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Quality Criteria Acquisition Support System of Product by Explaining It with Components

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Abstract: In creative activity, creators evaluate products whether they satisfy the criteria. Some criteria such as criteria of novelty are implicit and intuitive, so that it is difficult for novice creators to understand them. Since some criteria can be regarded as the existence of particular components, we can define the implicit criteria as the existence of components that the target product has. We propose a method for understanding implicit criteria by explaining it using existing components of the target product and construct system that supports proposed activity. Based on the evaluation experiment, it is found that proposed system can support enough explanation of criteria.

Keywords: Criteria understanding, self-explaining, concept understanding

1. Introduction

In creative activity, creators attempt to create good products. To create good products, it is important to evaluate the products by some quality criteria, and modify them based on evaluation. Quality criteria (hereafter we call it “criteria”) is how to determine existence of specific quality such as novelty or effectivity. Since criteria is implicit and intuitive, novice creators try to clarify it by reading its explanation written by others or asking others. For example, people who want to understand a criterion of “novelty” in research activity learn it by reading the criteria for novelty in the submission rules of the paper. However, it is difficult to apply the criteria written or translated by others to own products. To solve this difficulty, it is necessary to understand the criteria according to the way creators perceive the product. In this study, to be able to explain criteria by own words is assumed to understand it. We aim to construct a system that supports explaining criteria.

There is a learning method that allows learners to construct knowledge by explaining the concepts they want to understand (Chi, 2000). To support self-explaining learning, there is a method of giving other learners’ explanations as feedback on the explanation (Nakamoto, et al., 2023). The understanding of criteria differs from each people, so the explanations of others do not necessarily help one’s understanding.

In order to support explaining criteria, we need to clarify how criteria can be represented by concepts that learners know. To achieve this purpose, we propose a model that represents criteria in terms of the existence of specific components of the product. And we construct a system that supports explanation activity based on proposed model.

2. How to Explain Criteria

When we determine whether something has a particular quality, we focus on a structure that the target product (hereafter we call it “target”) has and determine whether target has the quality from existence of particular components. For example, to judge whether a research

approach is novel, we focus on existence of difference between research approach and related research approaches.

Others' explanations of criteria often include components that are essential for others to explain the criteria, such as "The novelty of research is explained using related research." On the other hand, since the quality of products are embodiments of general quality, it is also necessary to consider the components of products that correspond to the general quality and include them in the explanation. For example, if the general quality of "novelty" is the existence of components that are the same in type and different in content from others," it is sufficient to derive "the existence of approaches that differ from the approaches of related research" as the novelty of the research.

3. Criteria Explanation Support System

3.1 Overview

In this study, we propose an environment that allows learners to create valid explanation of criteria smoothly. Proposed environment is shown in Figure 1. This environment consists of a concept input system, a criteria explanation support system, and a domain knowledge database.

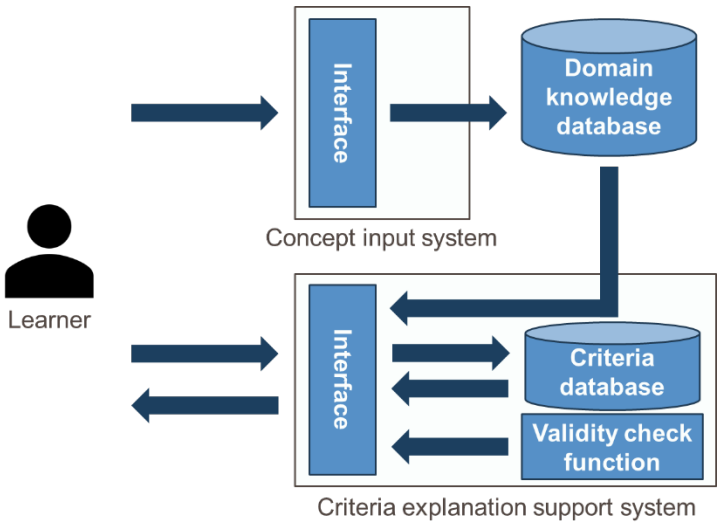

Figure 1. Criteria Explanation Support Environment

The domain knowledge database is a database that stores concepts and relations that learners recognize, and is input via the concept input system. The criteria explanation support system is a system that supports interpreting other's explanation to explain. This system consists of an interface, criteria database and a validity check function. The interface allows learners to carry out activities step by step, and the criteria entered on this interface is stored in the criteria database. The validity check function judges whether learner's explanation reflects general criteria and includes concepts and relations that exist in other's explanation and if these conditions are not met, feedback is provided to help construct a valid explanation.

The concept input system is very simple system that only provides the interface for inputting the concepts and relations, so we omit the introduction of this system and focus only on the criteria explanation support system.

3.2 Interface

When the system is started, the explanation target input form is displayed. In this form, the learner enters the explanation target in the format "<target object>, <quality>." For example, if the learner wants to explain the novelty of research approach, the learner needs to enter "research approach, novelty." <Target object> is selected from concepts that are stored in domain knowledge database. The learner also inputs the concept that exists in other's explanation. When the learner selects the explanation target and the concept that exists in other's explanation and presses the add button, the general criteria explanation form is displayed.

The general criteria input form has the explanation input area for explaining the general criteria in terms of concepts and relations. In the explanation input area, the concepts and relations included in criteria are displayed as graph structure with concepts as nodes and relations as links. Nodes and links on the graph have labels that represents concept name or relation name. In the initial state, only the <target> node that is entered as <target object> in

explanation target input form is shown. If the learner has previously explained the general criteria using the system, the previously entered structure is displayed. Clicking the Next button to move to the criteria explanation form.

Figure 2 shows the criteria explanation form. The criteria explanation form consists of the explanation input area and the general criteria display area. The explanation input area displays the concepts and relations entered by the learner using the concept input system. The general criteria display area displays the names of concepts that exist in other's explanation entered on the explanation target input form and a graph of the general criteria created on the general criteria input form. The names of the nodes displayed in the general criteria display area are labels, which are used to assign to concepts displayed in the explanation input area to explain them. Links are explained by creating links in the explanation input area with the same names as the links displayed in the general criteria display area. It is obvious that the <target> node in the general criteria display area is a concept that represents a concept with quality, and corresponds to the concept entered in the <target object> field. Therefore, the <target> label is initially assigned to the <target> in the explanation input area.

When the "Done" button in the general criteria display area is pressed, the system judges whether the learner's explanation of the criteria is valid or not, and if it is not, it provides feedback on what needs to be corrected. If it is judged to be valid, the system provides a comment, "Well done!" is presented, and then the system terminates.

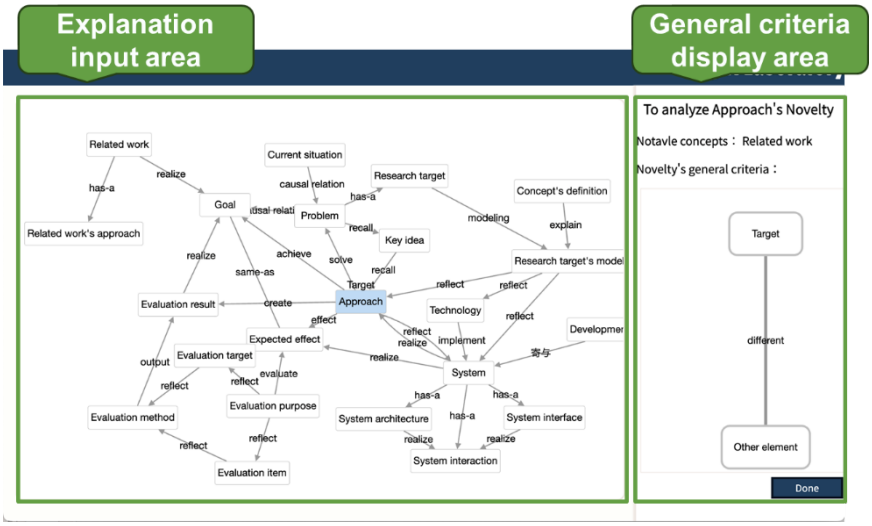

Figure 2. Criteria Explanation Form

4. Conclusion

In this paper, we proposed a method for explaining the criteria for general criteria and corresponding them to the concept of a domain, and constructed a system to support the explanation activities. In our proposed method, if the general criteria differ from the commonly considered criteria, learners cannot construct appropriate explanation. We may acquire the criteria by observing products that have quality. Therefore, we are examining a mechanism to correct the understandings in the general criteria based on the discovered commonalities and differences by collecting products that have or do not have quality and preparing an environment in which those commonalities and differences can be discovered.

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