Diagnosable Concept Map toward Group Formation and Peer Help

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Abstract: In this paper, we propose a framework of "kit-build concept map" as diagnosable concept map toward realization of dynamic group formation and peer help. In the framework, learners build concept maps by combining the provided components. Since such concept maps are composed of the same components, it is possible to diagnose them automatically by comparing within each other or ideal one. In this paper, implementations of a building environment of kit-build concept map and diagnosis of the maps are also briefly introduced.

Introduction

It is widely accepted that concept maps can help students to externalize their knowledge or ideas. Since externalizing their knowledge or ideas of each other and sharing them are a promising approach to promote collaborative learning. Several learning environments have adopted the phase where learners could construct concept maps for a learning topic or their ideas [Stahl 2010]. The concept maps are usually used as materials or opportunities to promote the collaborative activity of learners. Such maps, however, also include very useful information to support their collaborative learning more actively. For example, when learners construct individual map for a learning topic, each map describes about each learner's understanding and misunderstanding. Therefore, it is possible to realize dynamic formation of a group or selection of a helpful peer [Isotani 2009] by finding good combinations of learners based on the results of diagnosis of the maps.

In this paper, we have proposed "kit-build concept map" as a practical approach to realize computer-based diagnosis of concept maps. In the framework of kit-build concept map, learners build concept maps by combining provided components. Since the concept maps are composed of the same components, it is possible to diagnose them automatically by comparing within each other or ideal one. Each map is characterized by some differences. Besides, by piling up the several concept maps, an overlay map that describes the understanding of a learner group can be generated. These maps and the results of the diagnosis are useful to provide with effective information to support collaborative learning from the viewpoint of group formation and peer help. In this paper, implementations of a building environment of kit-build concept map and diagnosis function of the maps are also described.

Framework of Kit-Build Concept Map

In the framework of kit-build concept map, there are four main phases such as; 1) goal map built by teachers, 2) learner map built by learners, 3) comparison of several maps by system , 4) modification of maps by the teachers or learners. Figure 1 shows a simple example of a goal map representing "physical state of matter" in science learning. In this map, "Gas" or "Solid" corresponds to a node word and "deposition" corresponds to a link word. A set of components (we call them as "kits") is generated by decomposing the goal map, as shown in Figure 2. A learner can build a learner map by composing the kits. Figure 3 shows an example of a learner map. Since the learner map is composed of the same kits corresponding to the goal map, the differences between them can easily be detected. In this case, the learner map lacks "deposition" link and includes misconnected "condensation". These differences suggest incomplete portions of understanding of a learner. By overlaying the learner maps, a map describing incomplete portions of understanding of a learner group can be generated. We call such map as "overlay map". Figure 4 shows an overlay map where a link connected by many learners is marked with bold line, such as “melting”. A thin line such as “deposition” means that few learner’s maps include the link.

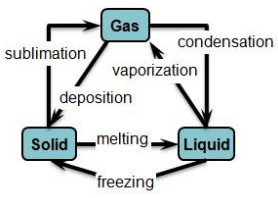

Figure 1. Goal Map.

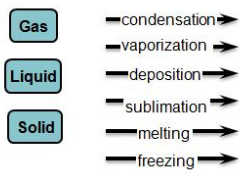

Figure 2. A Set of Kits.

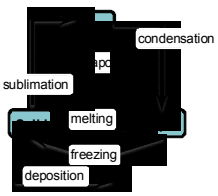

Figure 3. Learner's Map.

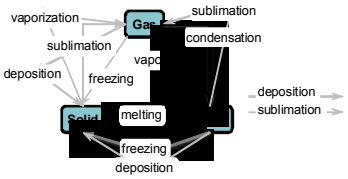

Figure 4. Overlay Map.

Based on these results, it is possible to support collaborative learning from the viewpoint of group formation and peer help. For example, a learner group should be formed so that the overlay map of the group

may include all correct links. The overlay map also indicates the weak points of the understanding of the group. Such information is useful to guide collaborative correction of their maps. Based on the information, it is also possible to find adequate peer to support a learner to correct mistakes in his/her map.

We have already implemented editors of goal map and learner map, and analyzer of kit-build concept map. In the next section, implementation of the editors and analyzer are briefly introduced. Design and implementation of collaborative learning based on the kit-build concept map is the next step of this research.

Implementation

We have developed a system based on the framework of kit-build concept map. The system is called as CmapSystem. It is a web application with three client systems (GoalMapEditor, LearnMapEditor and CmapAnalyzer) and a server system (CmapDB). Both GoalMapEditor and LearnMapEditor have been implemented by Java. Interface of GoalMapEditor is shown in Figure 5. CmapAnalyzer has functions to gather learner's maps, build overlay map and visualize the differences between maps. CmapAnalyzer was implemented by Flash. CmapDB has a function to store and share maps. This system was developed by Ruby on Rails and MySQL. Interface of CmapAnalyzer is shown in Figure 6. Here, only Japanese versions of these systems have been implemented, the words in figures are translated to English.

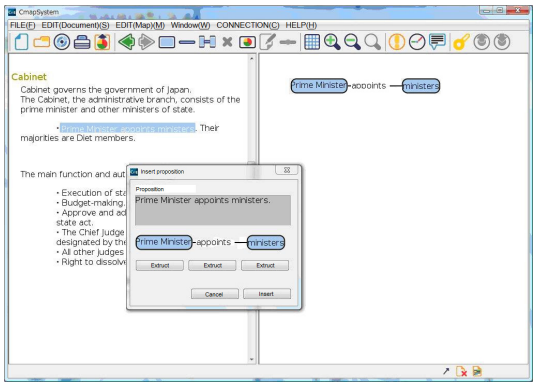

Figure 5. GoalMapEditor.

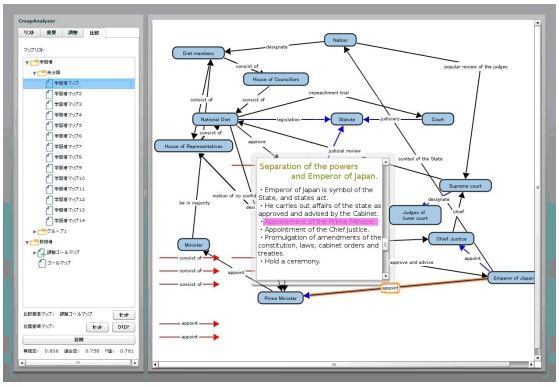

Figure 6. CmapAnalyzer.

Discussion

In usual concept mapping, a learner makes the components by him/herself and organizes them as a concept map. In contrast, ,a learner is requested to use given components and only to organize them in kit-build concept mapping. Therefore, a learner can focus on the organizing process of the components but misses the activity to make the components. In order to apply kit-build concept map adequately, it is necessary to estimate influence of the differences. There is a similar discussion in note-taking activity that is composed of (1) selecting information, (2) building internal connections and (3) building external connections. Kit-Build concept mapping is corresponding to building internal connections. In the process of building internal connecctions, selected information from a learning material or lecture is organized as a coherent structure. Several investigations [Kiewra 1991, Armbruster 2000] have suggested that building internal connections is the most influence for learning activity of note-taking and it is better to promote a learner focus on the internal connections by providing selected information by omitting the selection process. Examination of the differences in learning effects between kit-build and scratch-build concept map is our important future work.

Conclusion

In this paper, we propose a framework of "kit-build concept map" as diagnosable concept map toward realization of dynamic group formation and peer help. We have already built a learning environment where learners can make concept maps and they are diagnosed automatically. In the next step of our research, we would design the methods for dynamic group formation and peer help based on the diagnosis and try to practically use them.

References

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