# Presumptive Literacies in Technology-Integrated Science Curriculum

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## ABSTRACT

In this paper we explore the multiple literacies presumed in the design of inquiry curriculum created at the Center for Learning Technologies in Urban Schools (LeTUS). The current design of LeTUS inquiry-based, technology embedded science curriculum presumes a facility with, and strategic use of literacies on the part of students who enact the curriculum. Here literacy means two things: deriving meaning from patterns in knowledge domains like science and facility with different information forms. We use teacher interviews and on-line discussions to expose presumptive literacies in design and learners' literacy challenges and offer suggestions that teacher modifications to these units can inform future design to support literacy in science.

**Keywords**: technology supported science curriculum, literacy, universal design

## INTRODUCTION

Advanced learning technologies coupled with inquiry-based curricula can offer students access to powerful ideas in science as never before. For example, tools like Geodyamic data base and World Watcher makes visualizations of Earth's structures and data about its processes available to students and teachers in ways that fit into classroom activity. These tools, in theory, will allow all students to engage in more authentic analysis of current problems like the impact of global warming on the average temperature changes in our hemisphere or how to find earth's plate boundaries from earthquake and volcanic activity data. Curriculum projects like those at the Center for Learning Technologies in Urban Schools (LeTUS) (Gomez & Marx 1999; Krajick et. al. , 1998) and inquiry-focused projects(e.g. WISE) aim to create learning environments that make this sort of ambitious science a regular part of children's science learning. This is a challenging endeavor with many roadblocks. Nevertheless LeTUS and others are creating a substantial collection of technology-infused science units that are finding growing utility in urban classrooms. Heretofore our efforts at achieving utility have centered on matters like technology access, scaffolds to learners' prior knowledge, and technology usability. These are, and will for some time, remain important issues. We have devoted relatively less attention to the simple notion that learners must be literate to use these units. In this paper we focus on the literacy demands for urban children embedded in modern inquiry-based curricula. We now conjecture, and will later demonstrate, that, with respect to literacy, urban and second language learners lack the necessary literacy skills to use many of the curricular materials and tools of current inquiry based, technology integrated science curriculum.

To date a great deal of research has addressed how to create tools and materials to provide scaffolds (Edelson et. al., 1999; Loh et.al., 1998 that provide access and support for connecting students' prior knowledge to the opportunities to learning in curriculum, and deepen conceptual understandings in science domains. A central characteristic of these materials, whether graphics, text, or media-based, is that they heavily engage students' literacy skills. We conjecture that the very scaffolds that are designed to help students learn science may be inaccessible because they presume skills that students do not possess.

### The Presumptive Literacies Study

The Presumptive Literacies Study was created to understand how to foreground the literacy demands of LeTUS curriculum and how to design literacy supports within the curricula units. The project has three phases: (1) document the literacy demands of the curricula; (2) engage in university researcher-teacher researcher collaborative design teams to design literacy-based modifications to the units, (3) beta test the modifications in LeTUS classrooms, and develop a set of principles to support literacy and linguistic needs in LeTUS science curriculum.

#### *Method*

We engaged in a multi-methodological (interviews, on-line reports, classroom observation not reported here) approach to data collection. For the purposes of organizing and analyzing the resultant data, we used a constant comparative research approach. When we were satisfied that the final categories represented the literacy demands and teacher strategies themes we began to conduct micro level analyses of each theme. The goal of the micro level analyses was to more fully describe the themes and to develop a set of principles for supporting the literacy that is engaged in LeTUS science curriculum.

## FINDINGS

Results suggest that the LeTUS curriculum assumes that students require minimum support for, or have an adequate skill set to draw from, to do at least the following seven literacy-based activities: (1) conduct internet research; (2) identify research-relevant information; (3) recognize, record, and organize necessary information from science-related and documentary video; (4) interpret dynamic databases, scientific visualization graphs and systems modeling tools; (5) add research data to and organize information within advanced learning technology software; (6) access relevant background knowledge (often text-based) and make connections to current content and process requirements of activities; (7) organize and communicate research findings, especially utilizing multi-media tools. If curricular use requires these, and other, literacy skills and students do not even recognize these as genres with specific structure, students' access to the powerful ideas and tools of science made possible by inquiry-based techniques will be blocked. The data suggest that the literacy-centered curriculum modifications reported here fall into 10 topical areas; 1) accessing and building on prior knowledge; 2) vocabulary development, 3) deepening concepts; 4) providing students with tools to organize their learning and "hang their knowledge on, 5) building an awareness of patterns in information genres; 6) increasing reading comprehension; 7) focusing inquiry 8) data interpretation using multiple sources; 9) communicating complex ideas using multiple genres; 10) ongoing individual and collaborative assessment.

## CONCLUSIONS

At the beginning of this report we claimed that little attention has been paid to the notion that learners must be literate to use inquiry-based, technology embedded curricula. We have attempted here to call attention to the literacy demands for urban and second language learners in these curricula and have used teacher modifications of these curricula as a lens into understanding how to deepen content and process understanding while supporting literacy skills. In sum, we believe designers of inquiry curricular and supporting materials need to embark on two courses of action. First, designers need to engage in reflective critique of materials themselves to make the literacy demands visible. Second, designers need to pioneer a new set of techniques that will help in using science (and other curriculum as well) as sites to directly support secondary literacy skills. We believe that teacher adaptation is one important lens to help us see literacy demands and to see how to better support children in using literacy to learn.

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