

# Template-based Authoring of Educational Artifacts

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## ABSTRACT

The Walden's Paths project is developing tools for leveraging student learning with the incredible amount of educational material on the Web. Specialized templates based on established educational frameworks, learning theories, or activities aid path authors in creating pedagogically sound paths by guiding them in collecting and structuring the information included in the path. We describe a template based on the Inquiry-Based Learning educational framework and an implementation that provides support in applying the template to the path authoring process.

## Categories and Subject Descriptors

K.3.1 [Computers and Education]: Computer Uses in Education – *computer-assisted instruction*. H.5.4 [Information Interfaces and Presentation]: Hypertext/Hypermedia – *user issues*.

## General Terms

Design, Human Factors, Experimentation

## Keywords

Inquiry-Based Learning, Template-based authoring.

## 1. INTRODUCTION

The Walden's Paths system [3] supports forming a structured, unified *path* from independent Web content. Its browsing interface presents the path to the reader as unaltered Web pages decorated with navigational controls and an annotation, which can be used by the path's author to contextualize the page within the path. The path reader can follow the path's pages in sequence or can follow links at will; when browsing off the path, the interface provides a button that immediately returns the reader to the path.

Walden's Paths provides an interface for classroom use of Web-based materials. However, the degree of success associated with the use of these materials is tied to the degree to which their structure follows well-established pedagogical principles, and this in turn depends on the knowledge of the path's author and the degree of care taken in design of the path. To enhance the potential for pedagogically-sound paths, we have been examining template-based support for path construction.

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## 2. INQUIRY-BASED LEARNING

The Inquiry-Based Learning (IBL) approach incorporates the premise that students asking questions is the natural learning process. Defined by Suchman [4], IBL uses a discrepant event, an event with results that differ from what is expected, to stimulate student curiosity. IBL models that have been proposed include Suchman's Inquiry Training Model, Joyce, et al.'s five step model [2], and Jakes, et al.'s eight-step model, which uses the Web as the main information source [1]. Based on these models, we defined a six-step template for an IBL activity path:

1. **Introduction:** Pages that outline the activity and describe the tasks to be performed by the students

<p><b>Step:</b> Essential Question</p> <p>Essential questions are the backbone of an Inquiry-Based lesson. Essential Questions promote <b>decision-making</b> and/or <b>development of strategies</b>. An essential question is NOT a "What is...?" question and it does not necessarily have one correct answer. Essential questions may start with: "Why...", "How...", "Which one..." and additionally will require students to "Defend..." their decisions and strategies.</p> <p>The answer to an essential question is developed by the student through a process of Evaluation, Synthesis and Analysis. Students are challenged by essential questions to use critical evaluation and reflection. At this point in the activity, students should not be able to answer the question but could be required to make an initial guess.</p> <p><b>Step:</b> Pose Essential Questions</p> <p><b>Instructions:</b> Pose an essential question related to about the event or situation shown in the Opening Scene.</p> <ul style="list-style-type: none"><li>• <b>Title Help:</b> Use "Essential Question" as the title for this stop.</li><li>• <b>URL Help:</b> There is no URL for this stop in the path.</li><li>• <b>Annotation Help:</b> Enter the Essential Question as the annotation. State the question then ask students to make an initial guess at the answer (i.e. "List 3 possible answers...")</li><li>• <b>Annotation Help Example (Pop-up):</b></li></ul> <div style="border: 1px solid black; padding: 5px;"><p>In the video, you saw an egg fall into a bottle. The egg originally sat on the opening of the bottle, indicating that the bottle's opening is smaller than the egg. This leads to the Essential Question:</p><p style="text-align: center;"><b>Why did the egg fall into the bottle?</b></p><p>Before you begin investigating this question: List 3 possible explanations for the egg sliding into the bottle.</p><p>Then, circle the one explanation you think most likely caused the egg to fall and write one paragraph stating why you think this explanation is the best.</p></div> <ul style="list-style-type: none"><li>• <b>Additional Help (Pop-up):</b></li></ul> <div style="border: 1px solid black; padding: 5px;"><p>An example of an activity with an opening scene, essential question and example foundation questions:</p><p>a. Zebra Mussels: <a href="http://www.biopoint.com/msla/projects99/zebramussels.htm">http://www.biopoint.com/msla/projects99/zebramussels.htm</a></p><p>b. The above and other examples of full activities are found at <a href="http://www.biopoint.com/eq/topic1.html">http://www.biopoint.com/eq/topic1.html</a></p><p>More information about essential questions can be found at the following sites:</p><p>c. Asking Essential Questions: <a href="http://www.biopoint.com/ibr/askqueston.html">http://www.biopoint.com/ibr/askqueston.html</a></p><p>d. Writing Essential Questions: <a href="http://www.myprojectpages.com/support/ess_questpopup.html">http://www.myprojectpages.com/support/ess_questpopup.html</a></p><p>e. Framing Essential Questions: <a href="http://www.fno.org/sept96/questions.html">http://www.fno.org/sept96/questions.html</a></p><p>f. Creating Essential Questions: <a href="http://www.galileo.org/tips/essential_questions.html">http://www.galileo.org/tips/essential_questions.html</a></p><p>g. More on Essential Questions: <a href="http://www.washington.edu/uwired/outreach/teched/using/mod2less2quest.html">http://www.washington.edu/uwired/outreach/teched/using/mod2less2quest.html</a></p><p>Examples of Essential Questions can be found at the following sites:</p><p>h. Examples of Essential Questions: <a href="http://www.biopoint.com/ibr/essquestex.html">http://www.biopoint.com/ibr/essquestex.html</a></p><p>i. Examples of Essential Questions: <a href="http://www.biopoint.com/eq/page1.html">http://www.biopoint.com/eq/page1.html</a> (Click "next" on each screen, shows one question at a time)</p><p>j. Examples of Essential Questions, by grade: <a href="http://www.gen.bham.wednet.edu/essenque.htm">http://www.gen.bham.wednet.edu/essenque.htm</a></p><p>k. Examples at the end of the article: <a href="http://www.washington.edu/uwired/outreach/teched/using/mod2less2quest.html">http://www.washington.edu/uwired/outreach/teched/using/mod2less2quest.html</a></p></div>
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Figure 1. Template Details for the Essential Question step

- Opening Scene:** Pages that set the stage for these concepts. The opening scene is intended to spark questions and to motivate the overall goal of the lesson.
- Essential Question:** Pages directly related to the core question of the activity. This requires students to identify strategies and plans of action, and/or make decisions. They motivate students to construct knowledge from existing information.
- Foundation Questions:** The factual basis (the “foundation”) that is used to answer the essential questions. These are typically “What is...” questions and help structure the search for Web materials.
- Investigation:** Resources for the students as they begin seeking answers to the foundation questions.
- Create Answer:** Provides directions to students as they formulate an answer to the essential question and develop a product to represent the answer. Not all essential questions warrant a conclusive answer. Instead of a presentation, the final product could also be a written report stating a plan of action, a set of strategies, or a hypothesis with supporting or contradicting evidence.

The template prompts the author to include at least one page in the path for each step of the process. In addition to directions for authors, the template includes pointers to specific Web sites for locating additional help and information regarding the specific step and provides tips for creating annotations that will be useful for the students. The template also provides links to corresponding pages in an example path. Figure 1 shows the details of the template information for step 3, Essential Question.

### 3. TEMPLATE-BASED AUTHORIZING

The Template-Based Authoring Tool (TBAT) is a Web-based path authoring interface that presents templates, like the IBL template, to path authors.

Figure 2 shows the authors’ view of the IBL template. TBAT’s interface consists of five areas—labeled A through E—that are displayed to the authors at all times. Area A shows the outline of the current template that serves as a structural navigational aid. Clicking on a sub-title for a step in the template brings up the pages in the path associated with this step. The content of the center and right frames reflect the author’s current location and change as the author moves through the template.

Information related to the current high-level step and directions for the individual page are displayed in area B. Area C contains the text fields where authors provide page information, such as the title, Web location, and an annotation. The buttons located below these text fields allow authors to traverse pages in the path, save or delete the data for this page, and insert additional pages that correspond to the current location within the template. The “View Path” button provides a preview mechanism to let the authors preview the path as it will appear to their students.

A list of the pages currently in the path is displayed in area D. Pages are listed in the order of their appearance in the path and are grouped by their location with respect to the template as well. This display visually superimposes the template over the pages in the path to help authors understand how the actual path corresponds to theoretical guidelines of the template. The headings in this section also display the number of pages associated with each step in the template. For instance, the path in figure 2 contains thirteen pages in all. The “Foundation

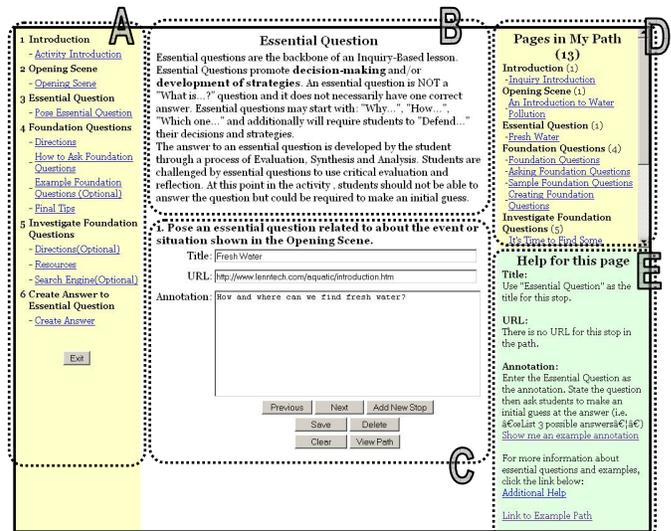


Figure 2. Template-based Authoring Tool (TBAT)

Questions” step contains 4 of these pages. Finally, area E displays the help information for the current step in the template.

### 4. DISCUSSION

Our initial evaluation using subjects with classroom teaching experience has been promising. We compared paths authored with TBAT with ones authored with our standard (undirected) authoring tool. We found it particularly interesting that all subjects authoring paths with the standard tool made mistakes in properly including all of the necessary elements in the IBL structure; an error not seen with TBAT-authored paths. This was true even though they had paper copies of all the same tutorial information describing inquiry-based learning and the template. We currently are conducting a more extensive evaluation and are planning an expert evaluation of the quality of the paths produced by the two methods. In addition, we are evaluating and refining the template mechanisms, and will be implementing templates that support additional pedagogical frameworks.

### 5. ACKNOWLEDGEMENTS

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