2002

Welcoming the culture of computing into the K-12 classroom: Technological fluency and lessons learned from second language acquisition and cross-cultural studies

Abbie Brown

Anne E. Campbell
Fairfield University, acampbell@fairfield.edu

Published Citation

Brown, Abbie. and Campbell, Anne E. (2002). Welcoming the culture of computing into the K-12 classroom: Technological fluency and lessons learned from second language acquisition and cross-cultural studies. Multicultural education, 10, 2: 10-14.

WELCOMING THE CULTURE OF COMPUTING INTO THE K-12 CLASSROOM

TECHNOLOGICAL FLUENCY AND LESSONS LEARNED FROM SECOND LANGUAGE ACQUISITION AND CROSS CULTURAL STUDIES

Abbie H. Brown & Anne Campbell

INTRODUCTION

The idea for this paper came from discussions that the authors had regarding the integration of innovative technologies into the current K-12 curriculum, as well as its impact on instructional programs for linguistically and culturally diverse students. While both of us are teacher educators, one specializes in Instructional Design/Technology, while the other specializes in Cross Cultural Studies and Bilingual/Bicultural Education. As our discussions evolved, we identified and examined multiple aspects of technology and several themes emerged.

One key theme was the common perception of a "culture of technology" and ways in which various perceptions of that culture influence the development of one's skill with computers and computing tools in particular. Another theme that permeated our discussions was that of "fluency," and the concept of developing technological fluency, currently a topic of much discussion among Information Technology specialists (Committee on Information Technology Literacy, 1999; Resnick, 2000).

As we worked to clarify our use of the phrase "technological fluency," we realized that the literature of language acquisition, multicultural studies, and information technology which framed our own perspectives have studied and defined fluency in different ways. We found that the combination of our differing perspectives enhanced our overall understanding of critical issues affecting technology integration in K-12 classrooms.

We begin with a description of the culture of computing and the debate that has shaped perceptions of that culture. We then present the recently developed technology standards for K-12 educators and the concept of technology fluency currently under consideration in the information technology literature. By extending the fluency metaphor with concepts from language acquisition theory, we examine its usefulness as a means of entry into the culture of computing and its implications for integrating innovative technologies into the K-12 classroom.

THE CULTURE OF COMPUTING

By the year 2000, virtually 100 percent of U.S. schools were in some way connected to the Internet. Developing ability and comfort with computers and computing tools, however, requires more than simply their presence (Brown, 2001; Cuban, Kirkpatrick and Peck, 2001; Kay, 1996). Ability and comfort with computing tools is based on a set of skills gained through specific training and experience (Schriver, 1997). Imparting these skills to students allows them access to computer-based information (i.e. what is available on the World Wide Web) as well as computer-based communities (e.g. online gaming simulations known as Multi-User Dungeons or "MUDS")While offering access may not always be a means of acculturating an individual, it is certainly a first step in the act of cultural reproduction as articulated by Miraglia, Law, and Collins (1999)—that is, inviting, inducing and compelling a younger generation to adopt a certain way of thinking and behaving.

This line of reasoning suggests that there is a "culture of computing." The idea

Abbie H. Brown is an associate professor in the Department of Elementary, Bilingual and Reading Education at California State University, Fullerton; Anne Campbell is an assistant professor in the Department of Teaching and Learning at Washington State University, Pullman.

of computing as a culture is open to discussion, but framing it as such may help articulate educators' needs and concerns meaningfully in order to, as Kay (1996) puts it, "reveal the elephant" (citing the ancient story of the blind men and the elephant), that is comprised of the challenges of incorporating computers and technology skills into the curriculum.

There exist among educators a variety of preconceptions about the culture of computing ranging from overconfidence in modern technology's ability to facilitate just about any activity for any individual, to fear of modern technology as a set of tools that only a select few can effectively use. The bases of these preconceptions can be found within popular culture and the conflicting presentations of the computer as a tool that makes media production or its use either accessible to the masses or the province of a select few (Brown, 2001).

One factor that influenced these perceptions is the fact that the personal computer became particularly popular in the late 1980s and 1990s as high processing speeds, increased memory, and improved printing, video, and audio output devices for personal computers became less expensive and ubiquitous (Brown, 2001; Negroponte, 1996). Within the last decade, media production processes traditionally viewed as the province of highly skilled technicians have come to be perceived by the general population as a function of software that will run on a desktop computer. Relatively inexpensive computer systems can now handle what were once highly specialized media production tasks. It is now possible to work with video, audio, text and still images in a digital format using a household computer system costing under $2000. However, the perception of how easy it is to actually use that system to produce video, audio, or elaborate print-based media varies widely (Brown, 2001).

Currently there seems to be an attitudinal tug-of-war, with two factions vying for sway over the general public's perception of computers and computing tools. Popular culture offers the dichotomous views that working with computers is either incredibly easy and may include anyone and everyone, or impossibly difficult and the exclusive province of an elite group of technophiles (Brown, 2001).

ONE PERSPECTIVE: THE CULTURE OF COMPUTING IS INCLUSIVE

Portions of the computer industry market their products for home and business use. Based on their marketing schemes, it is easily possible to develop an attitude that regards computers as a 'cure' for the difficulties of media production and communication. Television advertisements for computer products often suggest that computer hardware and/or software makes a wide variety of activities such as video-conferencing or creating professional-looking brochures simple and 'fool-proof.' With a computer and the right software, anyone can do just about anything. As Nicholas Negroponte puts it in *Being Digital* (1996, p. 82):

> Personal computers have moved computer science away from the purely technical imperative and are now evolving more like photography. Computing is no longer the exclusive realm of military, government and big business.

ANOTHER PERSPECTIVE THE CULTURE OF COMPUTING IS EXCLUSIVE

Another attitude, one that is in many ways the direct opposite of the former, is based on the pop-culture myth that regards computing as impossible to comprehend without ascription to a particular group or social class (i.e. young men often referred to as "nerds" or "geeks") (Brown, 2001). As Clifford Stoll puts it in *Silicon Snake Oil*, (1995, p. 60):

> It's the exclusionary nature of technocratic culture. For all the talk of friendly, open systems, there's no warm welcome for novices. It's up to the user to figure out new terminology, heavy with jargon and acronyms; up to the user to install and maintain the software.

The inclusive or exclusive nature of the culture of computing may not be a critical issue in terms of bringing it into the K-12 classroom. However, for the purposes of this paper articulating the range of perceptions about computers and computing is intended to show that there *is* a range and that this range defines the boundaries of what may be considered cultural issues.

EDUCATIONAL TECHNOLOGY STANDARDS

To facilitate the process of integrating technology into the K-12 curriculum appropriately, the International Society for Technology in Education (ISTE), in collaboration with the U.S. Department of Education, has published a set of *National Educational Technology Standards* (NETS) for students (NETS•S) and teachers (NETS•T). These standards provide a framework for planning, implementing and evaluating activities that introduce and/or reinforce the ethical and humane use of computing tools for communication, productivity, research, and problem-solving and decision-making.

The ISTE NETS have become a standard reference in the United States. They are supported by the U.S. Department of Education and have been adopted by the National Council for the Accreditation of Teacher Education (NCATE). The ISTE NETS are designed to provide a framework for the design and implementation of classroom activities. The NETS may also provide indicators for teachers attempting to discover how much they or their students are a part of the culture of computing.

INFORMATION TECHNOLOGY AND FLUENCY

Another articulation of membership within the culture of computing is the report from the Committee on Information Technology Literacy Computer Science and the Telecommunications Board (CTSB) of the National Research Council to the National Science Foundation on the subject of everyday use of information technology, *Being Fluent with Information Technology* (Committee on Information Technology Literacy, 1999). The report coins the term, "FITness" (Fluency with Information Technology), using the term "fluency" to connote "the ability to reformulate knowledge, to express oneself creatively and appropriately, and to produce and generate information," (Committee on Information Technology Literacy, 1999. Preface).

Fluency with information technology is described in the report as the convergence of information literacy, critical thinking skills, and computer literacy (McEuen, 2001). The proposition of the report is that an individual is FIT if he or she: understands the foundational concepts of computers, networks and information; has the necessary contemporary skills to use modern computer applications; and has the intellectual capabilities to manipulate computing tools in complex, sustained situations (McEuen, 2001).

The use of the word "fluency" in this manner is an excellent reminder that one may be part of the culture of computing to a greater or lesser degree based on one's ability to interpret and express the ideas of

that culture in appropriate language. The fluency metaphor, as used by information technology specialists, is helpful up to a point. One limitation is that while it articulates well what one does (the qualities one has) when one is fluent, it does not clarify the steps or processes one goes through to *become* fluent. There is a need to look beyond information technology literature to offer a greater depth of understanding, and it is here that the second language acquisition literature can offer insight.

REGISTERS

One concept from linguistics that is critical in understanding fluency is that of "speech registers." Elaborated extensively in the classic text *The Five Clock*s, Martin Joos (1967) posited that human communication can be classified according to five levels of language formality which he termed registers. In his discussion of Joos' work, Brown (1987) states that registers are defined by

> ...the context of a communicative act in terms of subject matter, audience, occasion, shared experience, and purpose of communication. A register is not a social or regional dialect, but a variety of language used for a specific purpose. Register refers to styles, which vary considerably within a single language user's idiolect.... Native speakers, as they mature into adulthood, learn to adopt appropriate styles for widely different contexts. (p. 208)

Joos (1967) articulated five levels of formality by which language use could be classified into registers: (1) intimate; (2) casual; (3) consultative; (4) deliberative or formal (which would include discipline-specific academic and professional writing); and (5) oratorical. The first three are generally learned at home and in one's neighborhood and community, while the last two traditionally have been learned at school and through other types of selected and formal study. The development of deliberative and oratorical registers may also be supported by family members, friends, and community members who are fluent in and provide informal instruction in those registers. Within each register, there is a continuum of formality. While it is beyond the scope of this paper to examine Joos' registers in depth, they do provide a useful framework for thinking about the current fluency metaphor framing discussions in the information technology community.

POSTULATING REGISTERS OF INFORMATION TECHNOLOGY FLUENCY

If we extend the concept of registers to include the variety of computer technologies and the styles or ways in which they are used to achieve specific purposes, then fluency in computer and information technology can be defined as the ability to use computers and their related technologies to achieve a variety of specific purposes in widely different contexts. With this definition in mind, we now propose five registers of information technology fluency using Joos' categories of classification as a reference. It is important to keep in mind that

. . . then fluency in computer and information technology can be defined as the ability to use computers and their related technologies to achieve a variety of specific purposes in widely different contexts.

we are applying these registers to information technology skill and *not* language ability or the ability to *talk about* computing, nor are we referring to the use of computers as surrogate electronic dittos or substitute textbooks.

The intimate register. At this level, a person might use a pre-configured personal computer, following the prompts and cues issued by the computing software. An example might be playing a computer game that is already installed or using a tutorial to learn more about a concept or tool (e.g., selecting, activating and watching a computer-based tutorial on how to use the software, Microsoft *Excel*).

The casual register. "Casual computing" implies an ability to alter computing situations that go a bit beyond the limitations of a pre-configured environment. Examples include the ability to re-configure software by changing the various modes of a computer game, setting the degree of difficulty on educational software, or making changes to the computer's operating system to alter the look of the desktop. At this level, a person probably feels comfortable with standard information manipulation tools (e.g., word-processing, spreadsheet, and Web page editing software).

The consultative register. At this level, the user is capable of using the computer to send and receive e-mail, to find and review information on the World Wide Web (using browser software) and is capable of doing so on a variety of computers (e.g. using a school computer to receive, review and send e-mail messages by accessing one's personal e-mail account). A person working within the consultative register may be comfortable posting Web pages, transferring files (using File Transfer Protocol or "FTP" to transfer data from one place to another, or attaching documents to e-mail messages) and compressing and decompressing files, using standardized software or well-described protocols to do so.

The deliberative register. A person operating at this level understands the basic concepts and processes that govern information technology practice. He or she may not be able to write software code or build a computer, but there is a sophisticated understanding of how this software and hardware are produced. We would argue that a critical distinction between the consultative and deliberative register as applied to information technology is that a person operating in the deliberative register often does not place the blame entirely on himself or herself if something goes awry while using information technology, but may seek to discover the inherent design flaws in the tools themselves.

The oratorical register. As in Joos' articulation, this the most highly stylized, governing activities such as delivering speeches or public writing and is the most rule-governed. At this level, a person would be capable of designing and developing sophisticated multimedia, programming software, specifying hardware components, and establishing or adding to computing networks.

THE ROLE OF AUTOMATICITY IN DEVELOPING FLUENCY

An important concept in second language acquisition is that of automatic processing of language (McLaughlin,1979). Automaticity refers to the point at which a person has internalized (stored in long term memory) a variety of language forms and styles so that he or she no longer has to think about the rules of pronunciation, grammar, and syntax that govern language production in a specific situation. He or she uses words without thinking about the exact meaning of each one or

having to look up the term in the dictionary. In written language, this also includes spelling and punctuation. In other words, the person's use of appropriate language and style is automatic. Once someone has reached this level he/she is considered to have developed fluency and may have reached native-like ability in his/her use of the language.

Providing Guidance and Direction. Regardless of whether the context is language acquisition or information technology skill, automaticity does not just happen. There is a body of literature and a tradition of acceptable practices for facilitating fluency in language acquisition. Information technology is currently in the early stages of developing similar literature and practice.

In language acquisition, adult members of the community constantly provide models and scaffolding, as well as extended and directed opportunities for practice that enable immature family and community members to develop automaticity with respect to the reception, understanding and production of language styles appropriate for their community. Thus, through practice and feedback, one learns to perceive and attend to the critical elements necessary for communication in a given context. When one is communicating through written or symbolic language, one also has to know the most appropriate tool to use to achieve the desired result. While one does not necessarily need to know how to construct the tool, one must know how to use it.

In foreign language teaching, automaticity is developed by taking students through a series of carefully planned lessons and activities that are designed to develop a student's independent and correct use of the language. A teacher may begin with what Paulston (1972) and Celcia-Murcia (1991) termed "mechanical" activities in which a language learner hears and is given opportunities for guided practice in the use of vocabulary and/or grammar forms that they are learning. The opportunities for production initially are structured and immediate feedback is provided with respect to the appropriate and accurate use of language.

Once the learner reaches a point where the mechanical activities and practice are too easy, the next level is meaningful practice. In such activities, the student has a limited choice of language options; however, the student learns to meaningfully use the language he or she knows for the purposes of authentic communication. The learner may be dependent on an adult speaker of the language for evaluation and feedback with respect to the appropriateness of the choices that she or he made and the success he or she had completing the language task.

The highest level of fluency is the independent level of language use. In such activities, the responses are open. The language learner can function in any language context and is free to say anything she/he wants, as long as it makes sense and is appropriate for the context. In foreign language learning, communication of meaning is paramount.

Information technology specialists do not yet have as complete an articulation of how to develop automaticity (and through it, fluency) as language acquisition specialists have. Certainly the idea of taking learners through a series of carefully planned "mechanical" activities, leading to an independent level of information technology use has its appeal. For example it is generally accepted among information technology specialists that keyboarding practice is essential and that this type of activity offers the learner initial access to the culture of computing (Landauer, 1996).

Perhaps the largest problem information technology faces in developing automaticity and fluency among learners is one similar to the historical example of immigrant parents and first-generation children — when the child is more fluent than the adult in the language of the new community.

However, there is still much debate as to what advanced activities might be appropriate, whether these activities are ones teachers are capable of leading, and whether young people by virtue of their exposure to innovative technologies are already more capable than their elders in this area. Perhaps the largest problem information technology faces in developing automaticity and fluency among learners is one similar to the historical example of immigrant parents and first-generation children—when the child is more fluent than the adult in the language of the new community.

Posttransfiguration. In second language learning there is a concept of posttransfiguration (Ovando & Collier, 1986). This occurs when the immigrant parents give over their authority as adults to their children because their children are more fluent in the use of the language spoken in the new community. In this situation there are two responses from the children. One is to become overly protective of the parents and to make sure that they are taken care of and safe. In this situation the children still respect the parents.

With the other response, the parents in effect become obsolete (Cho, 2001; Norton, 2000). The parents no longer have any authority because the language they speak and their understanding of social life may have little or no value in the new community. The children may manipulate the parents or they may become the parents or caretakers because of their fluency with the language. Neither situation is optimal, because the children do not have life experiences that an adult member of the new community has. They are still learning. What the children are missing is sophistication with respect to the multiple cultural contexts and registers of language use that a native-born, adult member of the community has.

This same concept, as it applies to a younger generation having greater facility with computing tools, is echoed in information technology literature (Roszak, 1994), and the younger generation is missing similar cultural components: sophistication with respect to multiple contexts and registers, as well as life experiences. Without these components, young people are forced to create a new culture, or do without one entirely.

The question is, are there people who are members of the computing culture, who deal with information technology fluently (at the oratorical register, as it were), who can be called upon to help develop activities that promote automaticity and to provide feedback and evaluation with respect to the appropriateness of choices made? We would assert that teachers are capable of accomplishing this, just as they are capable of teaching a second language. However, teachers will need access to established members of the computing culture as well as hardware and software to become individuals who are able to offer the feedback and evaluation learners need.

DISCUSSION AND RECOMMENDATIONS

The purpose of this paper is to address the question of how best to facilitate students' acquisition of technology fluency

and propose areas for further research; to provide an avenue for discussion that will lead to the welcoming of innovative technologies into the K-12 curriculum and the development of equitable programs for all students, especially those from high needs schools or groups whose initial access to these technologies may not be at home, but in school.

By articulating the culture of computing through descriptions of two very different perspectives (completely inclusive to completely exclusive), we hope to help educators find a way past the often intensely emotional responses connected with both feelings of inclusion and exclusion that bound the culture of computing in order to empower students with the skills they need to succeed in a society that places great store in the ability to effectively use computing tools and new technologies for communication.

Ideally, it will become possible to carry on the discussion of integrating innovative technologies into the classroom in a way that facilitates an appreciation for and valuing of the culture of computing in an appropriate manner—without fear and without unjustifiable enthusiasm. Making educators aware of the ISTE NETS as the currently accepted standards of Educational Technology in K-12 settings may help teachers understand what the general, national (United States) expectations are for bringing the culture of computing into the classroom.

Using fluency as a metaphor for technological facility and cultural inclusion, an educator might use our postulation of registers of technological fluency to determine where they fit within the larger culture of computing. Perhaps more importantly, the registers might be used as a measure of where both the students and the teacher falls within the continuum of information technology fluency in order to determine what the teacher would like to accomplish in terms of both professional development and the design of classroom activities.

Through extensive discussion of the issue, we have come to understand that technological fluency involves not only the acquisition of specialized terms and their related concepts (the language of technology), it also includes the development of specialized skills and the development of new ways to access and think about information. In other words, often it is not just how one speaks in the chat room, it is the method of finding and entering the chat room. Furthermore, technological fluency has become an important component of "cultural capital" which Bourdieu defined as the cultural practices developed by members of a social group to strategically use their cultural and economic resources (1977). Thus, access to technology, as well as opportunities to develop technological fluency are critical components in the development of cultural capital in current social and educational contexts.

Although we are able to identify a few of the more common practices associated with using automaticity-oriented strategies in developing the essential elements of technological fluency, we find ourselves asking what the appropriate analogy is in terms of automaticity in advanced language acquisition. What is meaningful? Independent? When does someone reach what is the equivalent of native-like fluency? In information technology, who are the equivalent of "natives?" Is a computer programmer the true native, or is it someone who is able to pick and use the best and most appropriate software at any given moment? Are there in reality several categories of "native" and does each of the categories have their own criteria for fluency?

We believe further study is called for in developing an understanding of how educators can make appropriate choices regarding the integration of innovative technologies and K-12 learning environments. Exploring concepts related to language fluency seems to have tremendous potential value in developing an understanding of issues surrounding the use of computing tools in the classroom, and we welcome any opportunities to continue our discussions with anyone interested into joining us.

AUTHORS' NOTE

The opportunities to hold discussions on the topic of information technology fluency were made possible by the U.S. Department of Education's Preparing Tomorrow's Teachers to Use Technology (PT3) Program, specifically Washington State University's' *teach.edu* project, funded by PT3.

REFERENCES

Bourdieu, P. (1977). Cultural reproduction and social reproduction. In J. Karabel & E. H. Halsey (Eds.), *Power and ideology in education*. Oxford, UK: Oxford University Press.

Brown, A. (2001). Poodles, Borg and Bungee Jumpers: The Development of a Taxonomy of Student Types Encountered in an Introductory Instructional Media Production Course. *Journal of Technology and Teacher Education,* Vol.9, No.3.

Brown, H. D. (1987). *Principles of Language Learning and Teaching* (2nd edition). Englewood Cliffs, NJ: Prentice-Hall.

Celce-Murcia, M. (Ed). (1991). *Teaching English as a second or foreign language*. New York: Newbury House.

Cho, D. (April 11, 2001). Separated by a wall of words. *Washington Post*, A1.

Committee on Information Technology Literacy. (1999). *Being Fluent with Information Technology*. Washington, DC: National Academy Press

Cuban, L., Kirkpatrick, H., & Peck, C. (Winter 2001). High Access and Low Use of Technologies in High School Classrooms: Explaining and Apparent Paradox. *American Educational Research Journal* Vol. 38, No. 4.

Microsoft Corporation. (1985-2000). Excel. [Computer Software].

International Society for Technology in Education. (2000). *National Educational Technology Standards for Students*. Eugene, OR: International Society for Technology in Education.

International Society for Technology in Education. (2000). *National Educational Technology Standards for Teachers*. Eugene, OR: International Society for Technology in Education.

Joos, M. (1967). *The Five Clocks*. New York: Harcourt, Brace, & World.

Kay, A. (1996). Revealing the Elephant: the use and misuse of computers in education. *Educom Review*, 31(4).

Landauer, T. (1996). *The Trouble With Computers*. Boston: MIT Press

McEuen, S.F. (2001). How Fluent with Information Technology (FIT) Are Our Students? *EDUCAUSE Quarterly* Vol. 24, No. 4.

McLaughlin, B. (1979). The monitor model: Some methodological considerations. *Language Learning*, 28.

Miraglia, E., Law, R., and Collins, P. (1999). What is Culture? Retrieved from the World Wide Web January 8, 2002: http://www.wsu.edu:8001/vcwsu/commons/topics/culture/culture-index.html

Mehan, H. (1991). *Sociological foundations supporting the study of cultural diversity*. Santa Cruz, CA: The National Center for Research on Cultural Diversity and Second Language Learning.

Negroponte, N. (1996). *Being Digital*. New York: Vintage Books.

Norton, B. (2000). Investment, acculturation, and language loss. In S. McKay & S Wong, (Eds). *New Immigrants in the United States* (2nd ed). New York: Cambridge University Press.

Ovando, C. & Collier, V. (1985). *Bilingual and ESL Classrooms: Teaching in Multicultural Contexts*. New York: McGraw-Hill Book Company.

Paulston, C. B. (1972). Teaching writing in the ESOL classroom: Techniques of controlled composition. *TESOL Quarterly, 6.*

Resnick, M. (March, 2001). Closing the Fluency Gap. *Communications of the ACM, Vol. 44, Issue 3.*

Roszak, T. (1994). *The Cult of Information*. Berkeley, CA: University of California Press.

Schriver, K. (1997). *Dynamics in Document Design: Creating Texts for Readers*. New York: John Wiley & Sons.

Stoll, C. (1995). *Silicon Snake Oil*. New York: Anchor Books.