# Computer Literacy Revisited: A Comprehensive Investigation of Computer Literacy

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The literature on computer literacy (CI) courses in higher education was reviewed. A survey was completed of components of CI courses from three populations. Results of the literature review, survey results, and most popular CI course components are presented, along with implications for CI course revisions.

## 1  HISTORY

The first use of the term "computer literacy" is credited to Andrew Molnar in 1972 when he served as the director of the Office of Computing Activities at the National Science Foundation (Gupta 2006). Others such as Dr. Kurt Lauckner at Eastern Michigan quickly began to use the term in 1973 for first courses in computing (Ueberroth 1994).

By 1979, computer literacy courses had drawn the attention ACM. With support from the National Science Foundation, ACM conducted a study of computer literacy courses, which was presented at the 1979 ACM Annual Conference (Engel 1979).

There have been a number of articles written by ACM members on computer literacy since 1979. Most have been written by members of the ACM Special Interest Group on Computer Science Education (SIGCSE). Of the 258,874 (9/28/09) full text articles in the ACM Digital Library, 2329 were identified as using keywords *"computer literacy"*. 770 were identified using keywords *"computer literacy in higher education"*. All of the abstracts of the 770 were reviewed for relevance to the subject of this investigation. Twenty-six were determined to be relevant to the investiga-

tion subject. A majority of the 770 were written prior to 2000. Less than a dozen have been written since 2000.

The table of contents of proceedings of the SIGCSE annual Technical Symposium on Computer Science Education from 2000 to 2009 was analyzed. Three additional relevant articles were identified.

Only one survey on computer literacy (in addition to the ACM 1974 survey) was identified. Forbes, J. and Garcia, D. D. (2007) surveyed 30 PhD programs listed in the 2007 U.S. News and World Report. They conducted a comprehensive survey directed at "where do we attract (or lose) our best students who have not considered majoring in computer science". Unfortunately, the survey data was not published as part of the proceedings. One finding of note was that Computer Science beginning courses (CS0) had almost as many different textbooks as schools.

The remaining relevant articles centered on revised computer literacy definitions, skills required or descriptions of course revisions. A review of the pertinent references may be helpful.

Revised Definitions and Refocused Courses

One would expect that with the increasing emphasis on assessment now being required for re-accreditation, course objectives as well as outcomes for all courses would receive increased attention, including the computer literacy course.

A number of authors proposed refocusing the traditional computer literacy course from the emphasis on computer hardware, technology and software skills such as WORD, Excel and PowerPoint, to other objectives. Banerjee (2009) proposed a more problem solving approach. Baron 1984 suggested including decision making and basic programming. Bartholomew (2004), Cohen (1987), and Hoffman and others (2005) recommended a move

toward information literacy, teaching students how to locate information. Hoffman, and others (2005) suggested including components on critical thinking and how the internet works. Hoffman and Vance (2005) suggested changing the name of the course to "communication literacy". In 2008, Hoffman and Vance made their case for teaching what technology enables, not teaching about the technology itself. Lio & Pope (2008) changed their course to include publishing to the web, using HTML.

Bartholomew (2004), Hoffman & Blake (2003), and Sloan & Halaris (1985) recommended the term computer fluency and suggested it should contain levels of fluency. Gupta (2006) and Bartholomew (2004) identified objectives and skills that should be taught in a computer literacy course. Huang and Briggs (2009) developed a new course for non-CS majors.

Foster & Dannelly (2006) and Stiller & LeBlanc (2006) shared how their college computer literacy course had been re-designed to meet new changing computer literacy course objectives and needs. Peterson (1987) suggested a computer literacy course should include the impact of technology on societal issues. Sellars (1988) suggested that "computer literacy" is a poor name for the subject, to cover the basic understanding of the computer and its effects on mankind. Hoffman & Blake (2003) recommended using the term "computer fluency" to convey a deeper understanding than CL.

Hoffman & Vance ((2008) as well as Ueberroth (1994) make the case for including data privacy and security in the course. Steiller and LeBlanc (2006) suggest that the computer literacy course should be focused on web expressions and be an instrument of communication.

## 1.1 Accessing Stakeholder input

It is unrealistic to expect all computer literacy courses to be the same. Or that there would ever be agreement on what the objectives or required competencies should be. However, it would seem that if we are about providing skills to students, they should be the skills that are most desired by stake holders. Bartholomew (2004) and Gupta (2005) recommend a set of skills/objectives. Willoughby (1983) surveyed graduates for computer literacy course components. Dednam (2009) surveyed other department chairpersons. No one apparently has surveyed the hiring companies.

Bartholomew (2004) suggested that the stakeholders, i.e. hiring companies, and program directors outside CS, should have a say in what components should comprise a computer literacy course. He suggested the course should be a tool of communication and coined the word "meta literacy". Willoughby (1983) suggested surveying the graduates.

Burger and Blignaut (2004), Hoffman and Vance (2005), and Mawhinney (1992), recommended assessing computer skills of incoming freshmen to determine what additional skills are needed. In most cases, it is the CS programming instructors that determine the skills/objectives that will be taught in the course. This would seem to have some build-in bias.

## 1.2 Faculty Illiteracy

Homan and Vance (2005) suggested the possibility of no single computer literacy course, but including computer literacy in many courses, a "computers across the curriculum" approach. Bartholomew (2004) and Wolf (1996) suggested that one major problem with computer literacy across the curriculum was that most students are more "literate" than their faculty outside of the CS department, and that non-CS major students could not become computer literate with illiterate faculty lacking competence. He proposed an objective in discipline course curriculums that forces instructors to "learn up" to the level of their students.

## 2 THE COLUMBIA COLLEGE EXPERIENCE

Columbia College began offering a computer literacy course CISS 170 required of all graduates in 1985. In 2001, a survey was done of non-CS departments to inquire what should be included in the course. Much faculty illiteracy was noted. The course remained virtually unchanged until 2008 when a significant focus on the impact of technology on societal issues was added. The general education requirements of the College (which includes the CISS 170 course) are approaching the ten-year review. Thus, the interest in this study.

## 3 SURVEY POPULATIONS

After an exhaustive search, no comprehensive sources of colleges and universities offering computer literacy courses were found. Several small lists from within this population were identified.

(1) SIGCSE (one of the 34 special interest groups of the Association of Computer Machinery, ACM) email newsletter subscribers (1365)
(2) Computing Research Association (CRC) list of 253 CS and MIS PhD offering programs (249) http://www.cra.org/reports/forsythe.html.
(3) Eduventures, Inc. Columbia College is a member of Eduventures, Inc., a private research organization. As such, the College is able to ask simple Q & A questions of the other member institutions. (93)

A short six-question survey was sent to members of each of the above groups. Because of the small number of completed surveys, results are obviously not conclusive, nor will they be projectable to the population of all colleges and universities. However, the results will give Columbia College, and other colleges as well, indications of the contents and trends in computer literacy courses across the country. It will also provide the basis for revision considerations for the Columbia College CISS 170 course.

## 4 SURVEY RESULTS

A total of 1707 surveys were emailed to the three groups with 130 responding. (7.6%) Eduventures received 19 responses out of 93 institutions (20.4%), SIGCE members returned 61 surveys out of 1365 (4.50%), and CRA returned 60 surveys out of 249 sent (20.1%).

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*continued*

**Q # 1** **Institutions Offering a for-credit Course on Computer Literacy**
Forty two percent of Eduventures institutions acknowledged a for-credit computer literacy course. SIGCSE members reported 72%, and CRA members indicated 66% had such courses.

**Q #2** **Which of the following student population subgroups are required to complete the computer literacy (CL) course offered by your institution? All respondents did not answer every question. Thus the percentages may not equal 100%**
Eduventures reported 57% of resonding institutions require the CL course of all students. SIGCSE reported 36%, and CRA reported 11.8%. Eduventures reported it as an elective course at 14% of their institutions, SIGCSE reported it elective at 35.2% and CRA reported it as an elective at 52.9% of their institutions.

**Q #3** **Does your institution currently offer students the option to test out of the requirement for taking the computer literacy course?**
Test out options were reported at 66.7% of the Eduventures institutions. SIGCE institutions reported 47.2%, CRA institutions reported 44.4%. No institutions reported test outs over the theory portion only or the Office portion only.

**Q #4** **Which of the following areas does the computer literacy course emphasize?**

| #4 Components | AVG |
| --- | --- |
| Office Skills | 83.70% |
| Technical terminology | 62.97% |
| Computer software | 61.67% |
| Computer Hardware | 58.17% |
| Computer security | 50.77% |
| Ethical implications | 47.60% |
| Information Literacy | 46.67% |
| Impact of technology on societal issues | 44.27% |
| Intellectual property issues | 43.90% |
| Data privacy | 42.80% |
| Computer Crime | 32.77% |
| Basic programming | 26.87% |
| Web Publishing | 24.43% |
| Decision-making | 22.77% |

This question gets at the heart of the research. Those reporting on this question listed Office Skills as the most common emphasis, followed by Technology terminology, Computer software and hardware, and computer security. Components at the bottom of the list were Basic programming, Web publishing and Decision-making.

**Q #5** **Which of the following external stakeholders have significant input on the required competencies?**
From the data below, it appears that in nearly half of the institutions, the Computer Science department is the sole determiner of the contents of computer literacy courses.
    In approximately one fourth of the institutions, program directors and other faculty or staff outside the computer departments have significant input.

| #5 Stakeholders | AVG |
| --- | --- |
| None of the above | 43.1% |
| Program Directors | 25.0% |
| Other Staff | 21.0% |
| Employers | 14.4% |
| Students | 9.1% |

**Q # 6** **Type of Institution**
The type of institution reporting was almost equally split between public and private colleges.

| #6 Institution | AVG |
| --- | --- |
| Public | 44.6% |
| Private, - non-profit | 50.6% |
| International | 3.5% |
| For-profit | 1.3% |

**5 PUBLISHER DATA**
A May 2009 survey conducted by Course Technology, a division of Cengage Learning, sheds additional light on several aspects of computer literacy courses. Of the 1601 responses to the Cengage survey, 47% came from faculty at two and four year institutions. The remaining were high schools and technical schools. The first eleven questions contribute some knowledge to the topic of this study. The survey results for the two and four year schools of the first eleven questions may be viewed at: http://sites.google.com/site/complitpubsurvey (Cengage Learning, Boston, MA 02210)

**6 SUMMARY**

- Of the responding institutions 60% reported offering a for-credit course in computer literacy.
- Slightly over one third of the Institutions require the course of all students (35%) while an almost identical percentage (34.5%) reported the course offered as an elective course.
- Test out options are almost equally split with 52.8% offering test outs, while 47.2% do not.
- *Office skills* remains high as the most common component of a computer literacy course, with an average 83.7% including it. Other components reported with an average over 50% included *Technical terminology, Computer software, Computer hardware and Computer security*.
- Almost half of the computer departments determine the competences in the course. Between 21% and 25% of other schools receive input from program directors, departments or other staff.
- The reporting institutions were almost evenly between public and private schools and colleges.

## 7 IMPLICATIONS FOR COURSE REVISIONS

While most of the articles in ACM publications reflect new approaches or new components for their computer literacy courses, this data suggests that the traditional components continue in a majority of the schools and colleges reporting. A full report of this data is available at: http://sites.google.com/site/computerliteracyrevisted/ **Ir**

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