Elements of Information Inquiry, Evolution of Models, and Measured Reflection

In 2003, Paula Montgomery, then chief of school media services for the Maryland State Department of Education, published a guide to teaching information inquiry (Montgomery 2003). Her staff also illustrated the elements of information inquiry as a recursive cycle with interaction among the elements occurring each time the inquirer encounters new information. This cycle is centered on a need or task, no matter how small or large, or how complex or simple (see figure 1). This cycle occurs with each information interaction, whether a portion of a project or culmination of the greater inquiry experience.

In 2003, Daniel Callison defined five elements as a consistent core found in the many models for information searching and use emerging at the time from a variety of academic educators and researchers, as well as from leading school library professionals. These five elements have remained central while there has been evolution in several of the leading information literacy instructional models (Callison and Preddy 2006). Callison also noted the elements of constructivist educational theory, as well as refinement of school library instructional practice, resulted in an evolution toward inquiry. While these advancements have moved toward a more student-centered teaching approach, the core information inquiry elements continue to provide the framework for inquiry-based learning.

Five Elements of Information Inquiry

Questioning: This element rests on natural curiosity held by most humans from birth. Who? What? Where? When? Why? How? But most of all, Why? This element, as it interacts with the other four, becomes a more refined skill set. The result is the ability to ask more focused, relevant, and insightful questions.

Information inquiry is based on a continuous questioning cycle, the essence of lifelong learning.

Explication: Closely tied to questioning, explication is the action taken to seek answers to the questions. In many cases, no specific questions are on the agenda, but the drive to satisfy curiosity moves the learner to search for information: reading, viewing, listening. As the information inquiry elements intersect and the abilities of the learner mature, exploration becomes the action to gain information related to specific questions. Exploration becomes a systematic search for and examination of resources and information to meet a need or task that is meaningful and holds purpose for the learner.

Over time and through many cycles of these elements, information needs and tasks become more focused. As a result, exploration involves a more discriminating process to seek and select information. Mature abilities gained through practice and experience result in a more efficient use of time to search, examine, and reflect.

Assimilation: This element involves the actions to absorb and fit information with that which is already known, believed, or assumed by the learner. In some cases, assimilation means reinforcing information or confirming what is known. In other cases, assimilation involves an altering of what has been accepted as knowledge by the individual learner or group of learners.

Inference: This element involves the actions or processes for deriving a conclusion from facts and premises. Inference may involve personal choice and actions taken based on conclusions that seem most relevant and meaningful. On a personal basis, inference is usually an internal message to the self and not one that is conveyed in a formal manner to others.

In other cases, inference may involve a wider communication of conclusions. The learner is either shared among members of a group or working on the same tasks in a cooperative effort. Inference is presented to those who might need the recommendations for action or need to evaluate the learner’s ability to address a problem and communicate a solution.

Information within the inference element is most useful when it becomes evidence. Evidence is necessary to support a claim, notion, plan for change, or hypothesis. Evidence may be necessary to justify the status quo or accepted norm. Evidence is always necessary to justify change. A new expectation for the Common Core State Standards Initiative is that students learn not only how to find satisfactory evidence, but also determine what is the best evidence possible.

Reflection: This element is unique to human learning and involves assessing the information inquiry process and determining if the results are satisfactory. Reflection can also involve assessment of the information inquiry process and determining if the results are satisfactory. Reflection can also involve assessment of the information inquiry process and determining if the results are satisfactory. Reflection can also involve assessment of the information inquiry process and determining if the results are satisfactory. Reflection can also involve assessment of the information inquiry process and determining if the results are satisfactory. Reflection can also involve assessment of the information inquiry process and determining if the results are satisfactory.
Reflective behavior will serve as a mentor who learns from mistakes as well as successes.

Comparing and Contrasting Inquiry Elements

Completely independent from my (Daniel’s) definitions and based on extensive professional experience of their own, several leading school library educators have established information literacy instruction models that have moved from an inquiry approach. Each will be examined below. While each model has a unique and copyrighted graphic that can be located through the citations provided, the elements of each model have been organized under a standard frame (see Table 1) to allow for comparison to information inquiry as well as identification of contrasting elements that bring new dimensions to the inquiry process.

The model developed for Follett Software by Marjorie Pappas and Anne Tepe (2002) moves beyond the basic information inquiry framework in many respects and brings quality literature to the center of the learning objectives, along with the student’s needs. Below are some of the actions Pappas and Tepe recommend for students and teachers:

- Foster appreciation and enjoyment of literature and the desire to learn, as these are foundational to establishing meaningful inquiry.
- Activate all senses for information intake.
- Do extensive brainstorming that will trigger potential topics for exploration, extend this brainstorming by identifying keywords and reading general resources to determine interests.
- Cluster questions to bring efficiency to the process.
- Encourage students to exercise methods that bring efficient use of time through skimming and scanning.
- Look for matching patterns and themes within answers to question clusters identifying these patterns and themes enhances prior knowledge and current interests.
- Experiment with a wide variety of communication formats to determine the most effective mode for students’ abilities to present and the audience to comprehend.
- Evaluate not only the product but also the process to raise new questions, assess the extent to which use of resources meets information needs, and recognize the degree of movement toward becoming an independent thinker.

Beyond the REACTS Model Barbara Stripling developed in collaboration with Judy Pitts (1988). Stripling has moved more recently to a process designed to meet inquiry learning projects across the curriculum and at various grade levels (see Table 2). Her model is designed as a conversation-planning instrument to be used collaboratively with teachers (Stripling and Harder 2002). Several of her strategies move beyond the information inquiry core to create a greater library-centered and learner-centered experience for students.

<table>
<thead>
<tr>
<th>Five Elements or Components of Information Inquiry</th>
<th>Stages</th>
<th>Inquiry Skills and Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquire</td>
<td>Connect</td>
<td>Identify own experience. Connect to ideas of others. Connect to prior knowledge and verify its accuracy. Provide background and context. Establish preliminary contact with idea through observation or experience.</td>
</tr>
<tr>
<td>Questioning</td>
<td>Connect</td>
<td>Connect to ideas of others. Connect to prior knowledge and verify its accuracy. Provide background and context. Establish preliminary contact with idea through observation or experience.</td>
</tr>
<tr>
<td>Exploring</td>
<td>Question</td>
<td>Develop wonder questions that will lead to new understandings about key ideas. Frame questions using prior knowledge, basic and framework of individual unit, and different levels of thinking. Develop questions to lead to active investigation and decision making.</td>
</tr>
<tr>
<td>Exploring</td>
<td>Wonder</td>
<td>Plan investigation and develop search strategies to find relevant, high-quality information. Identify, evaluate, and use multiple sources of information. Find and evaluate information to answer questions. Use notes using a variety of formats. Use information and technology, responsibly, skillfully, and ethically.</td>
</tr>
<tr>
<td>Inference</td>
<td>Investigate</td>
<td>Think about the information to formulate new questions and hypotheses. Identify gaps and conflicting information. Consider alternative explanations and predictions. Consider new understandings to propose new understandings.</td>
</tr>
<tr>
<td>Reflection</td>
<td>Reflect</td>
<td>Set high and clear standards for own work. Reflect on work. Use criteria to assess own process and product throughout the learning.</td>
</tr>
</tbody>
</table>

Note: Application of the Information Inquiry Elements to Stripling and Pitt’s REACTS model can be found in The Blue Book on Information Age Inquiry, Instruction, and Literacy by Daniel Collins and Lisle Prayde. Libraries Unlimited, 2010, Table B.6, page 530.
• Initiate a plan to find not just relevant information, but high-quality, credible information.
• Identify information gaps and conflicting information, and plan to deal with such issues.
• Look for patterns in data and patterns in conclusions from others.
• Transform information gathered to new contexts to determine new meaning based on the strength of the evidence.
• Study the expectations of the audience and tailor your presentations to address those demands.
• Apply self-assessment as much as possible but be able to reflect with others.
• Set new learning goals as part of the total reflection on the experience and make those new goals foundational to future inquiry.
• Understand that maturation in inquiry is the process of building toward new, meaningful mental models.

The most influential model for information literacy instruction has been that created by Carol Collier Kuhlthau: the Information Search Process (Kuhlthau 2000). Her work has extended across public schools and higher education and has been tested in a variety of demanding workplace environments. Her shift to greater emphasis on inquiry strategies is in keeping with her consistent application of constructivist learning theory and assumption that students have the ability to build on their experiences (see table 2). Through the development of Guided Inquiry Design (Kuhlthau, Maniotes, and Caspari 2012), even greater emphasis has been placed on the student as the centerpiece of the learning process. Strategies are designed to guide the student to a meaningful focus for inquiry. Without such, everything else is futile. Examples of ways educators can foster student engagement are listed below:

- Make sure tasks involved in teaching inquiry are complex enough to merit trained, collaborative teaching teams.
- Immerse the students in thinking about what they already know and what would be worthwhile knowing; guide the students but support individual effort when of value.
- Encourage students to scan and explore a wide variety of sources, including broad subjects and works at various reading levels.
- Guide students to concentrate question development on issues of importance.
- Expect students to maintain a record of the research experience and reflect on it regularly.
- Model actions such as visualizing and charting patterns to show growth in understanding and emergence of new knowledge.
- Advocate going broad, beyond the norm, in early exploration, but deep in quality and credibility when a focus has been established.
- Recognize that simple fact finding does not merit the students’ or the teacher’s time but reaching for new knowledge does.
- Encourage learners to make presentations as interesting for the audience as they are for the inquirers, as knowledge does not become rich and worthwhile until shared.
- Convince learners that self-assessment drives true reflection and recording reflection establishes the foundation needed to mature as an effective inquirer.

### Measured Reflections

While the evolution toward inquiry of information literacy models described here has been dramatic over the past decade, many aspects of reflection remain only slightly considered and some not at all. In 2005 Ross Todd and colleagues at Rutgers University reported that high school students engaged in guided inquiry training reported various aspects of change in student academic behavior:

- Students’ initial knowledge underwent a significant conceptual change.
- Students learned topical content in deep ways, shown in complex and coherent knowledge structures.
- Students became more skilled and confident as information seekers.
- Students became increasingly interested, engaged, and reflective during their learning process and saw information seeking as a constructive process of building both deep knowledge and deep understanding.
- Students gained practical skills in independent information seeking, and learned how to find information analysis and synthesis.
- Students showed increasing awareness of the varied quality of information, as well as of information sources and their credibility and often contradictory.

While Todd’s work has uncovered new evaluation measures that should be investigated and practiced further, we now very little about the process and value of student reflection, and we know even less about the array of behaviors that could become tangible measures of high performance. Areas that lie before us for further and deeper examination are:

- How do students identify conflicting information, document its differences, and resolve use of that information that seems most credible?
- How can they document value of primary and secondary sources?

### TABLE 3: GUIDED INQUIRY DESIGN (Kuhlthau, et al. 2012)

<table>
<thead>
<tr>
<th>FIVE ELEMENTS OR COMPONENTS OF INFORMATION INQUIRY</th>
<th>PHASES</th>
<th>INQUIRY COMMUNITY TASKS</th>
<th>LEARNING TEAM TASKS</th>
<th>STUDENT TASKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questioning</td>
<td>Reading, viewing, listening</td>
<td>Open rộng</td>
<td>Instrinsic to inquiry</td>
<td>Decide on the learning goals, create powerful opener that invites learners in, establishes inquiry intent, introduces general logic to engage the inquiry community.</td>
</tr>
<tr>
<td>Exploring</td>
<td>Reading, viewing, listening</td>
<td>Increase</td>
<td>Build background knowledge relevant to content and discover interesting ideas.</td>
<td>Deeply engage ways for students to immerse in the overall content ideas.</td>
</tr>
<tr>
<td>Assimilating</td>
<td>Reading, viewing, listening</td>
<td>Engage</td>
<td>Explore ideas that look around.</td>
<td>Guide students to browse and scan a variety of ideas and encourage them to keep an open mind as they explore and reflect on new information.</td>
</tr>
<tr>
<td>Categorize</td>
<td>Reading, viewing, listening</td>
<td>Categorize</td>
<td>The whole information gathering go on to a deep level.</td>
<td>Guides students to analyze and organize the information gathered.</td>
</tr>
<tr>
<td>Reflect on the learning</td>
<td>Reading, viewing, listening</td>
<td>Reflect on learning</td>
<td>Identify and organize facts to make meaning.</td>
<td>Guide students to go beyond simple fact finding and interpreting to summarize, interpret, and extend ideas.</td>
</tr>
<tr>
<td>Share</td>
<td>Reading, viewing, listening</td>
<td>Share</td>
<td>Organize short sessions to provide the best context for students to learn about current content from their peers.</td>
<td>Guide students to reflect on their own learning process and engage in learning from each other.</td>
</tr>
</tbody>
</table>

Note: Application of the Information Inquiry Elements in Kuhlthau’s Information Search Process can be found in The Blue Book on Information Age Inquiry, Instruction, and Literacy by Daniel Callison and Leda Preddy. Libraries Unlimited, 2006. Table 5.3. page 587.
• How do students illustrate their original data through graphics they produce, such as tables and charts? Do these become more precise with each new inquiry experience and does the student mature in his or her use of technology to construct such illustrations? (Lamb and Callison 2012)

• In what manner can students document their reflections on best and worst resources examined so that they may demonstrate more effective and efficient search strategies as they mature in the inquiry process? How can they best test the credibility and usefulness of evidence? (Callison 2015)

A portfolio of student products in inquiry learning should be compiled to show how the student has grown intellectually and matured in the information inquiry process. (Callison 1993). The Common Core States Standard Initiative and the American Association of School Librarians’ standards crosswalk provide progressive frameworks for this assessment process over the duration of the student’s academic career.

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* Tables designed by Katie Baker, computer technology teacher and technology integration specialist, Sycamore School, Indianapolis, Indiana.

Works Cited:


