Learning Scenario Creation for Promoting Investigative Learning on the Web

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(Received 24 June 2016 and accepted in revised form 10 February 2017)

Abstract The Web allows learners to investigate any question with Web resources to construct wider and deeper knowledge. In such an investigative learning process, it is important for them to elaborate their question, which involves decomposing it into the sub-questions to be further investigated. Such question decomposition corresponds to creating a learning scenario that implies the questions to be investigated and their sequence. However, it tends to be insufficient. This paper addresses the issue of how to promote the question decomposition. Our approach is to model the Web-based investigative learning process. In this model, the learning scenario is represented as a tree of questions to be investigated. We have also developed an interactive learning scenario builder (iLSB), which provides some scaffolds for building the question tree as modeled. This paper also reports results of our case study suggesting that iLSB has a potential to make an elaborate investigative learning process.

Keywords: investigative learning, Web, question decomposition, learner-created scenario, navigation, knowledge construction

1. Introduction

The Web currently allows learners to investigate any question, to learn from a great number and variety of Web resources. In the Web-based investigative learning process, learners are expected to construct wider, and deeper knowledge. Since Web resources are often unstructured and unreliable for learning, learners accordingly need to select the Web resources/pages suitable for learning, to navigate across them, and to integrate the contents learned at the navigated resources/pages by themselves, in which they could construct their own knowledge from their point of view.

However, learners tend to search a limited number of Web resources/pages for investigating a question, which often results in an insufficient investigation and limited knowledge construction. In order to make the constructed knowledge wider and deeper, it is necessary to facilitate an elaborate investigation. This corresponds to decomposing the initial question into related ones as sub-questions. The elaborate decomposition of the initial question would bring about wider and deeper knowledge construction. The initial question would also become better defined by means of the question decomposition.

In learning with instructional textbooks, on the other hand, learners are usually provided with a scenario like a table of contents, which implies the questions to be investigated and their sequence. Learners can follow the scenario to construct their knowledge about the contents of the textbooks. Web resources, however, do not always provide such a scenario. It is accordingly necessary for learners to decompose a question into the sub-questions while navigating Web resources/pages to construct their knowledge for an elaborate investigation. The question decomposition corresponds to creating the learning scenario in a question-driven way. Such a learner-created scenario would be helpful for them to self-regulate their navigation and knowledge construction process.

But, it is quite difficult for learners to create their own scenario concurrently with navigation and knowledge construction on the Web. Since their navigation and knowledge construction process tends to be intensive in investigating a question, they often miss finding the sub-questions, which results in an insufficient decomposition of the question.

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In this paper, we address the issue of how to promote the question decomposition in investigative learning with Web resources to scaffold the learning scenario creation. Our approach is to propose a model of the investigative learning process, which induces learners to decompose the question into its sub-questions. In this model, the learning scenario is represented as a tree of questions to be investigated. We have also implemented a cognitive tool called the interactive learning scenario builder (iLSB for short), which provides learners with some scaffolds for building their own scenario as modeled. This paper also aims to ascertain whether iLSB contributes to promoting the investigative learning process including question decomposition and knowledge construction.

In the following, we first describe our model of the Web-based investigative learning process. Second, we demonstrate iLSB, and then report a case study using it in which we compare investigative learning with iLSB to investigative learning with a Web browser. The results suggest that iLSB has a potential to make an elaborate investigative learning process.

2. Web-based Investigative Learning

On the Web, learners are allowed to search for Web resources/pages to navigate while investigating a question, and to decompose the question into sub-questions to be further investigated. On the other hand, Web resources are often unstructured for learning, and do not always provide the learning scenario implying the questions and the sequence to be investigated. Learners accordingly need to create their own scenario during the investigative learning process. However, their investigative learning process tends to be insufficient. Since the learners often pay more attention to the navigation and knowledge construction process involved in their investigation, the question decomposition gets stuck. It is accordingly necessary to promote the question decomposition so that the question can be elaborated.

2.1 Model

In order to address the issue of how to promote the question decomposition, we propose a model of investigative learning with Web resources, which includes three cyclic phases: (a) search for Web resources, (b) navigational learning, and (c) learning scenario creation as shown in Figure 1.

In investigative learning with the initial question “What is global warming?” as shown in Figure 1, for example, learners are expected to search and navigate the Web resources about the initial question, and to learn a number of related information terms such as Greenhouse gas, Ozone layer depletion, Sea level rise, Extreme weather, etc. In decomposing the question from the related information, they are then expected to select Greenhouse gas and Extreme weather as sub-questions to be investigated further. By repeating these three phases until no further question decomposition occurs, they can create their scenario to be represented as a tree of the questions shown in Figure 1.

2.1.1 Search for Web Resources

In phase (a), learners can use a search engine such as Google with a keyword representing an initial question and they traverse the hyperlinks embedded in the Web pages visited to gather Web resources suitable for investigating the question, and navigate across these resources. Since what to learn about the initial question and how to learn it are not predefined, the learners need to select the Web resources, and to decide the sequence to be investigated. They are also expected to search more resources so that they can find related questions as sub-questions.
2.1.2 Navigational Learning

In phase (b), the learners are allowed to navigate the Web pages in the selected resources to learn the contents and to construct knowledge. Such knowledge construction with navigation is called navigational learning\(^{(5)}\). In the navigational learning process, no guide for the knowledge construction is given. The learners accordingly need to make relationships among the contents learned at the navigated pages to construct their knowledge. This also requires them to self-regulate the knowledge construction process, which involves reflecting on whether the constructed knowledge is proper and sufficient for their learning\(^{(5, 9)}\).

Our previous work addressed the issue of how to help learners self-regulate their knowledge construction process with a cognitive tool in which they can combine the contents learned at Web pages by means of some pre-defined relationships\(^{(9)}\). The results of that work suggested the possibility that the cognitive tool promotes the learners’ self-regulation of their knowledge construction process.

In the model proposed in this paper, learners are also expected to extract keywords representing the contents learned at the navigated pages to make their relationships for representing their constructed knowledge.

2.1.3 Learning Scenario Creation

In phase (c), the learners are expected to find some related questions to be further investigated from the contents learned in the navigational learning phase (b). This corresponds to decomposing the initial question into sub-questions. In this model, the sub-questions are chosen from the keywords extracted in phase (b). Each sub-question is also investigated cyclically in the next phases (a) and (b).

The model of navigational learning proposed in our previous work\(^{(10)}\) does not include this phase, which expects learners to navigate Web pages about the related questions occurring in the navigational learning process instead of carrying out the question decomposition. The lessons learned also suggest that the knowledge construction tends to be structured but intensive for specific questions. With the aim of promoting a wider and deeper knowledge construction process, the model proposed in this paper differentiates the question decomposition from the navigational learning phase.

In this new model, the question decomposition results in a tree called the question tree, which includes part-of relationships between the question and the sub-questions. The root of the tree represents the initial question in the investigative learning process. This tree also represents the learning scenario. Creating the tree corresponds to defining the initial question, which specifies what to investigate and how for the initial question. The scenario creation is accordingly essential for Web-based investigative learning\(^{(5)}\).

The scenario created plays a crucial role in preventing learners from getting lost in the hyperspace provided with Web resources since it allows them to refer to the information on what and how questions have been investigated so far, and on what questions should be investigated next\(^{(1, 6, 11)}\). After the investigative learning process, the scenario also allows them to reproduce their knowledge construction process and to reflect on their constructed knowledge. Without the scenario, it would be difficult to understand how their knowledge has been constructed.

2.2 Related Work

Since the Web-based investigative learning process causes difficulties for learners, related work has been addressing the issue of how to promote it. In regard to the search for Web resources, it is not enough just to use a search engine to find useful Web resources for investigating questions. A promising approach to this issue is to prepare a repository including Web resources related to the questions, in which the resources are interrelated\(^{(2, 12)}\). Another social approach to building a repository of Web resources is to collect and index the resources used within a learning community\(^{(13)}\). Such repositories aim at providing Web resources that are instructive for learners such as textbooks on the Web. The repositories accordingly allow the learners to search and navigate across Web resources in a more fruitful way, although they cannot provide the authentic hyperspace of resources/pages on the Web.

As for the navigational learning phase, it is particularly difficult to self-regulate the navigation and knowledge construction process concurrently with navigating the Web pages and learning their contents\(^{(3, 4)}\). Adaptive hypermedia technologies\(^{(14)}\) could contribute to resolving this issue. But, it is not easy to adjust these technologies so that they could work even on unstructured Web
resources(2).

We have been accordingly developing cognitive tools as scaffolds for learners to self-regulate the navigational learning process in unstructured hyperspace(4, 9, 15). In particular, we have focused on planning and reflecting on the navigational learning process as self-regulation activities. These tools allow users not only to self-regulate but also to learn how to learn with Web resources. However, the tools are not intended to scaffold the question decomposition process.

As for the phase of learning scenario creation, the question decomposition process tends to be implicit, and often gets stuck since learners tend to pay more attention to navigating the Web resources/pages to learn the contents in the navigational learning phase. The created scenario is then simply structured, which brings about a poor investigation. It is accordingly important to consider how to make the question decomposition process elaborate(5). However, there is little related work on scaffolding for the scenario creation as far as we know. We address this issue by seamlessly combining the three phases indicated in the model, which is a novel point of our work.

3. Interactive Learning Scenario Builder

3.1 Framework of iLSB

Following the model of the investigative learning process shown in 2.1, we have developed iLSB, which is implemented as an add-on for Firefox(8). iLSB provides learners with three scaffolding functions to promote the investigative learning process:

- **Page browser with search engine**,  
- **Keyword repository** for navigational learning, and  
- **Question tree viewer** for learning scenario creation.

iLSB puts more emphasis on promoting the learning scenario creation involving the question decomposition with the question tree viewer. As for the rest of the phases, iLSB currently provides learners with comparatively simple functions such as a search engine and keyword repository. The keyword repository allows them to make only inclusive relationships among the keywords extracted in the navigational learning phase to classify.

Figure 2 shows the user interface of iLSB. The page browser and the question tree viewer are displayed.
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As tabbed pages on Firefox. The keyword repository is displayed in the left-side bar. iLSB reifies the cyclic process from the search for Web resources to the learning scenario creation with these three functions as follows.

iLSB first requires the learners to input an initial question as a keyword representing it (called q-keyword). Using their q-keyword in the search engine, they select and navigate across the Web resources. In browsing the Web pages, they extract the keywords about the question to store in the keyword repository. The learners are also expected to become aware of any keywords insufficiently learned or crucial for further investigating the question. These are viewed as the sub-questions of the initial one, which are represented as sub q-keywords. The question tree viewer allows the learners to decompose the initial question into the sub-questions. The question decomposition results in the question tree.

3.2 Scaffolds in iLSB

In iLSB, the three functions work together for learners to build a question tree. Here we consider how to scaffold the question tree building with an example in which learners investigate a question what Environmental issue is.

iLSB first locates the q-keyword Environmental issue initially input by the learners on the root of the question tree. The learners are allowed to search and browse the Web resources/pages to extract the keywords related to the q-keyword, each of which represents the contents learned at the browsed pages. The extracted keywords are stored in the keyword repository, in which the learners can make inclusive relationships among them for representing their constructed knowledge. In Figure 3, learners extract the keyword Sea level rise from the page of Global warming in the page browser, and then mouse-drag it onto the keyword Global warming in the repository to make an inclusive relationship between these keywords. The keyword repository also links the pages from which the keywords are extracted. When the learners mouse-click a keyword in the repository, the linked page can be displayed in the page browser to review the contents learned about the keyword.

When the learners find related questions in the keyword repository, they are allowed to mouse-drag the corresponding keywords to drop as sub q-keywords on the question tree viewer, and to make the part-of relationships from the root of the tree. In addition, the learners can change/delete the part-of relationships in the tree.
In Figure 2, the keywords Global warming, Desertification, and Kyoto Protocol are dropped as sub q-keywords of the q-keyword Environmental issue. Each q-keyword in the tree also embeds a link to the Web page where it was extracted from. Mouse-clicking a q-keyword in the tree viewer, the learners can review the contents learned about it anytime in the page browser.

Learners can then investigate the sub-questions by means of the three scaffolds in the next cycle. Mouse-right-clicking a sub q-keyword, they are allowed to automatically start the search engine with it. In Figure 2, they next investigate the question about what Global warming is, and then decompose it into the three sub-questions represented by the sub q-keywords Greenhouse gas, Ozone layer depletion, and Extreme weather.

The question tree viewer also allows learners to change the current focused-on q-keyword by mouse-clicking any q-keyword in the tree. When a q-keyword in the question tree is mouse-clicked, it becomes the current focused-on question. The keyword repository also changes the current q-keyword synchronously, which displays the keywords extracted for the current q-keyword. In other words, each q-keyword has its own sub-repository for storing the keywords extracted. Since the current q-keyword is displayed in the repository, it is easy for the learners to identify the question for which the displayed keywords are extracted. In Figure 3, Global warming, Greenhouse gas, and Sea level rise are the keywords extracted for investigating the current focused-on question what Environmental issue is.

In this way, iLSB allows learners to make their learning scenario creation process explicit, which would promote the investigative learning process involving question decomposition.

4. Case Study

4.1 Purpose and Preparation

We had a case study with the purpose of ascertaining whether iLSB could promote the Web-based investigative learning process as modeled. Compared with ordinary investigative learning with a Web browser that is not based on the model described in 2.1, in particular, we analyzed to what extent questions could be investigated, and to what extent constructed knowledge could be elaborated through the question decomposition and reflection.

The participants were 14 graduate and undergraduate students in science and technology who had more than 3 years’ experience in Web use. We set two conditions: (a) investigative learning with iLSB (iLSB-group), and (b) investigative learning with Firefox (Browser-group). We randomly assigned 7 participants to each.

As an initial question for investigative learning, we selected one that was unfamiliar to the participants. In the case of investigative learning on the authentic Web, there would be some possibility that the participants could not complete the investigation and could not conduct an elaborate knowledge construction under the time restriction we had. Accordingly, we limited the number of Web resources to be used in advance, and we provided a Google custom search engine that permitted the participants to search only limited resources.

4.2 Procedure

This study included 2 sessions referred to as Session I and II. In Session I, each participant was required to carry out investigative learning, and was informed that three days later they would be required to prepare a paper on the knowledge learned. In Session II conducted after three days, each participant was then required to make a table of contents (TOC) for the paper. The participants in iLSB-group were allowed to use the log (the question tree and keyword repository) generated with iLSB. In order to induce the participants in Browser-group to log the contents learned in Session I, on the other hand, they were required to take notes including the keywords representing the contents learned such as in Figure 4, and they were allowed to use the bookmark function to classify the pages learned. In Session II, they could use the notes and bookmarks for making the TOC.

Before Session I, the participants in iLSB-group were first given an explanation about the Web-based investigative learning model, and about how to use iLSB, which was intended to instruct them how to carry out investigative learning with Web resources, but which did not require them to promote the question decomposition to elaborate the learning scenario creation. The participants in the Browser-group were not given such explanation. They were allowed to conduct
investigative learning in their own way, but were required to take notes about the keywords representing the contents learned about the initial question. The participants in both groups were given a simulated pre-task of investigating a question about flora for practicing with the assigned tools. The time limit given was 20 minutes. After that, Session I was held.

In Session I, the participants in both groups were required to carry out the investigative learning process with a task of investigating the initial question about what Environmental issue is. The time limit was one hour. The participants were also provided with 19 Web resources that could be searched by means of our Google custom search engine. These resources were selected as informative ones for this initial question in advance.

In Session II, the participants were required to make a TOC within 15 minutes. Figure 5 shows an example TOC for representing the paper on knowledge to be constructed about the initial question what Environmental issue is. Lines numbered in TOC indicate the sections/sub-sections. The TOC also includes a tree of the sections/sub-sections as shown in Figure 5(b). We think this tree indicates the width and depth of knowledge learned about the initial question. The participants were allowed to look at the log generated in Session I (question tree and keyword repository for iLSB-group; notes and bookmarks for Browser-group).

In order to ascertain whether iLSB could promote investigative learning process, we gathered and compared the data about the investigation process in Session I that included the numbers of pages browsed, keywords used for searching Web resources, and q-keywords representing questions investigated. Although the participants in Browser-group were not required to create the question tree, they were expected to investigate the initial question and related questions to be decomposed during the investigative learning process. We could accordingly assume that the keywords taken in the notes and the folder names used for classifying the bookmarks represented the investigated questions and constructed knowledge. Under this assumption, we viewed these keywords/folder names as q-keywords (called predicted q-keywords) in Browser-group, although the keywords representing constructed knowledge might be included.
We also gathered and compared the data about the TOC made in Session II to ascertain to what extent knowledge constructed in the investigative learning process could be elaborated, and whether the investigated questions could promote reflecting on this knowledge.

In order to ascertain the usefulness of iLSB with these data, we set the following two hypotheses:

H1: iLSB causes more questions to be investigated, and

H2: iLSB causes constructed knowledge to be more elaborate.

### 4.3 Results

Table 1 shows the data of the investigation process in both groups, which included the average numbers of browsed pages, keywords used for Web resource search, and q-keywords/predicted q-keywords in Session I. The participants were allowed to use the search engine with any keywords including q-keywords/predicted q-keywords in Session I. Consequently, the keywords used for the Web resource search did not always correspond to q-keywords/predicted q-keywords.

From the results of the two-sided t-test, there were no significant differences between both groups in the average numbers of the browsed pages and the keywords for Web resource search. This suggests that iLSB does not impede operations necessary for conducting the Web-based investigative learning process compared with the Web browser (Firefox). From the results of the one-sided t-test, on the other hand, there was a significant difference between iLSB-group and Browser-group in the average number of the questions investigated: $t(12) = 2.05$, $p < 0.05$. This supports hypothesis H1.

We then analyzed the TOC made in both groups with the following data:

1. Number of sections/sub-sections in TOC,
2. Degree of section decomposition (SD for short)
3. Precision, which was the ratio of q-keywords (predicted q-keywords) to keywords used in sections/sub-sections, and
4. Recall, which was the ratio of keywords used in sections/sub-sections to q-keywords (predicted q-keywords).

The investigative learning process is expected to result in deeper and wider knowledge being learned about the initial question. SD represents to what degree knowledge is deeply and widely learned. As shown in Figure 5(b), the tree of sections/sub-sections in TOC can be used as a measure of the depth and width of knowledge learned about the initial question. SD is calculated for each section node except root and leaf nodes as follows:

$$SD(i) = d \times m,$$

where SD($i$) is defined as SD of section node $i$, $d$ is defined as the distance from the root to the section node $i$, and $m$ is defined as the number of nodes included in the sub-tree of the section node $i$.

In Figure 5(b), for example, SD(section 3.2) is calculated as 6 for $d=2$ and $m=3$. $d$ indicates how deeply the section $i$ is learned about the initial question, and $m$ indicates how widely the section $i$ is learned. The section that is located at a deeper level in the tree and that is decomposed into more sub-sections (descendant section nodes) has a higher SD. In evaluating SD of the tree, we use the maximum SD that is the maximum of SD($i$) and the average SD that is the average of SD($i$).

The data as to (3) Precision and (4) Recall indicate to what extent investigated questions could promote reflection on knowledge constructed in the investigative learning process. In the definition of these data, we regarded q-keywords/predicted q-keywords as correct keywords to be used for representing the sections/sub-sections in TOC. Following this regard, Precision indicates to what extent keywords used for representing the sections/sub-sections in TOC were equivalent to q-keywords/predicted q-keywords. Recall also indicates to what extent q-keywords/predicted q-keywords were used for representing the sections/sub-sections.

Table 2 shows the results of the TOC analysis. From the results of the one-sided t-test, there were significant differences between iLSB-group and Browser-group in the averages of the data (1) to (4) $t(12) = 1.87$, $p < 0.05$.
p<0.05 for (1) Sections/Sub-sections; \( t_{(12)}=1.77, p<0.10 \) for Maximum SD; \( t_{(12)}=2.44, p<0.05 \) for (3) Precision; and \( t_{(12)}=1.60, p<0.10 \) for (4) Recall.

These results suggest that iLSB allows the learners to make the paper contents more elaborate, which also brings about the suggestion that iLSB has a potential to allow learners to construct knowledge more elaborately. This supports hypothesis H2.

From the results of (3) Precision and (4) Recall, in addition, iLSB-group used more q-keywords to make the TOC. This also suggests that iLSB promotes reflection on knowledge constructed in the investigative learning process.

Following the above analyses, we ascertained the usefulness of iLSB under the condition that Web resources to be used for the investigative learning process are considerably limited.

### 4.4 Considerations

In order to ascertain to what extent iLSB could promote the question decomposition, we gathered and analyzed the following data about the question tree created in iLSB-group:

| (1) Sections/sub-sections |
|--------------------------|
| iLSB-group 21.6* |
| Browser-group 16.6 |

| (2) SD |
|----------------|
| Maximum SD 10.3† |
| Average SD 5.2* |

| (3) Precision |
|---------------|
| 58.1* |

| (4) Recall |
|------------|
| 74.1† |

* One-sided t-test: \( p<0.05 \), † One-sided t-test: \( p<0.10 \)

\( p<0.05 \) for (1) Sections/Sub-sections; \( t_{(12)}=1.77, p<0.10 \) for Maximum SD; \( t_{(12)}=2.59, p<0.05 \) for Average SD; \( t_{(12)}=2.44, p<0.05 \) for (3) Precision; and \( t_{(12)}=1.60, p<0.10 \) for (4) Recall.

Table 2. \( t \)-Test Analysis for TOC.

Table 3. Analysis for Question Tree.

| (1) Average depth |
|-------------------|
| 4.4 |

| (2) Average number of leaf q-keywords |
|--------------------------------------|
| 11.4 |

| (3) QD |
|--------|
| Maximum QD 8.7 |
| Average QD 4.9 |

where QD(i) is defined as QD of q-keyword i, \( qd \) is defined as the distance from the root to the q-keyword i, and \( qm \) is defined as the number of q-keywords included in the sub-tree of the q-keyword i.

In Figure 2, for example, QD (Global warming) is calculated as 3 for \( qd=1 \) and \( qm=3 \). \( qd \) indicates how deeply the q-keyword is decomposed about the initial question. \( qm \) indicates how widely the q-keyword is decomposed. The q-keyword that is located at a deeper level in the tree and that is decomposed into more sub-questions (descendant q-keywords) has a higher QD. In evaluating QD of the tree, we use the maximum QD that is the maximum of QD(i) and the average QD that is the average of QD(i).

Table 3 shows the results of the question tree analysis. From these, iLSB allows learners to build the question tree whose QD is 4.9 on average, and whose depth is 4.4 on average. In consideration of significantly more questions decomposed in iLSB-group as shown in Table 1, such a tree can be viewed as a deep and wide one to some extent, although we cannot compare the question trees between iLSB-group and Browser-group.

In this case study, in addition, we evaluated iLSB including the model described in 2.1 in order to ascertain the usefulness of the model-based investigative learning compared to the ordinary one with the Web browser. From the results of the study, we are unsure whether iLSB is a more suitable tool for reifying the investigative learning process as modeled. Although it is necessary to have another study for ascertaining the suitability of iLSB, we think the functions for the Web resource search and navigational learning seem weak. In particular, the navigational learning process needs more...
relationships for representing knowledge constructed from Web pages. In the previous work\(^{(9)}\), we have defined a number of relationships. In the future, we will refine the keyword repository in iLSB by making more relationships available.

In this study, we also observed some participants who built the question trees having QD and depth lower than the average ones. In order to help these learners better carry out the question decomposition, it is accordingly necessary for iLSB to provide not only the question tree viewer as a scaffold but also some aids for promoting its use. We are currently developing an aid for presenting attributes that characterize the part-of relationships between questions\(^{(16)}\). In the case of the question about what Global warming is, for example, there are some attributes such as influence and cause. When the attribute influence is presented to learners, the intention is to make them aware that the influence of Global warming could be the sub-question. In this case, Sea level rise, Extreme weather, etc. are the candidates for the sub-question. Such attribute presentation could promote the question decomposition. We currently classify attributes according to question types, and refine the question tree viewer that presents the attributes suitable to the types of the current focused-on question\(^{(16)}\).

5. Conclusion

This paper has proposed a model of Web-based investigative learning process including three phases, which are search for Web resources, navigational learning, and learning scenario creation. In this model, the learning scenario creation is viewed as decomposing a question into the sub-questions to build a tree of questions to be investigated. We demonstrated iLSB allowed the learners to conduct their investigative learning process as modeled. In Web-based investigative learning, it is important to define a question to be investigated. iLSB provided scaffolds for question tree building as the question definition. We also reported the case study using iLSB. The results suggested that iLSB caused learners to investigate more questions and caused learners to construct knowledge more elaborately.

Our case study was conducted under the use of limited Web resources. In the future, we plan to evaluate the usefulness of iLSB on the authentic Web. In addition, we want to ascertain the suitability of iLSB as a cognitive tool for the model-based investigative learning in comparison to the investigative learning process with a Web browser that follows the model. From these results, we will be able to identify the issues to be further addressed to refine the scaffolding functions in iLSB.

Acknowledgement

This work is supported in part by JSPS KAKENHI Grant-in-Aid for Scientific Research (B) (No. 26282047 and No.23300297).

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