable predictor of future creative achievement is previous creative achievement. Carson et al. (2005) reported findings for their score on the CAQ across 10 domains (self-report inventories) of creativity through five studies, with test–retest reliability of $r = .81$ ($p < .0001$), and internal consistency reliability of $\alpha = .96$ in a sample of 117 undergraduate students. The second study focused on predictive validity; a collage was produced by each of 19 participants and independently rated by five artists, and found correlations of $r = .59$
(p < .0001) between CAQ scores and collage evaluation scores. The third study established convergent validity with other self-report measures of creative potential such as openness, intellect, divergent thinking, fluency, originality and flexibility. Correlation between these other measures and the CAQ scores based on a sample of 86 graduate and undergraduates was $r = .47$ (p < .0001). In discerning whether the CAQ score was simply an indication of self-serving bias or IQ, the fourth study found zero-order correlations of $r = -.05$ with a self-serving bias questionnaire, and $r = .14$ with IQ.

A three-factor solution identified “expressive” achievement, “performance” achievement, and “scientific” achievement factors (Carson et al. 2005, p. 45) for their 10 dimensions of creative achievement. The factor with greatest alignment for application in the current study was performance achievement, as it incorporated writing and arts. Using only one of the CAQ factors may affect the instrument’s reliability. The inclusion of a semantic differential self-report could be used as an additional measure, to compare participants’ beliefs in their own creativity with their reports of creative performance.

2.2.1 Measuring creativity in photo stories.

Some suggest that “creativity is in the eye of the beholder, that is, it involves an aesthetic judgment” (Cropley & Cropley, 2008, p. 155). Assessing creativity is an emotional and subjective endeavor, but using semantic differential scales, “a substantial level of agreement by different observers (could be achieved)” (Cropley & Cropley, 2008 p. 155). Silvia and Berg (2011) studied appraisals in aesthetic experience of film, building on work in aesthetic appraisal from Silvia (2005, 2009; Silvia, Martin & Nasbaum, 2009) that assessed divergent thinking. The original research (Silvia, 2005) studied appraisals of
polygons and visual art to explore discriminant validity of aesthetic appeal. In subsequent research (Silvia, 2009), poetry was the stimulus used to explore differences in comprehensibility. In these studies, self-report and forced choice measures were used. A follow up study (Silvia et al., 2009) used all three types of stimuli with behavioral measures to determine reliability of self-reports. Silvia and Berg (2011) suggested that films have positive aesthetic appeal when they are seen as interesting but not confusing, and found that complexity predicted interest, with significant main effects for complexity ($b = .177, p < .001$), and comprehensibility ($b = .445, p < .001$). As long as a film was comprehensible, then the more complex it was the more interesting it was found it to be.

For the past 40 years concept mapping has been effectively used as a constructive learning tool, for assessment and for organizing information, with much of the research conducted in well-structured domains, often in the sciences. The same body of evidence does not exist for language-based uses of concept maps, however, initial findings are promising. One of the problems with comparing the use of concept mapping in different domains is that the control treatments vary. Measurement is also an issue in creative fields, particularly when tools for objectively ratings creativity are contentious. Creativity can mean different things to different people. In the current study creativity was defined as aesthetic appeal, pertaining to the dimensions of novelty, interest, clarity and the ability to understand.
Chapter 3: Method

3.1 Instrumentation

Participants reported age and gender, self-rated their creative achievement (CAQ factor), creativity, video editing experience, and concept map experience on a paper-based survey (see Appendix B). Experience with concept mapping, video editing experience, and creativity were self-reported on seven-point semantic differential scales. Semantic differential scales are not positively or negatively loaded and were selected because it is suggested that “people react more homogeneously to the Semantic-based than to the Likert-based items” (Friborg, Martinussen, & Rosenvinge, 2006, p. 882). The CAQ performance achievement factor was based on achievement in writing, drama, and media. The follow up survey (see Appendix C) was administered electronically through Fluid Surveys (https://queensu.fluidsurveys.com/account/#sort_field=-created_at&page=1&object=51919), and contained six questions. The first asked which planning method was used; there were two 5-point Likert responses and three qualitative responses referring to the planning method, ease of use, and level of helpfulness.

Two external raters assessed the photo stories using a rating tool adapted from Silva and Berg (2011) (see Figure 2). It comprised eight 5-point scales with two items for each of the dimensions of interest, novelty, clarity and ability to understand. Adaptation included the re-labeling of the scale anchor of “confusion,” as it appeared in Silvia and Berg (2011), to “clarity” to describe the positive aspect of this characteristic. Also the term “novelty” was used as a scale anchor instead of “complexity”. Previous work of Silvia and Berg (2005) focused on novelty and complexity, describing something as novel if it was
Figure 2. Photo Story Assessment- semantic differentials scored on a 5-point scale

“new, ambiguous, complex, obscure, uncertain, mysterious, contradictory, or unexpected” (p. 90). For this reason the use of the word novelty was not considered to be changing the scale.

3.2 Participants

Following ethics clearance (see Appendix A), Education students from an Eastern Ontario University were convenience sampled; recruitment was initially scheduled for a Primary/ Junior (PJ) Bachelor of Education (B.Ed.) lecture time slot, but due to a timing conflict needed to be rescheduled for the PJ B.Ed. tutorial time slots. There were 59 people who volunteered to participate in the study. The participants were provided details and reminders via email, but in the first three experimental sessions, only 14 of the participants attended. A second recruitment was undertaken with 3rd and 4th year Concurrent Education (PJ) classes. A further 21 people volunteered, and in the fifth and sixth experimental sessions another 14 participants attended. These groups were selected because they could potentially benefit from the intervention, and were unlikely to have extensive prior
knowledge and experience. The sample (n=28) comprised three males and 25 females, 13 participants were 19-20 years of age, five were 21-22 years of age, and ten were over 22 years of age.

3.3 Design

Teaching materials were produced for instructional purposes within the study, and tested in a research pilot. The pilot involved 6 graduate students (data from the pilot were not included in the study), and minor changes were made to instructional design based on feedback from participants in the pilot. Participants in the study were randomly assigned to equal-sized groups; either concept map planning or text-based planning, and both groups produced digital photo stories. Computers with headsets, iPads with Internet access, iMovie and CMAP Tools software were used for the research. The teaching materials were also printed out for participants to use during the experiment. Portable USB sticks were used to provide electronic documents to participants, and to save the copies of the photo story plans. The digital photo stories were transferred from individual iPads and securely stored on a research laptop prior to being rated.

3.4 Procedure

There were five experimental sessions, virtually identical in procedure, each of three-hour duration. The introduction included an explanation and definition of concept maps being used within the research session, such that participants were able to better respond to the survey question relating to concept map experience. Participants were told that they would be randomly assigned to one of two planning techniques, and were given the opportunity to learn, should they wish to, about the alternate technique after the
research. Participants completed demographic and prior knowledge surveys (see Appendix B), engaged in the photo story learning session, and were then randomly assigned to equal sized planning groups for the self-guided planning instruction tutorials. Both planning tutorials (see Figure 3) could be navigated either in a linear manner by clicking the forward and backward arrows, or in a non-linear fashion by clicking on the homepage buttons. Both tutorials covered the equivalent content. Because the process of concept mapping was potentially new to the participants, the concept map tutorial provided a short video explaining the process. Both tutorials contained video of the same photo story example that had been prepared for inclusion in the research. The videos allowed for consistent instruction over the five experimental sessions. An electronic planning template (see Figure 4) was provided to each participant, “CMap Tools” software was used for the concept map template, and Microsoft Word was used for the text-based template.

Participants were given an open-ended task brief asking them to consider an event, a place, or person that they were familiar with, and to plan using the method on which they had received instruction. Following planning, participants produced their photo story using iMovie on an iPad. The completed digital photo stories were identified only by a random code such that it was not evident to raters which photo story had been produced using which planning method. The follow-up survey (see Appendix C) was emailed to participants after the experimental session.

Two graduate students from the Faculty of Education rated the photo stories using the Photo Story Assessment semantic scales. On the rater’s recording sheets, some of the
Figure 3. Planning tutorial home pages- concept mapping and text-based planning

(CMap Tools)                  Text-based template (Word)

Figure 4. Planning templates provided electronically to each group for the development of their narrative plans

items were negatively coded; with the desirable attributes were listed on the left rather than the right. This was done to reduce the chance of conformity of scores running down the scoring sheet. The raters received training that included clarification of definitions, practice
rating of three samples (from the pilot study), and discussion about differences in interpretation.

There were initial differences in raters’ scores for the ability to understand scales. For instance, one of the raters was using a scale to penalize samples with minor technical issues affecting production quality. Technical ability was not a focus of this research, so it was determined that if a technical fault did not detract from the understanding of the story (message), then it should not negatively affect the score. For example, if the volume level in a photo story was very low but could still be heard, then the rater should just turn the volume up rather than record a low score on the scale for “ability to understand”. No other major discrepancies were found in the scoring of the photo story products.
Chapter 4: Results

Previous research (Nesbit & Adesope, 2006; Coffey et al., 2003; Rice et. al., 1998; Vecchia & Pedroni, 2007) demonstrated that the use of concept maps had an observable positive effect on learning. Although creativity is a new context for the use of concept maps, it was the hypothesis of this study that there would be an observable effect in terms of creative output when concept maps are used for planning. Alpha was set at .05 for the 95% confidence interval to address type I error, accounting for the possibility that concept map planning group might score higher than the text-based planning group purely by chance. There was also the possibility of a type II error, that concept mapping may in fact have a significant effect on creativity demonstrated, but could not be detected due to constraints such as sample size or confounding variables. This chapter reports the demographics for each group (4.1), how the photo story dimension scores were calculated (4.2), addresses the results for each the research questions in 4.3, and 4.4, and summarizes the post survey results (4.5).

4.1 Participant Statistics

There were 28 participants in total, 14 in the concept map planning group, and 14 in the text-based planning group. Due to the low number of males (two in one group, one in the other), gender was excluded from the analysis. Age was recoded into a dichotomous split between over 22 years of age (older participants), and 22 years of age or under (younger participants). Table 1 displays the age breakdowns and self-identified prior knowledge between and with each group. Creative achievement had a possible high score of 15, with an average score of four describing a fairly limited achievement in the areas of
creative writing, drama or media production. The other survey questions had a possible range of 1-5 points on semantic differential scales of “no experience - extensive experience”, or “not at all creative - very creative”. Independent sample t-tests were conducted to compare the differences between groups on the pre-test measures of creative achievement, self-rated creativity, video editing experience, and concept map experience, (see Appendix D). The assumption of homogeneity was not violated as the differences between groups were non-significant.

4.2 Scoring Photo Stories

Raters independently scored eight scales for each sample. These scores were paired scales for each of the four dimensions. The inter-item correlations for the paired scales was significant (see Table 2), so the scores were summed to calculate a raw dimension score per rater for novelty, interest, clarity, and ability to understand. The means of the raters’ scores
Table 2: *Paired scale (inter-item) correlations, and inter-rater correlations for each of the assessment dimensions*

<table>
<thead>
<tr>
<th></th>
<th>Interest Items</th>
<th>Novelty Items</th>
<th>Clarity Items</th>
<th>Ability to Understand Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired-Scale Correlation Rater 1</td>
<td>.722**</td>
<td>.400*</td>
<td>.599**</td>
<td>.669**</td>
</tr>
<tr>
<td>Rater 2</td>
<td>.402*</td>
<td>.710**</td>
<td>.640**</td>
<td>.492**</td>
</tr>
<tr>
<td>Inter-rater Correlation</td>
<td>.793**</td>
<td>.471*</td>
<td>.613**</td>
<td>.466*</td>
</tr>
</tbody>
</table>

** p< 0.01 level, *p< .05

were comparable (see Appendix E), but the standard deviations for each varied. To standardize the variability, the raters’ dimension scores were converted to z-scores. The correlations between raters’ dimension scores were significant (see Table 2), so were averaged to calculate the photo story assessment dimensions.

A maximum likelihood factor analysis using assessment dimensions yielded a single factor accounting for 56% of the variance (see Table 3), with *Clarity* as the highest loading of the four dimensions. Cronbach’s alpha was used to check the internal consistency of the four assessment dimensions; alpha was calculated to be .829. The total score for photo story creativity was calculated using the average of the four assessment dimensions.

4.3 Differences between Groups

Descriptive statistics for the standardized assessment dimensions are presented in Table 4. The skewness scores show that the data is approximately symmetrical, and the kurtosis scores show platykurtic distribution, but not significantly deviating from normal. Some calculations for normality (like D’Agostino-Pearson) are not recommended for small sample sizes, so Shapiro-Wilk Test was used (p>.05) to determine that the data did not significantly deviate from normal.
Table 3: *Factor matrix based on aggregated z-scores*

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty</td>
<td>.653</td>
</tr>
<tr>
<td>Interest</td>
<td>.801</td>
</tr>
<tr>
<td>Clarity</td>
<td>.861</td>
</tr>
<tr>
<td>Ability to understand</td>
<td>.665</td>
</tr>
</tbody>
</table>

Extraction Method: Maximum Likelihood.

Table 4: *Descriptive statistics by planning group (based on standardized scores)*

<table>
<thead>
<tr>
<th></th>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Skew</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty</td>
<td>Concept map</td>
<td>.028</td>
<td>2.265</td>
<td>.051</td>
<td>-.906</td>
</tr>
<tr>
<td></td>
<td>Text-based</td>
<td>-.028</td>
<td>1.522</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td>Concept map</td>
<td>-.277</td>
<td>1.611</td>
<td>.125</td>
<td>-1.077</td>
</tr>
<tr>
<td></td>
<td>Text-based</td>
<td>.277</td>
<td>1.830</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Concept map</td>
<td>.515</td>
<td>1.560</td>
<td>-.318</td>
<td>-.545</td>
</tr>
<tr>
<td></td>
<td>Text-based</td>
<td>-.515</td>
<td>1.922</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to understand</td>
<td>Concept map</td>
<td>-.027</td>
<td>1.625</td>
<td>-.250</td>
<td>.096</td>
</tr>
<tr>
<td></td>
<td>Text-based</td>
<td>.027</td>
<td>1.519</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n=14 for each group S.E. Skew= .441. S.E. Kurtosis= .858

MANOVA was performed to investigate the group effect for the dimensions of novelty, interest, clarity and ability to understand (see Table 5). A significant multivariate group effect, $F(4, 23) = 3.075 \ p < .05$, was found, but the univariate effects were all non-significant. Correlations between pre-test and post-test variables are presented in Table 6. As would be expected following the factor analysis results (see Table 3), there were medium to high correlations between all the of the photo story dimensions. The self-reported ratings for creativity, and creative achievement were correlated, $r(26)= .538, p< .01$, supporting the use of the single factor of creativity within this study.
Table 5: MANOVA between planning groups for the photo story assessment dimensions

<table>
<thead>
<tr>
<th>Group</th>
<th>Wilks’ Lambda</th>
<th>F</th>
<th>p</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Novelty</td>
<td>.652</td>
<td>3.075</td>
<td>.036</td>
<td>.021</td>
<td>.006</td>
<td>.940</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Interest</td>
<td></td>
<td>2.147</td>
<td>.722</td>
<td>.403</td>
<td>.027</td>
<td>.085</td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td></td>
<td>7.416</td>
<td>2.420</td>
<td>.132</td>
<td>.085</td>
<td>.682**</td>
<td></td>
</tr>
<tr>
<td>Ability to understand</td>
<td></td>
<td>.020</td>
<td>.008</td>
<td>.929</td>
<td>&lt;.001</td>
<td>.682**</td>
<td></td>
</tr>
</tbody>
</table>

Note: df for MANOVA was 4, 23; for ANOVA’s, 1, 26

Table 6: Pearson’s correlations between pre-test and post-test variables (n=28)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Video editing experience</td>
<td>-.160</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Concept map experience</td>
<td>.102</td>
<td>.257</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Self reported creativity</td>
<td>-.080</td>
<td>.308</td>
<td>-.154</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Creative Achievement</td>
<td>-.087</td>
<td>.541**</td>
<td>-.114</td>
<td>.538**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Novelty</td>
<td>.691**</td>
<td>-.281</td>
<td>.007</td>
<td>-.307</td>
<td>-.406*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Interest</td>
<td>.382*</td>
<td>-.068</td>
<td>-.176</td>
<td>.052</td>
<td>.050</td>
<td>.533**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Clarity</td>
<td>.330</td>
<td>.064</td>
<td>-.202</td>
<td>.138</td>
<td>.051</td>
<td>.569**</td>
<td>.682**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Ability to understand</td>
<td>.286</td>
<td>-.216</td>
<td>-.203</td>
<td>-.129</td>
<td>-.261</td>
<td>.396**</td>
<td>.542**</td>
<td>.580**</td>
<td></td>
</tr>
<tr>
<td>10. Photo Story Creativity</td>
<td>.497**</td>
<td>-.153</td>
<td>-.078</td>
<td>-.078</td>
<td>-.175</td>
<td>.784**</td>
<td>.854**</td>
<td>.872**</td>
<td>.753*</td>
</tr>
</tbody>
</table>

p< 0.01**, p< .05*  

Creative achievement positively correlated with video editing experience, r(26) = .541 p < .01, supporting the use of the single “performance” factor of the CAQ within this study. Although it was non-significant, it was unexpected that Creative achievement was negatively correlated with photo story creativity. Age was also negatively correlated with Creative achievement, but was positively correlated with photo story creativity, r(26) =
.497 p <.01. As there were a greater number of older participants in the text-based group, further investigation was performed to determine if controlling for age made a significant difference to the group effect for the photo story outcome.

4.4 Controlling for Factors Affecting Post-test Variables

Age had a significant effect on post-test variables (see Appendix F), and the interaction between age, and planning group for the post-test variables was not significant (see Appendix G), so age was selected for use in analysis of covariance (MANCOVA). Concept map experience was not significantly correlated with the post-test variables, but the literature (Cañas et al., 2003) suggests that the more expertise you have with concept mapping, the more effective it is likely to be. Also, novices can become overwhelmed with new information, and processes (Paas et al., 2003), which would likely result in poorer performance. To minimize error and get a more accurate analysis of the group effect, concept map experience was also included as a covariate. The results (see Table 7) show a multivariate group effect, $F(4, 21) = 3.09$ $p <.05$, only slightly higher than the original MANOVA, but there was a univariate effect on clarity $F(1, 21) = 3.06$ $p <.05$, with a relatively small effect size of $\eta^2=.113$. 

25
Table 7: MANCOVA of dependent variables with age and concept map experience as covariates

<table>
<thead>
<tr>
<th>Source</th>
<th>Wilks’ Lambda</th>
<th>F</th>
<th>p</th>
<th>Dependent Variable</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Group</td>
<td>.615</td>
<td>3.284</td>
<td>.031</td>
<td>Novelty</td>
<td>1.662</td>
<td>.821</td>
<td>.374</td>
<td>.033</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interest</td>
<td>.450</td>
<td>.170</td>
<td>.684</td>
<td>.007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clarity</td>
<td>13.075</td>
<td>5.260</td>
<td>.031</td>
<td>.180</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ability to understand</td>
<td>.120</td>
<td>.049</td>
<td>.828</td>
<td>.002</td>
</tr>
<tr>
<td>Age</td>
<td>.487</td>
<td>5.527</td>
<td>.003</td>
<td>Novelty</td>
<td>48.214</td>
<td>23.805</td>
<td>.000</td>
<td>.498</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interest</td>
<td>11.706</td>
<td>4.412</td>
<td>.046</td>
<td>.155</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clarity</td>
<td>14.756</td>
<td>5.936</td>
<td>.023</td>
<td>.198</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ability to understand</td>
<td>2.392</td>
<td>.969</td>
<td>.335</td>
<td>.039</td>
</tr>
<tr>
<td>Concept map experience</td>
<td>.881</td>
<td>.708</td>
<td>.595</td>
<td>Novelty</td>
<td>.638</td>
<td>.337</td>
<td>.567</td>
<td>.014</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interest</td>
<td>3.218</td>
<td>1.213</td>
<td>.282</td>
<td>.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clarity</td>
<td>7.602</td>
<td>3.058</td>
<td>.093</td>
<td>.113</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ability to understand</td>
<td>3.263</td>
<td>1.321</td>
<td>.262</td>
<td>.052</td>
</tr>
</tbody>
</table>

Note: df for MANCOVA is 4, 21; for ANOVA 1, 24

4.5 Participant Ratings

Twenty-three of the 28 participants completed the follow-up survey, 11 from the concept map group and 12 from the text-based group. Of the Likert response questions, the most common response from both groups was that the template was “easy”, and “helpful” to use. Participants were asked to describe any way that their planning method helped them in planning for their photo stories. The comments (Table 8) were analyzed using Lexalytics (http://www.lexalytics.com). Lexalytics is a data-mining program that uses natural (human) language processing, text analysis, and computational linguistics to detect themes and extract quotes related to those themes. The themes displayed in Table 8 show the overarching characteristics of each of the planning methods, from the perspective of the
Table 8: *Themes and representative comments for each group extracted by Lexalytics*

<table>
<thead>
<tr>
<th>Group</th>
<th>Themes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept Map</td>
<td>• Overview perspective</td>
<td>“It was easy to see and refer to”, “it prevented me from writing too much and spending too much time in the planning stage”</td>
</tr>
<tr>
<td></td>
<td>• Big ideas</td>
<td>“Good visual overview”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I like how the concept map was easily adapted to include more ideas”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I like how the concept map has prompts that help me map out what was going on in the story”</td>
</tr>
<tr>
<td>Text-based</td>
<td>• Necessary information</td>
<td>“It helped me obtain appropriate images and in the proper order”</td>
</tr>
<tr>
<td></td>
<td>• Complete story</td>
<td>“It was nice to have an outline of the necessary information”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“It served as a reminder of the elements I should keep in mind in order to write a complete story”</td>
</tr>
</tbody>
</table>

participants. The text-based themes are concerned with details, whereas the concept map themes center on the big picture.
Chapter 5: Discussion

In this study it was hypothesized that creative expression in a photo story is influenced by the organization of ideas, and that skills taught to support narrative organization may improve photo story creativity. Specifically, it was hypothesized there would be a difference between the photo story creativity (PSC) that resulted from planning using a concept map versus the PSC demonstrated when a text-based planner was used to organize the narrative. Photo story products were measured by “aesthetic appeal” pertaining to the dimensions of novelty, interest, clarity, and ability to understand. The scores for these dimensions were calculated using eight semantic differential scales, scored independently by two trained raters. The instrument (adapted from Silva & Berg, 2011) was designed with two scales for each of the aesthetic appeal dimensions. Correlations (see Table 2) between the two items for each dimension justified using the sum of these scales. Each rater’s dimension scores were converted to z-scores, and then averaged to form the standardized assessment dimensions. These dimensions were significantly correlated, and had a good level of internal consistency with an alpha of .829. Factor analysis found that the dimensions loaded as a single factor, so they were averaged to form the score for photo story creativity (PSC).

5.1 The difference in PSC between groups

A significant multivariate effect, $F(4, 28) = 3.08 \ p < .05$, between groups was found for the dependent variables of novelty, interest, clarity and ability to understand, but no univariate effect was found. There were many factors that may have confounded or influenced the outcome, such as the sample size, prior knowledge or variations in age.
Maas and Hox (2005) “raise questions about the acceptable lower limit to the sample size, and the accuracy of the estimates and the associated standard errors with relatively small sample sizes” (p. 85). There were only 14 participants in each group; a larger sample would have given more power to the analysis.

5.2 Relationships between pre-test and post-test variables

Ten of the total 28 participants were over 22 years old, and scored significantly higher than the younger participants. A conjecture could be made that the participants over 22 years of age had more life experience from which they could draw inspiration for narrative development. Participants were given an open-ended task to plan their photo stories; they were prompted to consider an event, place or a person with whom they were familiar. More life experience may have been one of the reasons that older participants scored higher (see Appendix F) than the younger participants in the study. Life experience was not measured within this study, so it is not possible to determine how experience affected the PSC scores for the participants.

5.2.1 Negative correlations.

Contrary to expectations, the students who rated themselves as highly creative did not produce photo stories that scored as well on PSC. This did not make logical sense so further investigation followed and it became apparent that it was the younger participants who had rated themselves as more creative and reported a higher level of creative achievement (see Table 1). The younger participants had a mean of 3.11 on the seven-point semantic differential scale between “not at all creative” and “very creative,” whereas the mean for the older participants was 2.55. It is possible that the younger participants may
have overstated creativity because they were either over-confident, or perhaps had a smaller reference group with which to compare. For example, one of the younger participants whose novelty score was lower than average stated in the follow-up survey, “I am highly creative.” This would seem to represent over-confidence, but there was no measure for confidence in this study.

Again, contrary to expectations the students who identified a higher level of creative achievement did not produce photo stories that scored high on PSC. It was also the younger participants who had rated themselves higher on creative achievement. The difference in this case was not so large (see Table 1): the mean for the younger participants was 4.83 (out of a maximum of 15) compared with 4.65 for the older participants. Self-serving bias was one of the factors that the Creative Achievement Questionnaire (CAQ) (Carson et al. 2005) did test in the development of their questionnaire. It was demonstrated to be non-significant in that case, but this is a different sample. It is possible that there might have been some distortion in responses by individuals. Even if there was self-serving bias in this study, the difference in creative achievement between groups was non-significant (see Appendix D), so these data were not further considered.

The younger participants reported having a higher level of video editing experience, but video-editing experience was negatively correlated with PSC. One possible explanation for this result could have been the expertise reversal effect. If this were the case, it would mean that the highly scaffolded planning instruction might have become ineffective for the more experienced learners (Paas et al., 2003). If participants were accustomed to a particular method or process for planning and producing audiovisual material, they may
have been opposed to the process applied within this study. However, it is plausible that rater training may account for the (non-significant) negative correlation between video editing experience and PSC. During rater training, the raters were instructed that if a technical fault did not detract from the novelty, interest, clarity, or understanding, then it should not negatively impact on the score. Whatever the reason was, video-editing experience was not a discernable advantage in terms of participants’ PSC scores.

5.3 Controlling for factors affecting dependent variables

There were no significant pre-test differences between the groups, but there were a greater number of older participants in the text-based group, and the older participants scored higher in PSC. The older participants also had a greater level of concept map experience, and even though concept map experience was not statistically significant, “making a map is a complex ability that cannot be taken for granted. [They depend]on linguistic abilities either for reading or writing them” (Moreira, 2010, p. 110). It was appropriate to consider the participants’ level of concept map experience because concept mapping was a skill central to the research,

Age and concept map experience were used as covariates to reduce error and provide a more accurate estimate of the effect of concept map planning for photo story production. Using covariates, a statistically significant univariate effect (see Table 7) was found for clarity as demonstrated in the produced photo stories. Previous research (Cañas et al., 2003) supports the use of concept maps as an aid to make communication clearer within group work. However, in the current study participants used concept mapping to develop a narrative that was then communicated through a photo story. Concept maps were used to
order and connect ideas for narrative development, explicitly describing the links between components of the story. The concept map scaffold allowed the participant to arrange the elements of the story in a non-linear fashion. This is a form of advanced planner in the same way Straubel (2006) suggested “moving from teacher-generated to student-completed scaffold maps helps students to imagine new characters and new plots” (p. 2). Straubel also suggested “the structured, hierarchical nature of concept maps has proven useful in all stages of non-fiction and fiction writing classes” (p. 7). Concept maps are easily rearranged and have cross-links connecting ideas. Their flexibility was evident in this research when the highest scoring photo story concept mapping participant stated, “I like how the concept map was easily adapted to include more ideas. I like how the concept map has prompts that help me map out what was going on in the story.”

The significant effect of concept mapping on clarity suggests that having a clear idea of the relationships between characters and the plot through the use of concept mapping translated into a greater level of overall clarity demonstrated in the photo story production. The dimension of clarity was the highest loading of the PSC factors in the factor analysis. Clarity might not be the most important element of creativity as demonstrated in the photo stories, but it would seem that participants in the concept map group were better able to clearly communicate their message within their photo story.

5.4 Limitations

The small sample size in this study weakened the power of the study to detect significant differences. Findings would have been more conclusive with a larger sample size. The target sample for this study was 60 participants and although 59 students
volunteered, only 28 actually attended the research sessions. Upon emailing the non-attendees, the reasons given for non-attendance (in order of most common response) were illness, fatigue, scheduling conflict, or that the three-hour time commitment was too long. This experimental design ran over five sessions each three hours in duration, and required the elaborate orchestration of multiple technologies, scheduling logistics, and food as an incentive. This study required multiple recruitment efforts and still only achieved a minimal sample; access and availability of participants proved to be an obstacle in this research.

Confounding factors that may have effecting the findings in this study include varied age of the sample and their previous experience. Also there was no way to know how life experience or confidence affected the use of concept maps for narrative development. The participants in this study participated in an experiment carried out only over a three-hour duration. According to prior research (Coffey et al., 2003) “when concept mapping is used in a course of instruction, it is better that it be an integral, on-going feature of the learning process, not just an isolated ‘add-on’ at the beginning or end” (Canas et al., 2003 p. 64). If this research were to be conducted in a school environment, it would be possible to include concept mapping as an ongoing component of learning. However, to gather the necessary sample size in a school environment would entail multiple teachers giving instruction of one type or another without random assignment, and having varying technological capabilities. The strength of the current study is that random group assignment was part of the research design.

The planning maps were not assessed themselves so it was impossible to determine if they had a predictive relationship to the demonstrated creativity. The use of concept maps
to predict creativity was not included as a research focus but may have been beneficial to
the analysis. This study was designed specifically to reduce its limitations by constraining
the experiment to a lab setting that allowed for random assignment, provided equivalent
instructional time, and ensured the same software was used to construct each of the photo
stories. There is no reason to believe that method and findings here would not be replicable
in a wider context more authentic context. Given more time to spend using concept
mapping for narrative development along with a larger sample it is plausible that the effect
would more easily observable.
Chapter 6: Conclusions

This research compared the effects of planning method on the creativity demonstrated in photo story production. The assumption was that creative application of narrative elements requires organization and problem solving skills (Straubel, 2006). The two-group experimental design comprised 28 Education students who were randomly assigned to either concept map or text-based planning to produce a photo story. The highest scoring photo stories in this sample were the most aesthetically pleasing; they were novel, but clear, interesting and able to be readily understood. A multivariate effect was found, for novelty, interest, clarity and ability to understand. With age and concept map experience as covariates, there was a significant effect on clarity demonstrated in the photo stories produced. Although the effect size was not strong, a positive finding supports the statement that “as a creative activity, concept mapping can also be used as a planning tool” (Cañas et al. (2003) p. 22). In addition, there was positive participant feedback for the concept map scaffold and for using this method for planning a photo story, but due to the small sample size and relatively short experimental sessions, the findings should be taken as tentative and requiring of further study.

6.1 Recommendations

With a larger sample, it would be more statistically viable to determine the significance of concept map planning on creative output when used for story development. It is recommended that further investigation be undertaken not only with a larger sample but embedded within an authentic educational context. A classroom environment offers a
more holistic, authentic environment for the development and organization of ideas, and has the flexibility to be implemented over a longer duration.

Life experience and confidence were not measured within this study and either factor may have affected the outcome. If this study was replicated data should be collected to determine how these factors may relate to creative output. The current study recruited Bachelor of Education and Concurrent Education students. Alternate populations would need to be studied to develop greater generalizability. This research was prompted in part by the recommendation in Nesbit and Adesope (2006), that “more research is needed on the effectiveness of concept mapping as a pre-writing activity” (p. 435). The current study posed a previously untested hypothesis, and found that compared with text-based planning, concept mapping had some effect on narrative development. Although the results need to be further tested, the suggestion that concept mapping aids clarity in narrative development adds to the limited research on the use of concept mapping as a pre-writing activity.
References


Appendix A: Ethics Approval

June 17, 2013

Ms. Natalie Simper
Master’s Student
Faculty of Education
Duncan McArthur Hall
Queen's University
511 Union Street
Kingston, ON  K7M 5R7

GREB Ref #: GEDUC-678-13; Romeo # 6010166
Title: "GEDUC-678-13 Concept Maps For Creative Development"

Dear Ms. Simper:

The General Research Ethics Board (GREB), by means of a delegated board review, has cleared your proposal entitled "GEDUC-678-13 Concept Maps For Creative Development" for ethical compliance with the Tri-Council Guidelines (TCPS) and Queen's ethics policies. In accordance with the Tri-Council Guidelines (article D.1.6) and Senate Terms of Reference (article G), your project has been cleared for one year. At the end of each year, the GREB will ask if your project has been completed and if not, what changes have occurred or will occur in the next year.

You are reminded of your obligation to advise the GREB, with a copy to your unit REB, of any adverse event(s) that occur during this one year period (access this form at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Adverse Event Report). An adverse event includes, but is not limited to, a complaint, a change or unexpected event that alters the level of risk for the researcher or participants or situation that requires a substantial change in approach to a participant(s). You are also advised that all adverse events must be reported to the GREB within 48 hours.

You are also reminded that all changes that might affect human participants must be cleared by the GREB. For example you must report changes to the level of risk, applicant characteristics, and implementation of new procedures. To make an amendment, access the application at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Amendment to Approved Study Form. These changes will automatically be sent to the Ethics Coordinator, Gail Irving, at the Office of Research Services or irvinggg@queensu.ca for further review and clearance by the GREB or GREB Chair.

On behalf of the General Research Ethics Board, I wish you continued success in your research.

Yours sincerely,

John Freeman, Ph.D.
Professor and Acting Chair
General Research Ethics Board

cc: Dr. Richard Reeve, Faculty Supervisor
    Dr. Don Klinger, Chair, Unit REB
    Erin Wicklam, c/o Graduate Studies and Bureau of Research
Appendix B: Demographic and Prior Knowledge Survey

**Background Information**

1. Do you consent to participate in the study titled “Concept Maps for Creative Development”, to have data collected and used for this research or subsequent related research? (Your identity will be protected to the extent possible and you have the right to withdraw from the study at the completion of the experiment if you feel it necessary).

   - Yes [ ]
   - No [ ]

2. What is your gender?

   - Male [ ]
   - Female [ ]

3. How old are you?

   - Under 19 [ ]
   - 19-20 [ ]
   - 21-22 [ ]
   - Over 22 [ ]

**Previous Experience**

Note: For questions 4, 5 and 6, you can place the checkmark on one of the markers or in the space between two markers.

4. Place a checkmark on the continuous scale below, corresponding to your level of experience with Concept Mapping.

   - Extensive experience

   - No experience

5. Place a checkmark on the continuous scale below, corresponding to your level of experience with video editing software.

   - Extensive experience

   - No experience
6. Compared to people you know, **how creative are you?** Place a checkmark on the continuous scale below, corresponding to your perceived level of creativity.

<table>
<thead>
<tr>
<th>Not very creative</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Very creative</th>
</tr>
</thead>
</table>

7. **Creative writing**
Place a check mark beside the sentence that most closely applies to you

1. I do not have training or recognized talent in this area
2. I have written an original short work (poem or short story)
3. My work has won an award or prize
4. I have written an original long work (epic, novel, or play)
5. I have sold my work to a publisher
6. My work has been printed and sold publicly
7. My work has been reviewed in local publications
8. My work has been reviewed in national publications

8. **Theatre and Film**
Place a check mark beside sentence that most closely applies to you

1. I do not have training or recognized ability in this field
2. I have performed in theatre or film
3. My acting abilities have been recognized in a local publication
4. I have directed or produced a theatre or film production
5. I have won an award or prize for acting in theatre or film
6. I have been paid to direct a theatre or film production
7. My theatrical work has been recognized in a national publication
Appendix C: Follow up Survey

Planning to produce a photo story in iMovie
This short questionnaire is designed to capture feedback from the photo story research session that you participated in. There are only 6 questions, and it should take no more than 5 minutes to complete. As there were fewer participants than expected in the photo story sessions, your responses here may prove invaluable in the overall context of the study.

1. I planned my photo story using...
   • A concept map (CMap tools)
   • A written plan (Word)

2. I found that this method for planning my photo story was...
   • Very difficult
   • Difficult
   • Neither easy or difficult
   • Easy
   • Very Easy

3. I found that the planning template that I used was...
   • Very helpful
   • Helpful
   • Made no difference
   • Somewhat helpful
   • Not at all helpful

4. Describe any way that your planning method helped you in producing your photo story.
   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________

5. Describe any way that your planning method constrained you in producing your photo story.
   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________

6. Do you have any other general comments?
   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________

Thank you for your feedback, please submit to finish.
Appendix D: Independent samples t-test between groups for demonstrated creativity, self-rated creativity, video editing experience, and concept map experience

<table>
<thead>
<tr>
<th></th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$</td>
<td>$p$</td>
<td>$t$</td>
</tr>
<tr>
<td>Demonstrated creativity</td>
<td>.001</td>
<td>.970</td>
<td>-.272</td>
</tr>
<tr>
<td>Creativity</td>
<td>.460</td>
<td>.503</td>
<td>.249</td>
</tr>
<tr>
<td>Video editing experience</td>
<td>.740</td>
<td>.397</td>
<td>.937</td>
</tr>
<tr>
<td>Concept map experience</td>
<td>.132</td>
<td>.719</td>
<td>.728</td>
</tr>
</tbody>
</table>

Note: Equal variance assumed
Appendix E: Mean scores per rater for the dimensions of novelty, interest, clarity and ability to understand and principal components factorial solution based on z-scores for the dimensions

<table>
<thead>
<tr>
<th>Rater's statistics</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Novelty</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rater 1</td>
<td>1</td>
<td>9</td>
<td>5.86</td>
<td>1.90</td>
</tr>
<tr>
<td>Rater 2</td>
<td>1</td>
<td>9</td>
<td>4.75</td>
<td>2.58</td>
</tr>
<tr>
<td><strong>Interest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rater 1</td>
<td>5</td>
<td>10</td>
<td>7.75</td>
<td>1.78</td>
</tr>
<tr>
<td>Rater 2</td>
<td>6</td>
<td>10</td>
<td>7.29</td>
<td>1.42</td>
</tr>
<tr>
<td><strong>Clarity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rater 1</td>
<td>5</td>
<td>10</td>
<td>7.21</td>
<td>1.40</td>
</tr>
<tr>
<td>Rater 2</td>
<td>3</td>
<td>9</td>
<td>7.16</td>
<td>1.86</td>
</tr>
<tr>
<td><strong>Ability to</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rater 1</td>
<td>5</td>
<td>10</td>
<td>8.36</td>
<td>1.59</td>
</tr>
<tr>
<td>Rater 2</td>
<td>4</td>
<td>10</td>
<td>7.66</td>
<td>1.69</td>
</tr>
</tbody>
</table>
Appendix F: MANOVA of age on dimensions of novelty, interest, clarity, and ability to understand.

<table>
<thead>
<tr>
<th>Source</th>
<th>Wilks’ Lambda</th>
<th>$F$</th>
<th>$p$</th>
<th>Dependent Variable</th>
<th>Mean Square</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.50</td>
<td>5.74</td>
<td>.002</td>
<td>Novelty</td>
<td>46.18</td>
<td>23.70</td>
<td>&lt;.001</td>
<td>.477</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interest</td>
<td>11.59</td>
<td>4.44</td>
<td>.045</td>
<td>.146</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clarity</td>
<td>9.48</td>
<td>3.17</td>
<td>.086</td>
<td>.109</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ability to understand</td>
<td>1.79</td>
<td>.74</td>
<td>.397</td>
<td>.028</td>
</tr>
</tbody>
</table>

Note: $df$ for MANOVA is 4, 23; for ANOVA 1, 24
Appendix G: Interaction between age and group, and interaction between concept map experience and group, for the dimensions of novelty, interest, clarity, and ability to understand.

<table>
<thead>
<tr>
<th>Source</th>
<th>Wilks’ Lambda</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group*Age</td>
<td>.904</td>
<td>5.59</td>
<td>.695</td>
</tr>
<tr>
<td>Concept map experience*Age</td>
<td>.805</td>
<td>1.27</td>
<td>.312</td>
</tr>
</tbody>
</table>

Note: df for MANOVA is 4, 21
Note: Age and concept map experience are dichotomous variables