DESIGNING CONCEPT MAPS FROM PROCEDURAL VISUALS: AN INNOVATIVE APPROACH TOWARDS INFORMATION PROCESSING IN EFL CONTEXT

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Concept maps have been traditionally used as a technique for information comprehension, visualization, brainstorming, schematization and document production in multiple ways. They are also considered an effective tool for visual-spatial learning. Concept maps have been used successfully in EFL learning situations. However, in most cases, concept maps have been based on the existing text available to the reader. This study made a preliminary claim that designing concept maps directly from a procedural visual, without using any text as reference, might facilitate information comprehension, retention and recall. That is, readers produce their own text based on the information they visualize in the procedural graphic, and then construct a concept map based on the text they produced. This study also makes certain recommendations on how to practice and design such assignments in the form of a controlled experiment and how this might be an effective L2 learning and document production strategy. Results from a pilot study show that readers in an EFL context are capable of understanding concept maps and their related applications. Preliminary indications suggest that with more practice, EFL readers would be able to process complex visuals and design concept maps with increasing degrees of efficiency.

Keywords: Concept maps, Technical writing, Procedures, Visual-spatial, EFL.

INTRODUCTION

We often do not have an explicit understanding of how graphic organizers, such as concept maps and use of procedural visuals, might assist with the formation of mental imagery and information comprehension, retention and recall and application—generally, and especially in an EFL context where text processing is difficult. Further, there is hardly any research on how information and schematization tools like procedural visuals and concept maps might complement each other in the process of generating mental imagery and subsequent text production. The arguments in this article revolve around a Japanese instructional context. This article will explore some of these issues in greater detail. Mental imagery plays a central role in scientific creativity and communication but is neglected in science classrooms. Visual-spatial thinking includes using imagery to identify, locate, and think about objects and ourselves in the world. It also includes formation of imagery, inspection, transformation, and maintenance of images in mind in the absence of a visual stimulus. A spatial image preserves relationships among a complex set of ideas as a single chunk of information in working memory, increasing the volume of information that can be maintained consciously at any given time (Mathewson, 1999).
There is plenty of research suggesting the use of objects and pictures to illustrate concepts (Ornstein & Levine, 2006). Graphic organizers provide a "means for organizing and presenting information so that it can be understood, remembered, and applied" (Crandall et al., 1992). Graphs, tables, maps, flow charts, timelines, and Venn diagrams are used to help students place information in a comprehensible context. They enable students to organize information obtained from written or oral texts, develop reading strategies, increase retention, activate schema as a pre-reading or pre-listening activity, and organize ideas during the prewriting stage (Crandall et al., 1992).

The concept map is one such type of graphic organizer and serves as an effective tool for information comprehension in the EFL context. Instruction for English reading in an EFL classroom context is usually centered on learning-to-read. However, in recent years, another trend of instruction, reading-to-learn, has also emerged and flourished; it aims to cultivate autonomous and strategic readers who can apply what they have learned about reading to different texts outside the classroom context (Chiang, 2004). This paper is influenced by the premise of the following study (Chiang, 2004) where the purpose was to investigate how college English majors learned to use a concept mapping strategy to enhance their performance in reading comprehension tasks and recall tasks. The results of the study suggested that learners had their individual ways of employing concept mapping effectively. The results also showed that the learners thought that the concept mapping strategy would benefit their recall tasks more than reading comprehension tasks. Data from another study indicated that each learner in a Japanese context made unique applications of the concept mapping strategy in their writing processes. This suggests that concept mapping may help ESL learners improve their composing skills, but in ways unique to individual experience, motivation, and task conditions (Ojima, 2006). The current study is further influenced, albeit indirectly, by the works of Talebinezhad and Negari (2007). Their findings revealed that students in an EFL context gained higher self-regulation as the result of concept mapping strategy teaching. These findings have implications for pedagogy as well as for research. These research studies commonly indicate that concept mapping increases reader autonomy, information comprehension, retention, recall and promotes uniquely individual performance. So, how do we promote reader autonomy through concept mapping in EFL situations where text processing might be difficult?

This exploratory study raises the question as to whether studying visuals might be a better way to comprehend and recall information more effectively as compared to reading comprehension tasks. However, the current study does not compare the efficacy of concept maps vis-à-vis reading comprehension tasks. This paper discusses the possibility of representing knowledge visually in a concept map—based on an informative visual, rather than supporting text, as is typically the case. The purpose would be to explore preliminary indications as to how such an approach could be effectively used in a technical writing classroom to enhance conceptual understanding of a problem, and as a visualization strategy for complex technical documents. The motivation behind using the concept maps for technical visuals is based on the importance of understanding different types of visual logical information representation, which is almost completely determined by the ways in which a problem is conceptualized and represented mentally.

Why should this approach be significant in Japanese context?
This visual-based approach is important in a Japanese context for multiple reasons. The following evidence is based on classroom teaching practices and supports the idea of why graphical analysis might have the desired effectiveness.

- Japanese students generate English text with minimal information processing, inadequate research and as a mechanical process, using digital dictionaries and machine translation.
- When writing an essay/paragraph in any genuinely production-based context, students often generate English text by copying information from other online sources. It is hard to identify and isolate such plagiarized sentences with every given assignment.
- Moreover, in a production-based context, assignments are often designed such that there is often no questioning of factual accuracy. Assignments are graded on the basis of students’ ability to produce language with some accuracy.
- When writing a summary, based on existing text, students tend to copy the existing material with minimal rephrasing.

The following sections explain why a concept map and procedural visuals-based approach as discussed in this article might minimize the problems mentioned above.

**Generating Text based on Visuals**

In an EFL context, the ability to process complex information using text is of paramount importance, but it is a difficult task to accomplish with low- and moderate-level English language skills. Students in such a context find it difficult to produce more text without using aids such as electronic dictionaries, translation software, etc., and experience difficulty with processing information in their native tongue. On the other hand, when students are able to process visuals independently, this promotes autonomy of thought and encourages an individual approach to information representation. Research has shown the positive effects of using instructional activities involving visuals, and how it helps secondary learners understand and remember what they read (Rakes, et al., 1995). Further, studies have demonstrated the positive effects of using static visuals in EFL classrooms (Huifen et al., 2006). In such cases, processing of visuals efficiently (often with minimal or no text as reference) and representing the visuals with self-generated moderate text in a concept map might be a more reasonable and efficient way to get started with text processing. The primary handicap in processing text in an EFL context (based on reading comprehension) might be that it is impossible to make sense of a text and its linguistics parts alone, without having an understanding of how other features of the text contribute to meaning-making (Kress, 2000). With more practice and exposure, this approach of generating text autonomously, based on visuals, could possibly promote superior ability for conceptual thinking and information processing.

**MAJOR RESEARCH QUESTION AND LEARNING GOALS**

The major research question in this article is to initiate a quest for better understanding the extent to which EFL learners are capable of analyzing and representing information in a procedural visual in the form of English text (producing own text), and then presenting the text logically in the form of a concept map. This is a major shift from the existing practice where concept maps are generated from a text presented to the reader. This is a production-based activity with multiple learning-based goals. They intend:
• To make sure that the visuals are properly understood and represented textually.
• To understand different genres in visual contexts and represent them textually.
• To understand any sequence or parallel tasks that might be represented in the visuals (often shown as a flow chart and systems diagram, which are specific types of concept maps).
• To understand the differences in concept map constructions that might result from different contexts in different visuals.

DESIGNING CONCEPT MAPS FROM PROCEDURAL VISUALS: AN EXAMPLE

As part of the pilot testing that is discussed later in this paper, two procedural visuals were used to help the reader explain the task context, generate text to explain it, and later draw concept maps. Readers were asked to prepare concept maps based on the explanation of the visual. Figure 1 shows an example.

![A. Procedural Visual.](image1)

![B. Concept Map based on Visual.](image2)

Figure 1. Concept Map based on Procedural Visual.

Readers were given specific examples of concept maps and procedural visuals. Also, they were given very specific instructions on how to design and generate the concept map based on direct explanation of the procedural visuals.

INSTRUCTIONS FOR EXPLANATION OF PROCEDURAL VISUALS

- Could you write a sentence explaining the major activity shown in the visual?
- Have you identified all the major actions taking place in the visual?
- Do you have a single word/verb to express the major action in English?
- Have you identified all the minor objects shown in the visual?
- Have you identified the end result of the activity shown in the visual?

Once the visual elements are properly identified, they have to be explained textually. Next, it is important to understand how to draw up the first node in the concept map, explaining the most important activity shown in the procedural visual.
INSTRUCTIONS FOR DESIGNING CONCEPT MAPS FROM VISUALS:

1. Generate the basic idea of the sentences in Japanese and then in English.
2. Generate the exact verbs to be used in nodes.
3. Identify whether the verbs express the actions shown in the visual.
4. Has the actor been identified for every major action?
5. Have the major objects been identified for every major action?
6. Do you understand how the different nodes connect to each other logically?

The following review of the literature might help us to better understand the importance of the concept map as a visualization tool, its importance in the EFL context, and its ability to promote visual-spatial learning.

A REVIEW OF THE LITERATURE

Jonassen (1996) argues that students show some of their best thinking when they try to represent something graphically, and thinking is a necessary condition for learning. For ESL/EFL learners with low prior knowledge of a subject matter, or lower ability to process text and express in writing, sound visualization-based instructional strategies might be a way to integrate information successfully. Visualization tools may assist students in visualizing their knowledge, as well as providing access to knowledge elements and task-relevant knowledge resources. Most existing tools focus on the visualization of knowledge or information only. However, there is research claiming that concept mapping may function as a bridging technology and as cognitive tools that may provide a basis for the development of synergistic approaches. These approaches may in help visualizing, accessing, and managing both subject-matter domain knowledge and information and foster resource-based learning (Tergan et al., 2006). Concept maps drawn by students express their conceptions or misconceptions and can help the instructor diagnose the misconceptions that make the instruction ineffective (Ross & Munby, 1991).

Concept maps are a result of Novak and Gowin’s (1984) research into human learning and knowledge construction. Concept maps are a graphical two-dimensional display of concepts, connected by directed arcs encoding brief relationships between pairs of concepts forming propositions (Canas, et al., 2004). Research (Talebinezhad, 2007) has investigated the effectiveness of concept mapping as a learning strategy in EFL contexts, focusing on students’ self-regulation (metacognitive self-regulation, time and study environment, effort regulation, peer learning, and help seeking). Concept mapping in general and sophisticated concept-mapping software in particular, offers many benefits for writing and knowledge organization on a large scale. Researchers have argued for the benefit of using concept maps at several points in the review process, running the gamut from developing terms, definitions, and electronic database searches, to finally writing individual papers (Czuchry, and Dansereau (1996); Giombini, 2004). Concept maps also provide a way to externalize knowledge and thinking processes. They have implications for communication between individuals and teams, as well as applications in knowledge preservation in large complex domains (McAleese, 1998). Concept maps are beneficial to visual/spatial learners because they provide a visual way to organize text.

The visual-based approach as adopted in this study has support from various similar research projects. A study of language learners performing an authentic classroom task in which they were asked to use visual information as a basis for free language production suggested that pictures in this instructional context were processed efficiently but superficially, and were frequently not regarded as significant sources of information. The study also suggested that
divergent picture interpretations are not unusual and could lead to communication problems mistakenly attributed to language deficits. Research suggests that a pragmatic way to achieve effective processing of the visual elements in language teaching materials is to design materials that include explicit, specific guidance on how the pictures they contain are intended to support language learning activities—together, where needed, with processing instructions (Skorge, 2008). This is where the importance of concept maps might play an effective role for logical language processing when represented in nodal forms.

Another important question is: Do concept maps also help with information retention in a structured way, and if so, to what extent?

Research suggests that a concept map improves long-term information retention, reduces verbatim retention of non-meaningful information, and improves transfer of knowledge in future problem-solving activities (Pintoi & Zeitz, 1997). So, how might such information retention work when a reader processes information based on visuals, as proposed here? Iconic learning involves the storage of images of scenes we encounter, people we meet, photos, and a host of other images. These are also referred to as iconic memories (Sperling, 1960; 1963). While the alphanumeric images Sperling used in his studies were quickly forgotten, other kinds of images are retained much longer. Our brains have a remarkable capacity for acquiring and retaining visual images of people or photos. For example, in one study, Shepard (1967) presented 612 pictures of common scenes to subjects, and later asked which of two similar pictures shown was one of the 612 seen earlier. After the presentation the subjects were 97% correct in identifying pictures they had seen. Three days later, they were still 92% correct, and three months later they were correct 58% of the time. This and many other studies have shown that humans have a remarkable ability to recall images, although they soon forget many of the details in the images. Considering how often we look at pennies, it is interesting that the subjects asked to draw a penny in a study by Nickerson and Adams (1979) omitted more than half of the features or located them in the wrong places. It is possible that with increasing complexity in a visual scenario, the schematics of the entire context might be lost over time from memory. This proposed concept-mapping framework/approach, which explains the entire visual context, might not only help retain the isolated visual elements in memory, but also might help a reader to understand and retain the structural, functional and overall logical arrangement of such visual elements.

Another reason why concept maps might be an effective tool for language production is because research findings have suggested that self-explanation effect based on visuals is better than text.

Self-explaining is an effective metacognitive strategy that can help learners develop deeper understanding of the material they study. This experiment explored if the format of material (i.e., text or diagrams) influences the self-explanation effect. Twenty subjects were presented with information about the human circulatory system and were prompted to self-explain; 10 received this information in text and another 10 in diagrams. Results showed that students given diagrams performed significantly better on post-tests than did students given text. The former group also generated significantly more self-explanations than the latter group. Furthermore, the benefits of self-explaining were much greater in the diagrams condition. To discover why diagrams can promote the self-explanation effect, results are interpreted with reference to the multiple differences in the semantic, cognitive and affective properties of the texts and diagrams studied (Ainsworth & Loizou, 2003).

Application Possibilities: It will be interesting to test whether concept-mapping tools, used in specific ways, might help in the systematic production of language from visuals. In the EFL
context, we might want to study how readers are able to fill in information in empty language nodes. For example, readers might study the visual carefully, think about a possible sentence to explain the visual, and then study a concept map where the object is mentioned. But the subject and verb in the sentence need to be filled in by the readers. Also, readers could see the entire structure of the language (based on the visual) with multiple nodes interconnected as branches, although with frequent missing information in various nodes. The issue of missing information in the nodes has been frequently studied in previous research projects on concept maps. Further, future test designs might look into information retention and self-explanation ability of readers when designing concept maps, based on visuals with varying degrees of difficulty. This might develop into an assignment to study how readers are able to comprehend concept maps with varying levels of information gap and then relate them to procedural visuals.

**DESIGNING A VISUAL-BASED CONCEPT MAPPING ASSIGNMENT**

The major research question in this article attempts to increase the understanding of whether concept maps are appropriate and reasonable tools for explaining graphics in an EFL learning context, like Japan. It is best to consider this as exploratory research because the literature hardly provides any data or argument as to whether concept maps could be generated from procedural visuals directly, if so, they could bypass the need for existing text as an intermediate medium that generally explains the flow of concepts. There exists much literature about the effects of visuals in explaining procedural tasks. But does visual-to-visual representation (procedural visuals to concept maps) enrich readers’ ability to generate reasonable text for a concept map-based explanation? Could this activity be the first step in generating more logical and significant flow of text as follow-up activities?

It should be mentioned in this context that brainstorming activities often involve the use of concept maps and flow charts. A brainstorming activity is often dependent on a mental imagery of how the activities should unfold. Often, such concept maps are not generated from explicitly written text. Use of language might not be the primary focus during overt schematization of mental imagery for brainstorming purposes. In cases of visual-visual text generation, there are enough graphical cues available to the EFL reader, upon which some text could be naturally generated for concept maps. This is also an attempt to make EFL readers write text and think systematically about the graphics as a whole.

Teaching evidence has been presented in the EFL context, at least in Japan, to show that when given explicit text, readers simply copy the text with a sentence-level (local) analysis and generate the concept maps. The concept maps are not generated to provide an overall holistic picture of the entire paragraph or the article. On the contrary, nodes in the concept maps merely position each existing sentence based on subject-verb-object level analysis.

However, when readers are exposed to a visual for generating concept maps, they will have little choice but to attempt to understand the context of the visual holistically and generate text on their own. They might not have enough skill to generate enough English text without the aid of an electronic dictionary or online translation services, but they will nevertheless have to generate the whole picture in Japanese and work out the English from there without any explicit language aid.

This article discusses a detailed schema for testing readers in an EFL context with concept maps, based on procedural visuals. A robust test design is also explained to demonstrate how procedural visuals could be systematically designed to promote a more constructivist learning scenario.
METHODS/PROCEDURES FOR A PILOT TEST: A TEACHING CASE

The following experiment was designed as an in-class individual assignment in a freshman-level technical writing course offered in this Japanese university. As part of this assignment, readers were asked to explain, in English, two procedural activities as they see it in the pictures. The pictures were quite elementary in nature and focused on demonstrating only one major action. Seventeen students participated in the experiment. They all had junior-level standing with little English language proficiency. All students had some prior experience with constructing concept maps (based on explicit text) for other class assignments. Also, almost everyone stated they had not processed any user manual in English before (meaning no experience with procedural visuals or learning about procedures). The experiment was completed over 90 minutes during a regular class session. Students used electronic dictionaries and online translation services to answer the open-ended questions in the questionnaire. However, no detailed face-to-face conversations between students were observed during the session.

Task: Students were given a questionnaire with 5 questions, wherein they were exposed to two procedural pictures as aforementioned. The questionnaire was based on two levels of understanding of the overall concept and readers’ ability to comprehend the pictures. The first level dealt with self-reporting of individual ability to comprehend concept maps, the pictures as shown and ability to think about concept maps as an important tool for representing information visually. No Likert scale was used for the questions. Readers were forced to explain their comprehension and feelings as part of an open-ended answer.

The second level dealt with accuracy checks of readers’ ability to comprehend the pictures and represent them in a concept map. Readers were asked to produce self-generated English, first to represent the picture and next to suitably use it in constructing a concept map. Participants were shown two different graphics with two different contexts altogether. The first visual showed a person changing a car tire, while the second visual showed a computer connected to a network. Each visual demonstrates a procedure, and an action. Also, each visual demonstrated only one major action.

During this stage, participants completed the following tasks:

- Analyze the picture
- Generate English text (either directly or by creating the Japanese text first and then translating it)
- Think about the design of nodes and word placement in the concept map
- Represent the English text in a concept map successfully

During the second stage, students producing concept maps based on self-generated sentences using IHMC concept mapping software. They exported the concept map as a JPEG file, saved it as a PDF, and then uploaded it in slideshare.net. Finally, the students submitted the URL of the slide share page in moodle (the learning management systems that students use for posting class assignments).

Open-ended questions and activities were designed in the questionnaire so as to make the participants more proactive in their responses. The aim was to encourage participants to represent their actual thought processes and understanding of the task situation in a production-styled activity, i.e. writing. A Likert scale for self-reports (first stage of this questionnaire) might have generated a more random response.
**Experience with Concept Map:** Students used concept maps throughout the semester as part of other assignments. They had enough time to get familiarized with the concept behind the construction of concept maps and also become adept at the IHMC concept mapping software. However, this was an innovative approach in the way they were asked to use concept maps. As part of regular class assignments, students generated concept maps, based on the reading of text. Students merely re-structured existing sentences as found in the text, and represented the text in concept maps as subject-verb-object. The serious problem with the text-based generation of concept maps approach is the merely localized perspective that it provides—often completely ignoring the global perspective of the context under discussion. This is often the case because of inadequate English language proficiency and non-willingness to explore the topic holistically. However, when explaining visuals directly in the form of a concept map, a global understanding of the context is not merely a necessity, but a compulsion. It is often unknowingly forced upon the student without their conscious understanding. The complexity of the graphic might make it a difficult case to explore in an EFL context, on a case-by-case basis. However, a more gradual and iterative approach in concept map design is still possible and probably a more reasonable option.

**Task Analysis:** The following point system can be identified as an assessment mechanism for grading the in-class assignment and experiment reported above. This system is designed to be an accuracy check for each question asked/answered in the questionnaire.

Open-ended questions in the questionnaire could be classified under the following headings:

- General understanding of concept maps (question #1)
- Ability to process visuals in a concept map (question #2)
- How concept maps could be used to represent information visually (question #3)
- Ability to explain a picture in text (question #4a, 5a)
- Production of concept maps based on the text generated from the visual (question #4b, 5b)

For each question as mentioned above, ability to comprehend was judged under the following two categories:

- Opinion-based
- Accuracy-based

Opinion-based answers were scored on the basis of the following criteria:

- Writing complete sentences
- Ability to explain
- Whether the content is comprehended

Questions 1, 2, and 3 are opinion-based. Each criterion has one point each. For each opinion-based question, participants were asked to write two sentences. Each sentence was judged on the basis of the above three criteria. Therefore, a participant could earn maximum of 3 points for each sentence and 6 points total for the two sentences for each of the three opinion-based questions.

Questions 4 and 5 (4a, 4b, 5a, 5b) consist of accuracy-based queries. The accuracy-based questions were scored on the basis of the following criteria:
• Writing complete sentences with a subject, object and verb (4a, 5a)
• Writing meaningful sentences that explains the picture in some way (4a, 5a)
• Whether the major action in the visual has been identified (4a, 5a)

For both 4a and 5a, participants were asked to produce two sentences each. Each sentence carried a maximum of three points, based on the three criteria mentioned above. Each criterion carries a maximum of one point.

For questions 4b and 5b, the following criteria are used to assess the concept maps produced:

• Were at least two nodes created to explain the visual?
• Has the major action in the visual been identified in the sentences generated in the concept maps?
• Were the sentences produced as part of 4a and 5a used in the concept maps directly?

Each criterion was designed to fetch a maximum of two points, with a maximum total of 6 points.

PRELIMINARY FINDINGS AND DISCUSSION

A detailed statistical analysis of the findings is beyond the scope of this article. Overall, preliminary results suggest that most students could understand the general idea behind the use of concept maps. However, because of serious language deficiency, they were not comfortable using English autonomously in a context where no text is available.

Their responses suggested that they were comfortable with the overall idea of using text in concept maps, but they needed more help, time and practice when it comes to using concept maps for explaining visuals directly, and by producing their own text first. Most participants struggled to generate their own text; often the sentences were grammatically incorrect. Further, some students required the extra step of translation from Japanese to English. However, most students considered the use of machine language as very natural and as an accepted form of communication. Thus, the mechanical process of translating text from Japanese to English text was seldom a cognitive process for most of the students.

However, in most cases, the general idea was conveyed successfully. Further, overall results suggested that the concept maps were produced based on the sentences generated. There was no evidence to suggest that concept maps were produced to explain sub-steps or sub-processes that went beyond the major actions shown in the visuals. When explaining the graphic for changing the tire, the position of the person was never mentioned, nor the position of the tire, with respect to the car. Thus, for the most part, no structural point was ever mentioned in the sentences that participants generated. In other words, when generating text or drawing the concept maps, no inference-based actions were mentioned.

RECOMMENDATIONS FOR PRACTICE

This pilot study is designed to achieve a preliminary understanding of how readers are able to process and generate text to explain visuals, and then represent it successfully in a concept map. Results provide the impression that this might be a way to encourage students to process
complex concepts through visual-spatial thinking. Evidence from other assignments, where students used reference text, provided preliminary indication that this proposed approach might be more effective in cases where EFL students struggle to generate their own text meaningfully while maintaining originality, based on a reference text. Processing information visual-spatially might help L2 learners attach more meaning to the overall idea.

This preliminary analysis suggests certain recommendations for practice in an EFL classroom. They involve processing of procedural information.

- Students might be asked to process visuals systematically, based on increasing degrees of spatial or task complexity.
- Assignments might be designed to provide reference text from moderate to minimal levels when constructing concept maps, thereby gradually increasing the importance of processing visuals to generate a concept map.
- Specific guidelines might be provided on what is expected in the text to be generated in terms of content.
- Specific guidelines might be provided regarding language needs.
- Incomplete concept maps might be used and students might be asked to complete them, based on their understanding of visuals. This should be done systematically, and by ensuring that there is a direct relationship between the content of the visual and the text to be generated.

Other assignments could be designed with similar assessment criteria. It is important to understand that such practices have to be iterative, and gradual. This means formative assessment strategies might work better than summative assessment strategies. Students must work on the basis of small text and graphical cues.

A POSSIBLE ASSESSMENT DESIGN

As part of an extensive exercise (for an upcoming research project on this topic), several genres related to declarative, structural, functional, logical and conditional text will be explained and analyzed for technical communication-related practices. This exercise is important for participants in order to understand different ways in which text could be analyzed and dissected in a procedural context.

During the first stage of this project, participants might be provided with a constructed concept map and several procedural visuals as steps, represented in the concept map. Participants will be tasked with the responsibility to read the text in the concept map, write it down in a sequential order, and then match it with the related visuals. This activity is designed to test EFL learners’ ability to identify text and visuals appropriately at an elementary level.

During the second stage of this project, participants might be provided with a concept map already constructed, but with missing text in the nodes. Related procedural visuals (each for a step) will also be provided. Participants will be tasked with the responsibility to complete the nodes with word choices of their liking, and then write the text separately as separate sentences. Each sentence would represent a step, and would be matched (as steps) with procedural visuals. Each procedural visual represents a step. This activity is designed to test EFL learners’ ability to process text at an intermediate level with adequate text and visual cues.
During the third and final stage, participants might be provided with several procedural pictures with comparable visual complexity. Participants will need to study the visuals carefully, understand the visual identifiers and represent the visual sequence or picturized idea in a text-visual format using concept maps. This is the final stage of the activity. This activity is designed for relatively more advanced-level visual and text processing. The range of the following activities will assess the practice effect and language learning/acquisition ability in a given text-visual context.

If the following exercise is used as part of a class assignment, or for an experiment, care must be taken to ensure that there is a systematic progression from one stage to another, in terms of visual complexity and choice of text that participants analyze. Further, systematic design should also ensure a seamless progression between procedural visuals, shown as steps. It might also be possible to focus on text complexity, keeping the complexity of the visuals relatively constant between different stages.

This future assessment/experimental design will do the following: explain the methods for choosing visuals for such activities as mentioned above; provide examples of how concept-mapping structures might be constructed; and show how several assessment criteria could be constructed for grading the performance. The criteria will be based on visuals complexity, choice of text, grades based on verb choice for concept maps, matching concept map-visuals task, ordering the sentences as steps, and other factors related to participant comprehension, confidence and motivation to complete the task. This future design will also discuss the following: how several experimental studies could be designed for measuring text and visual processing ability; possible statistical analysis for the text-visual information structures; and setting up reliability and validity for such constructs.

CONCLUSION

This is an important study and distinctive in the discipline because it looks at analyzing procedural visuals with yet another visual tool—one that uses text as a visual medium with non-linear representation. This approach is different from thinking about text as a modality, where the sequence of operation and connections/relations between objects are implicit and not immediately understood unless the complete text is read, scanned or skimmed in a sequential/linear pattern. This paper highlights concept maps as a readily available means for visual processing and conceptual representation with minimal text, and in a non-linear set up.

REFERENCES


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