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Learning Task Generation from a Series of Propositions of a Learning Topic: Kit-Building Task of Concept Map and Multiple Choice Task of Fill-in-the-blank Questions

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Abstract: Kit-building task of a concept map is a promising exercise for strengthening and assessing learner's comprehension for a topic that a learner already has learnt. In order to investigate the value of the kit-building task of a concept map, we are comparing it with multiple-choice task of fill-in-the-blank questions. As a step to realize the comparison, in this paper, it is described an implementation to generate learning task from a series of propositions, that is, (1) kit-building task of concept map and (2) multiple choice task of fill-in-the-blank questions.

Keywords: Kit-Build Task of Concept Map, Multiple Choice Task of Fill-in-the-blank Questions, Strengthening of Comprehension, Assessing of Comprehension

1. Introduction

Kit-building task of a concept map (Hirashima et. al., 2015) is a promising exercise for strengthening and assessing learner's comprehension for a topic that a learner already has learnt (Sugihara et. al, 2012). In our research, in order to investigate the value of the kit-building task of a concept map, we are comparing it with multiple-choice task of Fill-In-the-Blank (FIB) questions. The multiple choice task of fill-in-the-blank questions is also used to strengthen and assess learner's comprehension, and the answer can be automatically evaluated. Then, the both task can be generated from the same series of propositions, that is, from the same contents. In this research, we have implemented an authoring tool that supports to generate (1) Kit-Building Task of Concept Map, and (2) Multiple Choice Task of Fill-in-the-blank Questions from a series of propositions.

2. Learning Task Generation from a Series of Propositions

2.1 Relationship between Fill-In-the-Blank Questions and Kit-Build Concept Map

A semantic unit of concept map is a combination of two nodes representing two concepts respectively and one link representing relationship between the two concepts. The link has a link word/phrase to specify the relationship. The combination of two nodes and one relationship represents a proposition. In other words, a concept map expresses a series of propositions. In this paper, a concept map is regarded as a set of propositions composed of two concepts and one relationship

For an example, in a topic of "Movement of the Sun" in science learning in elementary school, it is possible to depict a teacher map as shown in Figure 1. This teacher map is composed of four propositions: (1) the "sun" "rises in" the "eastern sky", (2) the "sun" "passes through" the "southern sky", (3) the "sun" "sits in" the "western sky", and (4) the "sun" "doesn't pass through" the "northern sky". These four propositions are connects by "sun" and form a series of propositions. Here, a colored rectangle expresses a node and a phrase composed of one or few words in the rectangle expresses the label of the node. We call the phrase "node label". A phrase in white rectangle between two nodes

expresses a label of link. We call the phrase “link label”. “Western sky” and “Sun” are node labels and “Sets in” is a link label.

In this case, when a teacher inputs the four sentences and specifies three parts (one or a few words) corresponding to two nodes and one relationship in each sentence, the four sentences are regards as four propositions. Because the propositions are connected to a series of ones, a concept map is generated. This is a procedure of authoring of a concept map from a set of sentences. When a series of propositions is generated, it is possible to generate FIB questions by specifying a blank in each proposition. For an example, when all link words are specified as blanks in the above propositions, four FIB questions are generated from the same content. This is a procedure of authoring of FIB questions from the same content with a concept map.

From viewpoint of these assessment characteristics, a set of FIB questions has the similar ability. Therefore, in this research, we realized activities of KB map building and answering FIB questions for the same content and compared their learning effects. Procedure of authoring KB map and FIB questions in this research shown in Figure 2. In this example, a teacher writes a summary about “movement of the sun” as a learning topic (step-1) at first. Each sentence consisting of the summary is required to form a proposition. Then, the teacher is requested to specify two concepts (as node labels) and a relationship (as a link label) in each sentence. By the specification, a proposition is made from a sentence. So, a set of propositions are generated from a summary (step-2). From the set of propositions, a concept map for the learning topic is generated (step A-1). This map is a teacher map. If the propositions are not connected to one, the teacher is required to modify the sentences or specification of nodes or link. By decomposing the teacher map, a set of components that are provided to students are generated (step A-2). In order to make FIB questions, the teacher is required to specify a place to make the blank in each sentence. The place should be corresponds to a node label or a link label (step B). Consequently, both KB map and FIB questions are made from the same proposition set. And then, both are possible to realize automatic assessment in proposition level.

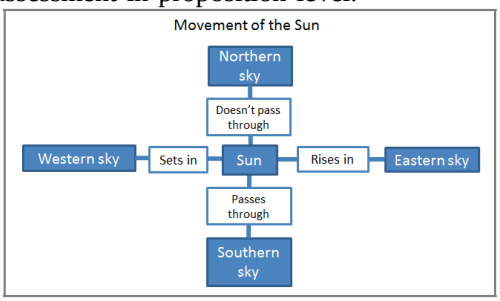

Figure 1 One example of a teacher of the map about “Movement of the Sun”

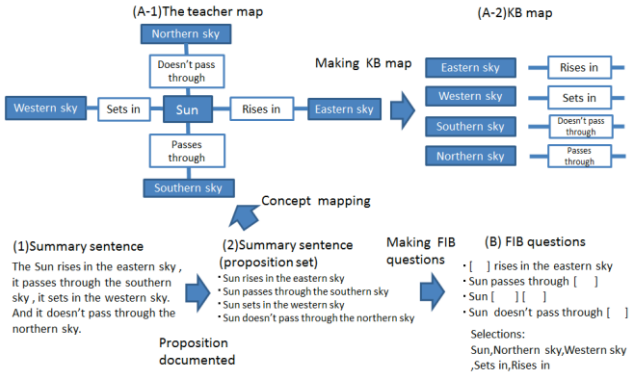

Figure 2 Example of the relationship between KB map and FIB questions

2.2 Framework of Implementation

Figure 3 shows the process to make a set of propositions. In this interface, a teacher specifies two node words/phrases and one link word/phrase in each sentence. Nodes are marked by “#” and “&”, and link word is marked “@”. By this marking, it is possible to make a set of propositions automatically. The teacher map is registered in KB map system and a student is allowed to build a concept map with KB map editor.

From the set of propositions shown in Figure 4, FIB questions are able to generate by specifying the blanks. Figure 4 shows the process. Here, the first concept in each proposition is specified as the blank. Then, sentences with the blank and the words to put in the blank are also specified. Currently, choices for the blanks are given as a set of deleted words to make the blanks. Figure 5 shows answering editor of FIB questions generated by specification shown in Figure 4. In the answering editor, several sentences with blanks are shown in the left side and the set of choices are given in the right column. By drag and drop manipulation, a choice is put into the blank in a sentence. In Figure 5, sentence (4) and (5) are filled the blanks correctly corresponding to propositions.

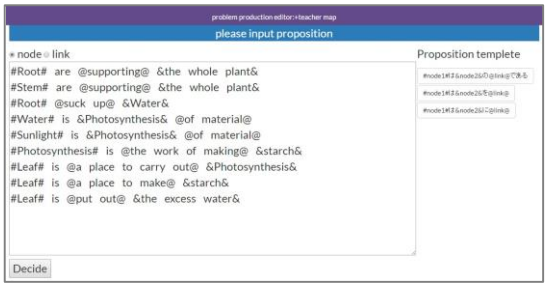

Figure 3 Inputting proposition

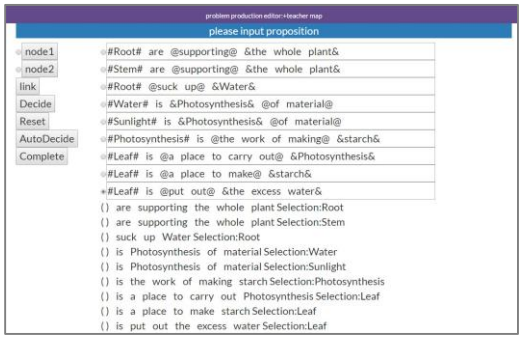

Figure 4 Creating FIB question

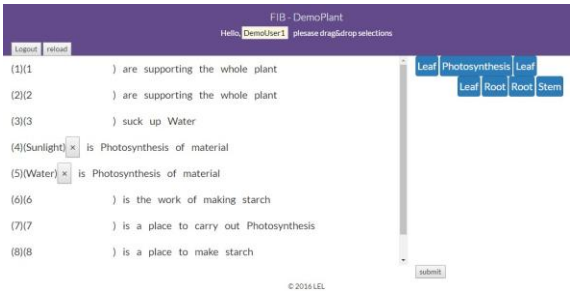

Figure 5 FIB Questions

3. Conclusion and Remarks

We have proposed the kit-building task of a concept map as a promising exercise for strengthening and assessing learner's comprehension for a topic that a learner already has learnt. In this paper, as a step to compare it with multiple-choice task of FIB questions, we introduce the two task generation from a series of propositions. By using the task generated from the same contents, the comparison is realized.

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