21st Century Information Fluency: Assessing Students' Knowledge and Skills

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Background Information

The Illinois Mathematics and Science Academy’s Twenty-first Century Information Fluency Program (21CIF) is a federally grant-funded program through the U.S. Department of Education's Funds for the Improvement of Education. The 21CIF grant program is entering its fifth year of research and development with regard to providing Illinois educators with professional development experiences and online learning materials and software tools for teaching students how to find, evaluate and use digital information effectively, efficiently and ethically. To date, the program has trained 1532 educators from 701 schools/districts across Illinois with addition outreach nationally.

DIF Definition and Core Competencies

Digital Information Fluency (DIF) is the ability to find, evaluate and use digital information effectively, efficiently and ethically. DIF involves knowing how digital information is different from print information; having the skills to use specialized tools for finding digital information; and developing the dispositions needed in the digital information environment. As teachers and librarians develop these skills and teach them to students, students will become better equipped to achieve their information needs.

The following DIF model represents the findings of the grant program's ongoing research about 21st Century information knowledge, skills and attitudes needed to be successful online learners. Progress assessing DIF knowledge and skills is represented by the following diagram. The Digital Information Fluency Model consists of a number of decision points, each of which contributes to finding, evaluating and using information effectively, efficiently and ethically. The process is not quite as linear as the model depicts, but for the purpose of defining competencies required and assessment opportunities, the model is sufficient.
As shown in the model above, three questions summarize the Search phase of the model:

- What information am I looking for?
- Where will I find the information?
- How will I get there?

One question encompasses the Evaluation phase: How good is the information?

The final question depends on the Evaluation phase and addresses Ethical Use: How will I ethically use the information?

The knowledge, skills and dispositions required for fluency at each point of the model are described in more detail below:

**What information am I looking for?**
- Learners identify key concepts in a research question
- Learners create effective and efficient search queries
- Translate a natural language question into a search query

To conduct a digital information search:
- Develop and apply vocabulary building strategies to effectively conduct a digital information search
- Effectively act on informed decisions to revise their search queries based on search results/feedback
Where will I find the information?
* Learners understand the organization of digital information
* Learners effectively and efficiently select digital collections based on their characteristics
  o Select visible Web collections (and sub-collections) based on their characteristics
  o Select invisible Web collections (and sub-collections) based on their characteristics
  o Select other digital collections (and sub-collections) based on their characteristics

How good is the information?
* Learners evaluate the quality of a search result to determine its usefulness in the search process
  o Determine whether or not the digital information addresses the natural language question
  o Decide whether or not the digital information suggests revisions to search queries (revision decision)
* Learners evaluate the quality of a search result to determine the reliability of its content
  o Investigate internal content reliability
  o Investigate external validation of information

How will I get there?
* Learners select digital search tools based on their effectiveness and efficiency
  o Select features of a variety of digital tools based on the probability of effectiveness and efficiency
* Learners select appropriate search strategies to effectively and efficiently locate reliable digital information related to their academic learning goal(s)
  o Navigate hyperlink, i.e. browsing strategies
  o Use subject directory strategies
  o Use search engine strategies
* Learners apply appropriate search strategies in order to efficiently locate reliable digital information related to their academic learning goal(s)
  o Navigate hyperlink, i.e. browsing strategies
  o Use a directory (subject index)
  o Use a search engine

How will I ethically use the information?
* Learners ethically use digital information
  o Learners decide whether or not to integrate digital information related to a specific information task
  o Learners give credit to the source and/or author for the selected digital information

Overall competencies (Applicable in all phases of the digital information fluency process):
* Learners acquire the dispositions necessary for successful digital information fluency:
Demonstrate curiosity for exploring ideas when engaged in the digital information fluency process
Demonstrate confidence in finding a solution when engaged in the digital information fluency process
Demonstrate persistence to continually engage in the digital information fluency process
Demonstrate focus to avoid distractions when engaged in the digital information fluency process
Demonstrate open-mindedness to a variety of strategies and tools when engaged in the digital information fluency process

* Learners acquire self-regulation necessary for successful digital information fluency:
  - Demonstrate meta-cognitive thinking to adjust their strategies and tools when engaged in the digital information fluency process
  - Demonstrate attitude of adaptability to respond to inconclusive or ineffective results when engaged in the digital information fluency process

The grant research shows that these are the core competencies that form the basis for assessing Digital Information Fluency. All of the DIF assessment instruments developed under the grant are formative and should not be regarded as tests in the summative sense. Development work on assessment has produced a number of different tools which may be categorized as knowledge-based or performance-based. The Internet Basic Assessment (IBA) integrates many of the competencies through the use of live Internet-based search challenges and information evaluation and integration scenarios as well as knowledge-based multiple choice items. Online searches assess the extent to which searchers use alternate keywords and operators effectively. Search scenarios assess whether searchers appropriately evaluate information found on web pages. The IBA multiple choice items allow for baseline comparisons between knowledge of DIF facts and processes and the ability to apply that knowledge in practice.

Other assessments, such as Keyword Challenges, may be characterized as interactive. Here the assessment is meant to inform and change the user’s search habits. Immediate feedback is given by which the individual knows whether he or she is engaging in a specific aspect of the search process effectively or not. While these activities may be viewed mainly as tutorial in nature, they do incorporate measurement that permits an individual to self-assess and become more proficient using competencies defined by the DIF model. The diagram below includes examples of assessments tied to specific competencies.
Assessments and Competencies

Live Search Challenges, such as the **Kermit Challenge**, integrate competencies from the first four phases of the DIF Model.

Examples:

- **Keyword Challenges** -- Learners identify key concepts in a research question
- **Soccer Challenge I** -- Learners translate a natural language question into a search query
- **Soccer Challenge II** -- Learners develop and apply vocabulary building strategies to effectively conduct a digital information search

Examples:

- **Citation Wizard** -- provides students with a template for creating properly formatted citations which teachers may use for assessment
- **MicroModule Quiz, Citation** -- Learners give credit to the source and/or author for the selected digital information

Examples:

- **IBA: Cassini Mission** -- Learners evaluate the quality of a search result
- **Snippet Sleuth** -- Learners determine whether or not the digital information addresses the natural language question

Examples:

- **Archery Challenge II** -- Learners select digital collections based on their characteristics
- Select visible Web collections (and sub-collections) based on their characteristics
- **Soccer Challenge II** -- Learners select digital collections based on their characteristics
- **Archery Challenge I** -- Learners apply appropriate search strategies in order to efficiently locate reliable digital

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A Sample of Online DIF Resources available on the 21CIF portal:

**Live Search Challenges (Broadway, Kermit, Pump Price, Apollo 8, etc.)**
http://21cif.imsa.edu/tutorials/challenge/SC001/SC_directory.html

**MicroModule Quizzes** (see individual MicroModules)
http://21cif.imsa.edu/tutorials/micro/

**Keyword Challenges (Broadway, Great Wall, Hollywood, Stamps)**
http://21cif.imsa.edu/tutorials/challenge/Q2Q/KeywordChallenge.swf

**Soccer Challenges I - IV**
http://21cif.imsa.edu/tutorials/challenge/soccerchallenge/Nyms_index.swf

**Snippet Sleuth**
http://21cif.imsa.edu/tutorials/challenge/snippetsleuth/SS_FunnyGirl_beta4.swf

**Archery Challenges (Database Match, Can Google google it?)**
These newly created tutorial/assessment are part of the new Full Circle Resource Kit, normally available by subscription only, provided at no charge to NECC participants:
http://21cif.imsa.edu/tutorials/challenge/archerychallenge/archervindex.swf

**Retired IBA questions** (available upon request)

1. Which query would be the most effective to use in a search engine to find an answer to the question: "What toy utilizes a construction technique that reduces damage from earthquakes?"
   a. toy construction earthquakes
   b. toy construction technique earthquakes
   c. toy construction "damage from earthquakes"

2. How confident are you that information on the “What are the Odds?” web site http://gslc.genetics.utah.edu/units/disorders/counselors/cancer.cfm is trustworthy?


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