The Computer Literacy Potpourri: A Review of the Literature, or McLuhan Revisited

Robin H. Kay
Ontario Institute for Studies in Education

Abstract

Defining computer literacy has proven to be an elusive endeavour. A variety of conflicting criteria has created a somewhat confusing and chaotic state of affairs. The following paper provides a framework to organize and understand the evolving and ephemeral meaning of computer literacy. Employing Marshall McLuhan's now famous axiom "the Medium is the Message," it is proposed that advances in computer technology have strongly influenced the way in which computer literacy has been defined. Significant advances in computer technology have spawned six relatively distinct perspectives on computer literacy. These perspectives or stages include (a) computer awareness, (b) programming, (c) evolving concept and planning (d) behavioural approach, (e) reaction and process, and (f) personal needs. It is argued that significant advances in computer technology should allow educators to stop focusing on how to use computers and start focusing on how to apply computers.

In 1989, a comprehensive review of the literature on computer literacy revealed five strategies used by researchers to define computer literacy: specificity, global, planned, evolutionary, and individual needs (Kay, 1989). It was concluded that educators should stop trying to define computer literacy and begin to focus on using computers to attain educational goals. While the final message of the present article is the same, a more cohesive and illuminating model is presented to explain the evolution of the term "computer literacy." It is argued that the computer medium has largely determined how computer literacy has been and will be defined. Ultimately, educators will have to focus not on how to use computers but on how to apply computers to educational goals.

In 1964, McLuhan presented the now famous axiom "the Medium is the Message" in order to identify and acknowledge the tremendous impact that a specific medium or method of communication has on the nature of the message being communicated. Messages through the medium of the radio, for example, have induced an intimate or private experience in the listener and helped turn "the psyche and society into a single echo chamber" (McLuhan, 1964, p. 261). Another medium, television, has changed the nature of communication considerably, creating a sort of global village in our living rooms. A similar analogy can be drawn for computers and computer literacy. The growth and sophistication of computer hardware and software (the medium) has largely determined how computer literacy has been defined (the message).

Heraclitus, famous for the doctrine that everything is in a state of flux, claimed "You cannot step twice into the same river; for fresh waters are ever flowing upon you" (Russell, 1980, p. 63). The computer medium, in the form of hard-
ware and software, is about as stable as Heraclitus' river. The phenomenal speed at which computer technology has evolved in the last 10 years has accounted for a considerable amount of the variation in computer literacy definitions. At least five relatively distinct stages of hardware and software development have closely paralleled the development of six, equally distinct, philosophical approaches to defining computer literacy.

The first stage involved the use of mainframe computers in higher education in the early to mid 1970s. Since use of the computer was reserved for the university elite, the definition of computer literacy consisted of mostly theoretical concepts, commonly referred to as computer awareness.

The introduction of the microcomputer in 1978 marked the second stage of technological development, yielding a new criterion for being computer literate, namely, being able to write computer programs.

Rapid growth in computer hardware in the following few years precipitated the third approach to examining computer literacy. It was at this point that theorists realized that computer literacy was an evolving concept and that planning was required.

The introduction of sophisticated application packages in the form of word processors, databases, and electronic spreadsheets, launched the fourth, fifth, and sixth stages of computer literacy.

In the fourth stage, emphasis was placed on using the computer as a tool. Theorists sought to develop menu-like definitions incorporating all facets of computing to that point.

The fifth stage was a natural extension of the tool philosophy of examining computer literacy. Further sophistication in programming brought about the concept of "friendly software," requiring computer users to possess only the basic skills of reading and typing. Consequently, educators focused on fundamental assumptions regarding computer literacy. The principal question asked was "Why do we need computers?"—and many authors offered practical solutions.

The sixth and last stage involved a magnification of the fifth stage. Overwhelming technological developments forced researchers to focus on personal needs with respect to computer literacy.

It is important to note that the development of computer literacy definitions in the first three stages is markedly different from the development that occurred in the latter three stages. A natural, chronological flow is evident in stages one through three. This is probably reflective of the relatively distinct developments in hardware and programming. The explosive nature of hardware and software development in the early to mid 1980s makes chronological differentiation of stages four to six more difficult. Nonetheless, the overall pattern of the computer medium determining the nature of the computer literacy message remains steadfast. A detailed examination of the six-tiered model, incorporating a review of the literature regarding computer literacy, will help illustrate this intricate medium-message relationship, originally proposed by Marshall McLuhan.
STAGE 1. MAINFRAME COMPUTER AWARENESS

In its infancy, the definition of computer literacy revolved around mainframe computer technology. These large computers were used by graduate and undergraduate students for research purposes. The widespread use of computers throughout the education system was clearly speculative at this juncture; consequently, architects of computer literacy definitions were reduced to using theoretical building blocks.

In 1978, Andrew Molnar pronounced the next great crisis in education: computer literacy. Molnar explained why there would be a great need for computers, pointing to the shift from an industrial society to an information society. He necessarily dodged ascribing any concrete or practical definitions to computer literacy, primarily because very little of consequence was being done with computers in education. Mainframe technology was not available to the average elementary or secondary school student. It is worth noting that in 1981, Molnar included programming as a component of computer literacy. At that time, programming was one way in which secondary students could communicate with computers.

Johnson, Anderson, Hansen, and Klassen (1980) and Anderson and Klassen (1981) extended Molnar’s theoretical concept of computer literacy into one of computer awareness. Even though the average student was severely limited in what he/she could do with computers, an awareness of hardware, software, possible applications, the impact of computers, attitudes, and values was well within a teachable definition of computer literacy. This pencil-and-paper approach was one of the first comprehensive attempts to define computer literacy. The ability to program, although somewhat played down, was considered important in the overall definition.

The awareness perspective on computer literacy met with severe criticism (Luehrmann, 1981) because it did not emphasize doing something with the computer. In fairness, the definition of Johnson et al. (1980) was restricted by the limits of computer technology. In 1981, Anderson, Klassen, and Johnson admitted that their earlier definitions were not activity-focused, and that their current approach emphasized the importance of programming. Ultimately though, they were dogmatic about computer awareness being fundamental to the proper use of computers.

STAGE 2. MICROCOMPUTER PROGRAMMING

The introduction of the microcomputer in 1978 had profound effects on future definitions of computer literacy. This technology was now available, albeit not readily, to the entire education system. Although little in the way of applications software was developed at this point, programming in the form of Logo and BASIC added a new dimension to the concept of computer literacy.

Arthur Luehrmann (1981, 1982) might be considered the original father of the programming approach to understanding computer literacy. He maintained that “mere awareness [of computers was] not worth the time it took away from
teaching” (p. 686). He believed that in order to be computer literate, one had to be able to control the computer, and to really control the computer, one had to be able to program. His rationalization for this approach is summed up by the Chinese proverb “I hear, and I forget. I see, and I remember. I do, and I understand.” Although there might be a need for different levels of computing (bonehead computing, orthodonture computing, and human computer science), the major thrust of computer literacy was doing something, and that something was computer programming.

Galanter (1984) added fuel to Luehrmann’s argument by claiming that unique skills were fostered by programming, namely those involved in operational logic, or the ability to plan and execute actions.

Instead of choosing either computer awareness or programming, a number of authors decided to develop comprehensive definitions of computer literacy, encompassing both awareness and programming skills (Anderson et al., 1981; Foell, 1983; Hunter, Dearborn, & Snyder, 1983; Tannenbaum & Rahn, 1984). They included factors such as awareness of how computers functioned, their uses in society, the abuse and misuse of computers, the social impact of computers, the history of computing, and a sound knowledge of programming skills. These seminal efforts at providing an exhaustive definition of computer literacy sowed the seeds for stage-four theorists, who took the same comprehensive approach but included a longer list of necessary criteria.

STAGE 3. RAPID TECHNOLOGICAL ADVANCE—EVOLVING CONCEPT AND PLANNING

The pace of computer-related technological advances in both hardware and software in the early to mid 1980s was simply staggering. Hardware costs were regularly being halved and halved again. The quantity of software was increasing at an explosive rate. This technologically overwhelming state of affairs precipitated two perspectives on computer literacy. First, theorists saw computer literacy as an evolving concept. Second, they perceived a strong need for planning.

Evolving Concept

Ragsdale (1982) was perhaps the first researcher to clearly articulate the evolutionary nature of computer literacy. He identified four eras of computer literacy. The first era occurred in the early 1960s, where the primary site of computer education took place at the graduate school level with mainframe computers. Throughout the 1960s, a second era emerged where general access to mainframe computers was available to undergraduates. With the introduction of microcomputers, students were able to acquire computer literacy skills at the secondary and elementary school levels, marking the beginning of the third era. Today all three eras are developing simultaneously. In the fourth era, Ragsdale predicts “that computers will be at least as common as cassette recorders in the elementary classroom” (p. 13).
Berg and Bramble (1983) also took an evolutionary approach to examining computer literacy. The early 1960s marked the beginning of the experimental phase with the harnessing of mainframe computers for research. The popularization phase commenced in 1977 with the introduction of the microcomputer. The transition phase was to start in the mid-1980s and involved the use of computers to fundamentally improve education.

**Planning**

While some authors chose to explain how computer literacy had evolved through the last few decades, others forged ahead with organizational and planning schemes. Dickerson and Pritchard (1981) were tired of the hit-and-miss viewpoint taken on computer literacy. Due to the startling amount of computer activity, they advocated more training programs, systematic support, and careful planning.

Klassen (1982) echoed Dickerson and Pritchard's sentiments, deeming planning to be essential. He listed four goals: (a) define the computer-literate student, (b) provide resources to achieve this literacy, (c) help institutions to handle information effectively, and (d) provide computer literacy training for educators. Klassen anticipated resistance to attaining these goals in the form of reluctant and fearful faculty.

Other theorists supported the planning cause, but in slightly different ways. Pickert and Hunter (1983) claimed that there was a need to look at educational objectives. Simon (1983) saw fundamental research on human thinking as requisite for an effective definition of computer literacy. Randhawa and Hunt (1984) also looked to systematic research and evaluation. Finally, Haigh (1985) took a more global outlook, focusing on societal needs and sociopolitical implications with respect to computers.

The underlying factor in the third stage of computer literacy definitions was technological overload. Theorists responded by either looking back or planning ahead.

**STAGE 4. APPLICATION SOFTWARE—BEHAVIOURAL APPROACH**

The doing-something phase of computer literacy was rejuvenated by the plethora of software that flooded the educational market. After the initial feeling of being overwhelmed, educators saw a number of useful software packages that appeared germane to any comprehensive definition of computer literacy. Educators were ready to organize the technological mayhem into a menu of essential computer literacy skills.

In 1985, the Illinois-Wisconsin ISACS computer coordinators report on computer literacy proposed that computer literacy was synonymous with using the computer (ISACS, 1985). Keyboarding, word processing, graphics, database management, problem solving, algorithmic thinking, spreadsheets, utilities, and programming were listed as important skills required to become computer lit-
erate. In essence, they believed that an individual should feel comfortable using the computer in a variety of settings.

Gabriel (1985a, 1985b) collected and organized a hierarchical set of 30 computer aptitude objectives into two tests designed to measure computer literacy (general problem-solving skills, interacting with computers, functions and uses of computers, computers' impact on society) and computer science aptitude (writing software, hardware operations, applications software).

Some researchers continue to develop computer literacy measures that are based on the all-inclusive approach to defining computer literacy. Simonson, Maurer, Montag-Torardi, and Whitaker (1987), for example, constructed a computer literacy measure to examine programming skills, awareness, and computer applications.

This stage of computer literacy is characterized by the availability of numerous software application packages that could be neatly organized into a comprehensive menu of essential computer literacy skills. Theorists could readily point to a number of specific tasks that needed to be mastered in order to become computer literate.

STAGE 5. REACTION AND PROCESS

During the fifth stage of computer literacy development, it was no longer necessary to be competent in a number of computer applications. Sophisticated software programs allowed unsophisticated users with only basic reading and comprehension skills to do highly advanced tasks with the computer. The concept of user-friendly software was taking a firm hold on the computer world. The definition of computer literacy shifted accordingly. The ease of using computers allowed educators to take a long-awaited breath and begin to examine computer literacy from a more critical perspective. The application software recipes cooked up by stage-four theorists were being tasted and digested. Basic assumptions were evaluated and a more tool-oriented definition of computer literacy was popularized.

Hassett (1984) maintained that computer purchases often have less to do with enthusiasm and more to do with a sense of coercion or compulsion. The foundation of computer literacy was being rocked with claims that money spent on computers could be better spent on curriculum improvements.

Zemke (1984) also took a critical look at computer literacy. He did not feel it was reasonable for an individual to drop everything and become computer literate. He accepted that some people did not need or could not justify the use of computers with respect to cost. In essence, he felt that individuals should ask why they want to use computers before they chase the elusive computer literacy carrot.

An even firmer anti-computer stance was taken by Ekins (1985). He stated that "the proliferation of technology, and the growing sentiment that computer literacy should be considered as one of the new basics, threatens to further undermine the objectives of a classical liberal education" (p. 32).
Pipho (1985) also believed that more time should be spent on educational skills as opposed to working with computers: "It is a mistake to devote too much time to teaching the operation of machinery. ... Instead educators should devote themselves to teaching students how to write, how to think, and how to understand their cultural heritage" (p. 103).

Calfee (1985) criticized the piecemeal approach to defining computer literacy. He maintained that user-friendly software should take care of the practical concerns of operating a computer. The critical aspect of computer literacy was process, not content.

Meierhenry (1982) felt that many factors of computer literacy had been overlooked, including level of education, reasons for taking a course, location of programs, and preferred instructional methods. He also felt that the internal merits of using computers should outweigh the externally imposed reasons for using computers. Many educators have not been able to see the fit between what they are doing and what the computer can do for them.

Longstreet and Sorant (1985) believed that, for too long, educators have placed their faith in a handful of programming experts to lead them toward a definition of computer literacy. They stated that more time must be spent on assessing the most appropriate use of computers. Also, subjective as well as objective uses of computers have to be evaluated.

While the vernacular success of the term “computer literacy” has been assured, Van Dyke (1987) claimed that its meaning is unclear. She argues that computer literacy skills need not be mandatory or universal. In the long run, it is unlikely that computer literacy skills will be as fundamental as verbal ability. She notes that the definition of computer literacy is not static and is a reflection of social policy. In the final analysis, computer literacy should be thought of as a process to explore and discover.

The driving force of the fifth stage was the growing development of user-friendly software. This allowed theorists to focus on process, not content. Computer literacy was becoming a question of why computers should be used, as opposed to how computers should be used.

**STAGE 6. PERSONAL NEEDS**

The final stage of computer literacy had educators moving from a global to a more personal definition of computer literacy. The proliferation of computer technology created a situation where no one individual could possibly acquire all the skills necessary to run a computer in every conceivable way. In fact, the abundance of hardware and software choice precipitated a personal-needs perspective on defining computer literacy.

In 1986, Rhodes interviewed the aficionado of the personal-needs approach to computer literacy, Sherry Turkle. Turkle saw the computer as a Rorschach, a medium that allowed people to understand themselves and their own personal learning styles: “When people appropriate the computer in ways that allow the machine to be integrated into their sense of identity, ... that’s the biggest pay-
off” (p. 15). This sense of identity is not achieved by planning but rather by negotiation and experimentation.

A number of authors concur with Turkle’s approach to computer literacy. Levin (1983) believed that although there may be certain core concepts required, computer literacy could be appropriately seasoned to suit an individual’s taste. Baxter (1984) added that the degree to which a person was computer literate was largely dependent on the amount of time he/she was prepared to devote to computer-related activities. Ganske and Hamamoto (1984) further elaborated on the needs philosophy of computer literacy by stipulating that the following set of skills are essential computer literacy criteria: (a) adequate assessment of personal needs, (b) defining content of a self-study program, and (c) efficiently pursuing this line of study based on needs and content. A clear distinction between learning about computers and learning with computers was noted by Heermann (1986). He felt that computers should assist the learner and allow greater ownership over the learning process.

The final perspective on computer literacy looks at personal goals in conglomeration with educational goals. Scheffler (1986) felt that computer literacy was important but that there was a great need to focus on educational goals and the higher ideals of learning: “To speak of an object as an instrument is to convey some implicit reference to a purpose. In abstraction from purpose, no object is an instrument” (p. 516). In other words it is necessary to look beyond computers to determine the purpose and direction of future educational activities. Too often, goals have been refined to accommodate the computer. Scheffler offered the following advice: (a) take a critical attitude, (b) take an educational perspective, and (c) consider the consequences of using computers.

No distinct technological advance effected the personal-needs philosophy of computer literacy. Yet there is a distinct difference between looking at process (stage five) and defining the parameters of that process. The theorists in stage six have viewed computer literacy as a process that is dependent on an individuals' personal needs. They have also begun to realize that personal needs are directly influenced by educational goals. A definite shift has occurred from focusing on computer literacy to focusing on what computers can do to achieve certain educational desires.

SUMMARY

The literature addressing the definition of computer literacy is indeed a potpourri. Marshall McLuhan offered us a useful vehicle to organize the apparent mayhem and confusion surrounding this ever-elusive term. Simply stated, the evolution of the computer medium has had a direct influence on the meaning of computer literacy.

A somewhat cumbersome and relatively inaccessible mainframe computer forced educators to look at the impact of computers on society. The invention of the microcomputer completely changed the definition of computer literacy. Initially it was synonymous with being able to program, for programming was the only way to do anything concrete with the computer. Programming lead to
highly sophisticated software that enabled users to do a variety of tasks. Investigators of computer literacy responded with definitions incorporating evolutionary principles and planning. Others valiantly tried to incorporate a plethora of application software skills into the list of criteria required to become computer literate.

The computer revolution was still not over, and soon computer literacy theorists were completely overwhelmed with the exponential explosion of computer technology. Prices plummeted. Quantity and variety of software soared. The ease with which application software could be run allowed educators to react and examine basic assumptions surrounding computer literacy. Eventually, investigators were forced to accept a personal-needs approach to computer literacy. Clearly there were too many computer activities to be understood and conquered by any one individual. It was up to the individual to pick his/her special use of the computer. As long a person could use a computer to satisfy a particular need, he/she was computer literate.

In the final analysis, computer technology has quickly eroded the need for defining computer literacy. Basic reading and comprehension skills are all that is required to do highly complicated and sophisticated tasks with a computer. The quest for an all-encompassing definition of computer literacy has not come up empty-handed. Computers have forced educators to reevaluate educational goals. It is no longer necessary for educators to teach students how to use the computer—they must help students learn how to apply the computer.

Contributors

Robin H. Kay obtained his B.Sc. and M.A. at the University of Toronto, specializing in psychology and computer applications in education. He is currently working on his Ph.D. in educational psychology at the Ontario Institute for Studies in Education, where he is investigating individual differences in learning how to use computers. He is also looking at issues involving gender and computers as well as developing scales to assess computer attitudes and risk-taking. (Address: Robin Kay, 118 Gloucester Ave., Oakville, Ontario, L6J 3W4, Canada.)

References


