HyLighter: An Effective Interactive Annotation Innovation for Distance Education

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This paper briefly describes the HyLighter innovation for teaching and learning and document-centered work groups. HyLighter has two main parts: (a) an interactive annotation system with the unique ability to aggregate or merge annotations (i.e., highlighting of text and related comments) from multiple readers and generate composite displays for purposes of learning and assessment and (b) an electronic spreadsheet for editing and manipulating the results of the process for a single document or synthesizing and generating new ideas from multiple documents. HyLighter extends the capacity of the document as a medium for the negotiation of meaning (Brown & Duguid, 1995) by making thinking that is ordinarily hidden, become "transparent" and easily accessible for consideration by members of a group.

The ability to gain knowledge from text in widely different subject matter areas is key to academic success and lifelong learning. The process of attaining critical understanding of ideas in text requires a robust repertoire of learning or study strategies, metacognitive knowledge for regulating their use, and willingness to apply them. Although much is known about the basic design of learning environments to develop higher-order thinking skills and motivation to learn, educators have, in general, not changed their practices to reflect new knowledge. The lack of procedures that are easy for teachers to administer and provide results that teachers may use diagnostically in their courses for assessment of complex cognitive skill development is a major obstacle to widespread adoption of new approaches.

HyLighter and a pedagogically sound implementation of this technology, referred to as the Interactive Annotation Model, supports learner-centered instruction, metacognitive teaching, and provides a practical way to perform authentic learning and assessment activities in distance and distributed learning modes. Initial field tests and evaluation studies suggest that Interactive Annotation practices (a) increase participation and depth of engagement, (b) develop reading, writing and learning skills, and (c) improve instructional quality.

The HyLighter Software Component

HyLighter builds on advances in technology that allow readers to annotate electronic documents in ways similar to paper and share annotations with other people over a network. This includes highlighting important text and adding comments. To use the program, an instructor fills out simple web forms to create a class, uploads HTML documents, and assigns participants. Once the class is set up, contributors mark up assigned documents within their browser window with an easy to use interface. As displayed in Figure 1, a contributor selects text using the cursor, clicks the "Highlight" button, enters a comment in a notes field, and clicks "Submit" to save the results. Generally, the task of the reader is to create a layer of markup, which represents the reader's "mapping" of the purpose for reading the material.

Once participants have marked up an assigned document, clicking the Compare button reveals differences and similarities between a selected reader's view and all or selected others. HyLighter has the unique ability to display an aggregated or merged view of a group's annotation through color-coded highlighting linked to corresponding comments. The colors and what they indicate are as follows:
1. Yellow highlighting indicates text fragments highlighted by a selected reader but not highlighted by others in a group of readers.
2. Shades of blue highlighting indicates text fragments highlighted by one or more group members but not by the selected reader.
3. Shades of green highlighting (i.e., yellow and blue combined) indicates text fragments highlighted by the selected reader and members of the group.

**Figure 1.** HyLighter 2.0 screen shot shows a section of text selected for highlighting and the comment field open for adding a comment.

Figure 2 shows a comparison view of highlighting between a selected reader and group members. Excerpts (or text fragments) highlighted by the selected reader but not the other group members appear in yellow; excerpts not highlighted by the selected reader, but marked by one or more group members, appear in shades of blue (the darker the shade of blue, the more "votes" for that text fragment); and excerpts highlighted by both the reader and one or more group members appear in various shades of green (the darker the shade of green, the more votes for that text fragment). In Figure 3, mousing over the highlighted text shows a fraction indicating the number of readers who "voted" for that text fragment over the total number of contributors (e.g., 3/8). Clicking on the green area shows remarks of the root or logged in reader and two other group members.

**Figure 2.** HyLighter screen shot shows a comparative view of several readers. Green highlighting indicates overlap or agreement.

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and The Annual Conference on Distance Teaching and Learning
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HyLighter facilitates Interactive Annotation by providing mechanisms to (a) edit one's own comments (click the red x icon to delete; the hand icon to edit), (b) label highlighted text (e.g., as a main idea, supporting fact, or example) and categorize comments (e.g., as a question, a challenge, or a link) and sort comments by categories, (c) make comment on other readers' comments (click the flag icon), (d) make general comments or summarize (i.e., comments which are not linked to a specific text fragment and are displayed by selecting a special icon, not shown), (e) add embedded annotations to the original text (e.g., the instructor places icons in strategic locations throughout the selected document; when a reader clicks an icon, a message prompts the reader to perform a specific task), (f) record and play audio annotations, (g) create small-group views (i.e., users form small groups, edit their highlighting and comments into group views, and compare to other group views), (h) view annotation in a print preview format (i.e., each paragraph in the original document is displayed followed by readers' comments) with capability to export to a word processor, and (g) view annotation information in alternative display modes, such as the spreadsheet mode described shortly below, for diagnosis, assessment, and group coordination. In the future, HyLighter will (a) provide an integrated chat feature to facilitate collaboration at a distance, (b) offer integrated concept mapping to represent understanding of interrelations among important ideas and coordinate group activity, (c) allow users to upload graphic annotations, and (d) enable annotation of graphics and video.

The HyLighter Annotation Matrix

The HyLighter Annotation Matrix (HAM) provides a way to display Interactive Annotation data to diagnose and score performance, as illustrated in Table 1. HAM promotes metacognitive thinking of teachers by providing them with tangible evidence of readers' engagement with the text and readers' reasoning processes in a form that is revealing and efficient to use. Teacher awareness of the sources and characteristics of students' misconceptions enables selection of instructional strategies to address misconceptions and evaluate change (Hartman, 2001).

HAM displays each paragraph in a selected document sequentially in the top row of a matrix (i.e., the reader scrolls left to right to move forward in the document). Comments linked to each paragraph are displayed vertically in columns under the target paragraph. The names of participants are listed alphabetically in a vertical column on the left margin. In Table 1, reading horizontally across a row presents all comments contributed by a selected reader, and reading vertically down a column presents all remarks linked to a selected paragraph. Clicking a selected comment shows highlighted text linked to the comment. The instructor writes a brief review for each comment, enters the type of error when appropriate (or selects from a menu or decision tree of common mistakes), and rates the remark on a scale reflecting a set of scoring criteria. HyLighter calculates scores to reflect the judged quality of comments.

Figure 3. Clicking the green area links to readers' remarks.
for (a) each student on the entire document, (b) the class as a whole on each paragraph, and (c) the class as a whole on the document as a whole. HyLighter may also produce a frequency distribution of diagnosed problems that helps the teacher make instructional decisions for individual students and the class as a whole. Of note, a future version of HyLighter scheduled for release toward the end of 2004 will provide a spreadsheet function similar to HAM for collaborative writing and intertextual linking (i.e., performing literature reviews and writing from multiple sources).

Table 1. *HyLighter Assessment Matrix (HAM)*

<table>
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<tr>
<th>Benchmark</th>
<th>Paragraph 1</th>
<th>. . .</th>
<th>Paragraph n</th>
<th>Totals</th>
</tr>
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<tbody>
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<td>&quot;Expert&quot; comment</td>
<td>. . .</td>
<td>&quot;Expert&quot; comment&quot;</td>
<td></td>
</tr>
<tr>
<td><strong>Reader 1</strong></td>
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<td>Instructor review score =</td>
<td>Reader comment</td>
<td>Instructor review score =</td>
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<tr>
<td><strong>Reader n</strong></td>
<td>Reader comment</td>
<td>Instructor review score =</td>
<td>Reader comment</td>
<td>Instructor review score =</td>
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<td></td>
<td>. . .</td>
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<tr>
<td><strong>Totals</strong></td>
<td>Paragraph 1</td>
<td>score =</td>
<td>Paragraph n</td>
<td>score =</td>
</tr>
</tbody>
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**Research Results and Future Directions**

Results of initial field tests suggest that HyLighter may (a) increase participation, engagement, accountability and completion rates in local and distance learning modes, (b) help students develop active reading skills, learn how to gain knowledge from text and improve writing ability, (c) improve the quality of instruction, (d) facilitate diagnosis of obstacles to learning and assessment of higher-order thinking skills and complex cognitive skills, and (e) increase productivity of document-centered group work. Although preliminary field trials have been quite promising, many questions remain for investigation. Until appropriate summative evaluation and validation studies are completed, the rationale for using HyLighter for instructional purposes is largely based on face validity (i.e., a subjective appraisal of its value). Currently, HyLighter studies are underway in a variety of distance-learning settings including (a) second semester English at Tallahassee Community College, (b) an online Masters program in Human Resource Development at Florida State University, and (c) a training division at a major corporation.

From another perspective, HyLighter provides an effective alternative to threaded-discussion groups. Discussions supported by HyLighter are anchored in the context of a shared text and tend to be more convergent than in threaded-discussions, and, as a result, more productive. Requirements to annotate documents, "publish" results, and reconcile differences with other students promote increased accountability for doing reading assignments on time, more time on task, and a deeper processing of information. Requirements to write intelligible remarks and the many opportunities to “compare notes” helps students improve their writing and communication skills. Requirements to "reread and reflect" support comprehension, critical thinking, and completion rates.

**Conclusion**

The most promising uses of educational technology promote changes in students' study techniques and attitudes toward learning and help students and faculty monitor the changes. HyLighter represents an
alternative way to teach learning-to-learn skills, support the social construction of knowledge, promote a positive disposition toward learning, assess progress, evaluate effectiveness of instruction, and increase completion rates. Interactive annotation practices supported by HyLighter provide opportunities for social interactions, which expose students to multiple perspectives and feedback on performance and understanding. In sum, HyLighter (a) improves users' critical thinking and reading skills necessary for reading comprehension and literature appraisal (i.e., cognitive and metacognitive skills of reading, particularly ability to distinguish relevant from extraneous information in a text), (b) develops users' skills essential for writing from sources across the curriculum, including their ability to synthesize textual information from multiple documents, and (c) enhances users' motivation and self-regulation of learning. Future development of HyLighter technology (e.g., expand document annotation spreadsheet functions and add capabilities to "hylight" graphics and video) will open new ways to enhance teaching, learning, and document-centered group work in distance and distributed modes.

References


Biographical Sketches

David G. Lebow is President and Director of Research and Development of HyLighter, Inc. He received his Ph.D. in Instructional Systems Design from FSU in 1995 and has taught graduate-level courses on alternative methods of teaching and learning and technology for teachers. His research efforts have focused on designing and developing computer-supported collaborative learning environments.

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