Six Elements for Technology Integration in Multicultural Classrooms

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ABSTRACT Although the number of computers in American schools multiplies, educational inequity remains evident in the area of technology. The socio-economically disadvantaged, the physically disabled, and the culturally and linguistically different have limited knowledge of and experiences with technology. Equitable access to technology requires the infusion of effective multicultural teaching strategies into educational technology use. These strategies must be broad enough to be inclusive of diverse learners, yet specific enough to be valuable as a guide to multicultural teaching. Similarly, they should allow for individual creativity and personal differences in teaching and learning. In this paper, the author proposes and defines six elements for integrating technology in culturally diverse classrooms: cultural awareness, cultural relevance, culturally supportive environment, equitable access, instructional flexibility, and instructional integration. These six elements are based on research on effective teaching of diverse students. They are not exhaustive of good instructional practices for technology use with diverse learners. Nevertheless, the author found their application in the evaluation of 32 technology-integrated units both informative and effective in identifying how teachers integrated computers for diverse learners. The author recognizes the need for further validation of these criteria and for research on effective teacher use of technology in multicultural settings.

Introduction
According to the Educational Testing Service (Coley et al, 1997), 98% of all schools in the United States own computers and 85% have multimedia technology. At the same time, school access to the Internet increased
steadily from 35% in 1994 to 64% in 1997 (Coley et al, 1997). President Clinton’s ‘Technology Literacy Challenge’ and his goal of making all teachers comfortable with computers (National Council for Accreditation of Teacher Education, 1996) give additional momentum to this trend. It appears, then, that “the tools of teaching and learning are rapidly moving from the traditional chalk and blackboard to computer terminals” (Reid-Wallace, 1996, p. 7).

While the number of computers in American schools multiplies, cultural diversity increasingly characterizes our classrooms. Schools today must educate a population that differs widely in income, ethnicity, language, ability, and culture. Almost a third of all elementary and secondary students in the United States of America come from minority cultures (Gay, 1993). Of the 45 million school-age children in US public schools in 1990, some 9.9 million lived in households where a language other than English was spoken (Menchaca, 1996). By the year 2000, one in three children will be from an ethnic, cultural, or linguistic minority (Carbo, 1995). In addition, between 1976 and 1990, the number of children receiving special education services increased from 3.7 million to 4.8 million (National Clearinghouse on Professionals in Special Education, 1992). These diverse students bring with them learning styles, interpersonal styles, beliefs, and expectations that alter the learning and teaching context (Pond, 1996). This diversity defines the meaning of the multicultural classroom in this article.

Unfortunately, our schools have inadequately served the needs of minority populations. A disproportionate number of ethnic minority students drop out of school, are expelled or suspended, or achieve far below their potential (Bennett, 1995). Equally important, over 75% of language minority students acquiring English are placed with teachers who have no training in second language acquisition, English as a second language, or Bilingual Education (Fueyo, 1997). African-American and Hispanic children are likely to have teachers who tend to de-emphasize higher-order thinking (Foster, 1989) and who have low expectations for these students (Padron, 1993). Although socio-political factors contribute to the economic and societal barriers facing minority children, “Educators must understand that they play a major role in the lack of academic success of students of color” (Grant, 1991, p. 252). We must also recognize that many children receive an inequitable education.

Educational inequity is highly evident in the area of technology. Though the current ratio of students to computers is 10:1 (Coley et al, 1997), schools with high populations of poor and minority students continue to have more students per computer (Trotter, 1997). Despite the widespread purchase of computers through Title I funding, children in US schools with large minority populations still have less access to the Internet, to multimedia, to CD-ROMs, and to cable TV than children at other schools (Coley et al, 1997). For example, one Bilingual Education teacher shared...
with me that her children’s knowledge of the computers’ capabilities was limited by the absence of a working printer. Her children could not publish their writing on the printer, an important literacy activity in the primary curriculum.

Moreover, minority and economically poor children are not the only ones experiencing inequitable access to technology. Female students, students with disabilities, and those attending rural schools also encounter inequitable access. Contributing to this inequitable access are uneven distribution of computers, unequal use of technology by students within schools, as well as the absence of adaptive devices and special software (Neuman, 1991).

Exacerbating the inequitable access to technology is the fact that minorities are much less likely to have access to computers outside the school. Whereas 31% of White students in grades 1-6 reported using a computer at home, about 9% of African-American and 7% of Hispanic students did (US Department of Education, 1995). Research indicates that proficiency with information technology is strongly related to computer access beyond school (Martinez, 1994). Thus, the minority student’s limited access leads, not only to less computer experience, but also to decreased probability of entering a career that requires computer applications (Oakes, 1990).

Merely providing access to hardware will not eliminate this inequitable access. Inequity frequently “results from oversight rather than intent” and from the dissimilar use of technology (Neuman, 1991, p. 2). Neuman (1991), referring to Daniel Watt’s (1982) observations, notes “economically disadvantaged students, who often use the computer for remediation and basic skills, learn to do what the computer tells them, while more affluent students, who use it to learn programming and tool applications, learn to tell the computer what to do” (p. 1).

This learning “to do what the computer tells them” is not restricted to the socio-economically disadvantaged, but also to students with disabilities and language minority students whose teachers often use technology for electronic drill and practice activities. These children rarely learn to use technology for productivity and information gathering. Hence, their experiences and knowledge of technology are limited and often negative. Moreover, such instructional methods “tend to accentuate any inequality in skills and knowledge that may be present when children are initially admitted to school” (Villegas, 1991, p. 5). Ultimately, educational technology can only be as effective as how teachers implement it.

Diversity and Technology

To prepare children for the technological, informational, and interpersonal challenges of the next century, schools need to implement instructional
strategies that develop technological and interpersonal skills. These strategies must ensure equitable access to technology and must cultivate respectful intercultural communication. Further, they must be attuned to individual and cultural differences that influence learning and social interaction. Equitable access to technology, therefore, requires the infusion of effective multicultural teaching strategies into educational technology use.

Regrettably, teachers do not automatically transfer their cultural literacy and cultural competency to educational technology use. As educators integrate computers into multicultural teaching, they encounter distinct pedagogical and technological challenges. Transferring knowledge of how to integrate computers into the multicultural classroom is a prevailing pedagogical dilemma. While there is much information on computer hardware and software, textbooks “say a great deal less about how to teach effectively with computers” (Ryba & Anderson, 1993, p. 11). Moreover, transfer of knowledge is a higher-level thinking skill which requires synthesis and application of skills to new contexts. Thus, it is not an easy process.

The computers’ inherited cultural attributes further complicate the infusion of technology in multicultural classrooms. Computers, being cultural artifacts, inherit the values, preferences, and cognitive schema of their creators (Chisholm, 1995-96). At the same time, software programs reflect the heuristics and epistemological framework of their developers. Hence, they are not culturally neutral, but culturally bound. The cultural characteristics of the computer can differ significantly from those of the learner. For example, not all cultures value the step-by-step, analytical thinking underlying menu-driven programs. In fact, many cultural groups tend to prefer a holistic approach to thinking and learning. Even icons commonly used in multimedia programs can be culturally inappropriate. For instance, in some African cultures the use of heads and hands as icons are perceived as taboo images of dismembered body parts (Andrews, 1995).

Equitable and Culturally Responsive Strategies

Effective teachers of culturally diversified populations accommodate the cultural characteristics of their learners through culturally compatible teaching (Villegas, 1991). Current research shows the positive impact of culturally responsive teaching on academic growth (Gutierrez, 1992; Tharp & Gallimore, 1988; Tharp & Yamauchi, 1991; Phillips, 1983; Villegas, 1991). Moreover, given the differences in individual needs, cultural heritage, educational opportunities, and the exclusion from technology that some students experience, equitable teaching strategies become crucial.

What, then, constitute equitable and culturally responsive strategies for educational computer use? Equitable strategies are those that meet the
student’s individual learning needs (Chisholm, 1994). Hence, they are child-centered and build on the child’s strengths. Culturally responsive strategies stem from the premise that how people procure learning differs across cultures (Villegas, 1991). Culturally responsive teaching connects learning to the child’s real-life experiences and is compatible with the cultural background of learners and their community (Tharp, 1989). Given that equitable and culturally responsive strategies are child-centered and relevant to the learner, they benefit all students and create an empowering classroom atmosphere.

Equitable and culturally appropriate strategies for technology use must be broad enough to be inclusive of diverse learners, yet specific enough to be valuable as a guide to multicultural teaching. At the same time, such strategies should not be so prescriptive as to squelch individual creativity or personal differences in teaching and learning. In addition, these teaching strategies must be grounded in sound pedagogical practices that transcend grade, instructional program, and academic discipline. Appropriate content and classroom materials, culturally responsive instructional approaches, and a supportive educational setting are among the factors identified as important to effective teaching of diverse students (Banks, 1993; Ladson-Billings, 1994; Reyes-Blanes & Daunic, 1996). In short, equitable and culturally appropriate use of technology is good teaching.

**Six Multicultural Elements**

Based on the research on effective teaching of diverse students and the previously discussed parameters, I propose six elements for integrating technology in culturally diverse classrooms: cultural awareness, cultural relevance, culturally supportive environment, equitable access, instructional flexibility, and instructional integration. These elements are not exhaustive of good instructional practices for technology use with diverse learners. Instead, they focus on key multicultural concepts that are supported by the literature on effective multicultural teaching. They also highlight the complexity of teaching in that they emphasize the need to orchestrate a variety of elements in the multicultural classroom and, indeed, are in common with good educational practice.

Recently, the author applied these six elements in the evaluation of 32 teacher-generated instructional units that integrated technology. The application of these elements proved both informative and effective in identifying how teachers integrated computers for diverse learners. Extensive thematic units illustrating some of these elements are available at the Creighton Elementary School District web site: http://www.ariz.com/lomalinda.
Cultural Awareness

The first element, cultural awareness, refers to instruction and learning activities that demonstrate support for differences in learning preferences, intelligences, and language. Cultural awareness requires cultural literacy and cultural competence. Cultural literacy is a knowledge and respect “of the history, traditions, and values of persons from diverse backgrounds” (D’Andrea, 1995, p. 46). Cultural literacy serves as a basis for teaching that builds on the child’s existing knowledge by incorporating the child’s culture and language.

Whereas cultural literacy relies on a cognitive understanding of cultures, cultural competence implies social and affective understanding. Cultural competency is the ability to function comfortably in cross-cultural settings (Chisholm, 1994). Moreover, it indicates an understanding of one’s own cultural heritage and how it influences perceptions, beliefs, and behaviors. The creation of a respectful, accepting, and non-threatening classroom environment that is conducive to learning requires cultural competency.

Cultural awareness also calls for a knowledge of second language acquisition and the application of language-supportive strategies. Though English language literacy is critical for academic success in our schools, limited English proficiency should not prevent children from developing content knowledge and skills, nor from having equitable access to technology. Cummins (1989) suggests that students from “dominated” social groups are either “empowered” or “disabled” as a result of their interactions with their teachers. Teachers need to empower these children to learn while they are acquiring English. Supportive instructional strategies, such as adaptation of materials, pairing students, teacher demonstrations, visual clues, and simplification of language (Richard-Amato & Snow, 1992) not only support the second language learner, but also benefit other students.

Furthermore, cultural awareness requires knowledge and acceptance of cultural patterns of discourse and participation. Cultural awareness includes the ability to interpret both the verbal and nonverbal cultural patterns of communication of students. Patterns of communication and participation vary across cultures. As Tharp (1994) reminds us: “The courtesies and conventions of conversation are among the most powerful differentiating elements of culture” (p. 3).

For example, some Native Americans expect a long pause between speakers and use nonverbal cues for turn-taking (Protheroe & Barsdate, 1991). A teacher who is unaware of this pattern of conversation may assume that a child from this cultural group is sullen, unresponsive, intellectually deficient, or antagonistic. Other groups, such as some Latino and African-American people, have an overlapping pattern of conversation in
which individuals interject comments before a speaker has finished. In this type of communication, interruptions demonstrate that one is listening, thinking, and reacting to the speaker. Teachers who are unaware of this cultural pattern of communication may interpret such behavior as rude and disruptive. Misinterpretations of culturally acceptable communication patterns can result in alienation, low self-esteem, and negative feelings towards the teacher and schooling in general.

Cultural awareness requires a knowledge of learning styles and their application to classroom instruction. Reid (1995) defines learning styles as “an individual’s natural, habitual, and preferred way(s) of absorbing, processing, and retaining information and skills” (p. viii). Hillard (1989) suggests that, just as individuals have a personality that represents their habitual ways of responding to experience, cultural groups also have a personality which reflects the preferred, consistent, and learned behavior styles. Although there is much variability between individuals within a cultural group, research suggests that across cultural groups there are different preferred ways of learning (Griggs & Dunn, 1989; Jacobs, 1990; Rhodes, 1990) and that children from different cultural communities approach learning differently (Villegas, 1991). Thus, an awareness of cultural and individual learning style preferences and behaviors is essential in culturally responsive technology use.

Because cultural awareness takes into account both individual and cultural differences in how we acquire and organize knowledge, it is consistent with multiple intelligence theory (Gardner, 1983). As with learning theory, multiple intelligence theory emphasizes individual differences and individual strengths. Gardner’s multiple intelligence theory implies that teachers need to build on children’s more developed intelligences for the acquisition of new knowledge and skills. As Gardner himself comments: “What we have been doing is to teach and assess everybody as though each has the same kind of mind” (reported in Steinberger, 1994).

An example of the application of cultural awareness to educational technology comes from one of the teacher-created units that I examined. Ms J found that many of her children acquiring English as a Second Language (ESL) benefited from kinesthetic activities. Consequently, she designed hands-on learning activities, such as tallying the number and types of transportation that passed in front of the school during a 30-minute period. She then had students transfer their observations to the computer as charts, graphs, and, eventually, a slide show. Thus the teacher provided her students with learning opportunities that took advantage of their strengths and then linked these activities to computer applications.

A second example comes from an eighth-grade teacher who recognizes that content knowledge can be acquired through multiple avenues. Ms L pairs ESL learners in her class with bilingual students at the computer to
facilitate navigation of software and the gathering of information through library and Internet research. She allows students with limited-English communication skills to present their work on the computer in their native language while another student translates. Interpersonal intelligence, linguistic intelligence, kinesthetic intelligence, and spatial intelligence come into play in these activities.

Cultural Relevance

The second element, cultural relevance, must become an integral part of the curriculum and classroom activities (Abdal-Haqq, 1994). As such, it goes beyond overt add-on activities, holiday celebrations, or special events and connects learning to children’s everyday, real-life experiences. It exists where educational technology, topics, activities, programs, and resources relate to the children’s background, prior experiences, current knowledge, and personal interests. According to Ladson-Billings (1995b), “relevance refers to the ability of the curriculum to make deep and meaningful connections with the lives of the students” (p. 333). Instead of seeing culture as “an explanation of past failure rather than success, of present problems rather than achievements and of future difficulties rather than possibilities” (Little, 1990, p. 1), culturally relevant instruction uses the learners’ cultural backgrounds as a vehicle for learning (Ladson-Billings, 1995a). Research suggests that building on the cultural knowledge that children bring with them may enhance learning (Gutierrez, 1992; Lee, 1992). Moreover, “children are more likely to learn material that stimulates their interest” (Montgomery & Rossi, 1994, p. 3).

Cultural relevance is particularly important in teaching economically poor and minority children. These children may “see little evidence of the value of school knowledge” and “may know few people who have done well in school” (McDiarmid, 1991, pp. 259-260). These children, as McDiarmid (1991) explains, see education as something unrelated to reality. It is to be endured, rather than enjoyed. Because school learning is unrelated to their experiences, they see no justification for school knowledge. Croninger (1991) explains that the academic failure of some students is due to learning that “just doesn’t make sense” (p. 10). Since culturally relevant instruction connects learning with the student’s reality, it becomes purposeful, animates intrinsic motivation, and encourages transfer of knowledge.

Given that cultural relevance relates instruction to the learner’s knowledge, experiences, and interests, the learner develops a sense of ownership of the instructional content and activity. Not only does cultural relevance acknowledge the value of the learner’s knowledge and experiences, it also validates what is learned within the larger cultural community. Further, culturally relevant instruction generates enthusiasm and an understanding of how learned skills and concepts relate to the real
world. Cultural relevance makes learning meaningful and induces students to become actively engaged in their own learning.

In developing the multicultural elements for educational technology integration, I focused on three types of relevance: personal experiences, prior learning, and immediate relevance. Associating new learning with personal experiences links learning to personal events, knowledge, understanding, perceptions and emotions. Thus, new knowledge becomes relevant as it acquires personal significance. Explicit reference to previous learning helps the student organize new learning within the framework of existing knowledge. Therefore, new concepts gain relevance through their association with prior knowledge. A learning activity has immediate relevance when the student finds the current learning activity purposeful, pertinent, challenging, and product-oriented. Immediate relevance taps into the learner's interest and is related to what others call state motivation. State motivation, according to Tharp (1994), refers to “those motivational and incentive variables existing in the classroom itself, and which are manipulable by teachers ...” (p. 8). In short, immediate relevance emerges from interesting and engaging content-related activities.

Ms R’s unit on oceanography for a fourth-grade bilingual class illustrates each of these three forms of instructional relevance. Ms R began her lesson by asking students to recall things that are necessary for survival. Thus, she had them think about what they had learned previously, as well as what they knew from experience. After brainstorming, students then word processed their lists. Next, students used their experiences to talk about the beach, thereby linking the instructional content to personal experiences. Finally, the teacher created immediate relevance by sharing several interesting objects that she had found on a west coast beach. The students examined these objects and then compared them with objects she had found on an east coast beach. They drew conclusions about the differences in the objects from the two beaches and used a CD-ROM encyclopedia to find additional information on oceans.

Proactive, problem-solving activities that focus on issues within the community are another example of culturally relevant learning. In discussing the nature of good teaching, Haberman (1994) declares that good teaching occurs “whenever students are involved with issues they regard as vital concerns” (p. 311). For instance, students may explore such topics as waste dumps and their effect on their community, the nutritional value of traditional cultural foods, the increasing violence in their school, or the unavailability of after-school programs for neighborhood children. In discussing these problems, children may engage in a variety of interdisciplinary activities such as formulating research questions, researching pertinent information, conducting interviews, analyzing data, drawing conclusions, preparing an oral or written report, writing letters, and creatively finding possible solutions. Spreadsheets, word processing,
electronic databases, Internet searches, and even electronic mail could be integrated into these culturally relevant activities. Integrated, interdisciplinary learning, as suggested here, helps students go beyond isolated facts to major concepts and general principles. Broad visualization and active student involvement in real-life experience are also attributes of good teaching (Haberman, 1994).

A Culturally Supportive Environment

The third element, a culturally supportive environment, pertains to the classroom environment in which the computer is used. It is a safe, accepting environment in which individuals genuinely respect all forms of diversity. A culturally supportive environment is inclusive; all voices are heard and equally valued. Divergence of opinions is accepted and encouraged.

In addition, the culturally supportive environment demands and challenges students to learn, explore, and discover. There is an expectation for higher-level thinking and academic success for all students. Thus, in a culturally supportive classroom, children develop their individual abilities, skills, and potential. Activities provide for differences in learning preferences and afford opportunities for both individual and collaborative work. In short, the goal in culturally supportive classrooms is “to enrich students’ experiences, not to correct deficiencies” (Villegas, 1991, p. 26).

Because the culturally supportive environment explicitly respects and accepts diversity, it welcomes the cultural community. The student’s family and culture are part of the learning experience. Partnerships with parents strengthen the development of supportive learning environments (Flood et al, 1995). The presence of parents in the classroom and at school conveys to students a valuing of their parents’ contributions and knowledge (Eckermann, 1994). Additionally, community involvement and parent participation increase the teachers’ understanding of the culture and language of their students. In turn, parents become informed about school programs and instructional methodology (Eckermann, 1994).

Though parents and community members are rich sources of knowledge, they are often ignored (Pérez & Torres-Guzmán, 1996). There is evidence that teachers in inner-city schools expect parents to perform many education-related activities with their children at home and blame parents for low involvement. Yet, these teachers fail to inform parents on how to engage in such activities (Epstein & Dauber, 1991; Dauber & Epstein, 1993). Clearly, there is a need for mutual understanding and collaboration between teachers and parents. Culturally supportive teachers are cognizant of the underlying socio-cultural factors which inhibit parental involvement and they try to minimize the barriers. They maintain open communication with parents, actively plan for parental involvement, and empower parents to be
actively involved in their children’s learning. Such collaboration and support benefit teachers, parents, and students.


Teachers conveyed expectations verbally and through nonverbal cues (Vasquez, 1994). A study by Babad & Taylor (1992) illustrates the potency of teacher expectancies conveyed through nonverbal cues. These researchers asked experienced New Zealand teachers, who spoke no Hebrew, to watch 48 10-minute video segments of four Israelis speaking Hebrew. The Israeli teachers talked about and taught two students, one described as having ‘high potential’ and the other as ‘poor potential’. On 16 of these segments, the teachers were heard, but not seen. On another 16 segments, the teacher was seen, but not heard. In an additional 16 segments, the teacher was seen and heard. In viewing the sound-off and the sound-on segments of the Israeli teachers talking to their students, the New Zealand teachers detected strong differences in expectancy. This study suggests that subtle paralinguistic features (e.g. tone of voice and rhythm), body language, and facial expressions transfer across cultural boundaries. Given the number of non-English and limited English speakers in our classrooms, this study has significance for teaching. Since teacher expectations influence teacher-student interactions, students’ academic performance, students’ aspirations, and their self-concept (Cazden & Mehan, 1989; Hillard, 1989; Irvine, 1990), high expectations for students in multicultural classrooms become critical.

An instructional unit prepared by Mr G helps to illustrate the integration of technology in a culturally supportive environment. Using an interactive simulation program that presents social problems, Mr G had students work in small, cooperative groups to find solutions to the problems depicted. The children learned to give each other feedback, monitor their responses to disagreements, and negotiate solutions to problems. The cooperative learning activity developed interdependence, mutual respect, social competence, and collaboration among diverse students with varying backgrounds, skills and abilities. Every student in each group contributed ideas and helped in finding solutions. In addition, all students engaged in higher-level thinking, creativity, and problem-solving. Thus, the teacher demonstrated high expectations for all learners.

A second example comes from Ms S in teaching about the Navajo culture to a class consisting largely of Latino children. Together, the teacher
and students read stories about the Navajos. She then had students discuss the similarities and differences between their own culture and that of the native American culture they were studying. Next, students created Venn diagrams on the computer to illustrate the similarities and differences they had identified. Throughout this lesson, students used higher-level thinking while developing a deeper understanding of Navajo culture as well as of their own culture. By associating what they were learning with their own experiences, the Navajo culture became less foreign and more tangible. Moreover, the group brainstorming of similarity and differences helped the students understand the similarities and differences among themselves in a non-threatening atmosphere of acceptance.

**Equitable Access**

The fourth element, equitable access to technology, refers not only to the students’ access to the hardware, but also to varied software. Equitable access means that children use programs that best meet their own needs. Consequently, children may not all use the same programs or in the same ways. By treating all learners in the same way, we guarantee inequity for the many (Cortés, 1990). By implication, teachers must be competent in using a variety of software programs and schools must own an assortment of programs for student and teacher use.

At the same time, equitable access means that all children use interactive technology in ways that engage them in higher-level thinking and productivity. Meeting individual needs through technology does not mean that less knowledgeable students or those with special learning needs should be relegated exclusively to drill and practice programs. Though they may use and benefit from such programs, equitable access means that they also use other more challenging and interesting programs.

Equitable access to technology signifies that children with language differences or disabilities are not excluded from technology use and from quality interactive programs. Students may need dual-language or native-language software, large print displays, or special adaptive equipment, such as a mouth stick. Alternative modes of support include peer facilitation and adaptive instructional strategies. Reyes-Blanes & Daunic (1996) affirm that “cultural and linguistic differences must also be integral to the teaching process” and, therefore, teachers need to continuously “modify instructional practices to facilitate and promote academic success” (p. 108). Consequently, teachers need to adjust their instructional activities to provide all learners with access to technology.

Concomitantly, schools must provide the necessary software and devices that will ensure all children equitable technology access. Purchase of equipment and software cannot be based solely on how many teachers or students will use it, but on what needs exist among the students and
teachers. Administrative thinking based solely on getting the most for one's money leads to inequity.

Teachers determine access to computers by deciding who uses the computer, with whom, for how long, and for what purpose. As the SRI International Report (1997) advises: “Technology cannot become a meaningful support for students’ work if they have access to it for only a few minutes per week” (p. 5). Therefore, equitable access depends on the resources available at schools and on the classroom teacher. Teachers’ beliefs, expectations, computer skills, and cultural competency mediate technology access.

Institutional and social factors, as discussed previously, also influence students’ access to technology. The number and availability of computers, the types of technology on hand, the quality of software, the distribution of hardware and software, and the maintenance of existing equipment all play a role in technology access. In addition, the provision of in-service technology training and technical support for teachers also affects whether technology is used in multicultural classrooms and how it is used.

Inequitable access to technology leads to information-poor segments of our society. Robert Bauchspies (1996), in providing criteria for defining the information poor, says they are:

- illiterate;
- unable to determine their information needs;
- unable to discern value or relevance of information to their needs;
- unable to develop information-seeking strategies;
- unable to afford access to information;
- unable to access information due to cultural or physical barriers;
- computer or technologically illiterate.

Most of these elements describe many of our minority and economically poor students. Essentially, these factors can be ameliorated or eradicated through effective and equitable multicultural and technological education. Unless information-poor children are assisted in acquiring the skills, knowledge, and access to a wide range of information tools, they shall become, or continue to be, the economically poor of our nation. Hence, the question of technology access has political, sociological, economic, and cultural implications.

The following examples show how teachers provided equitable technology access through instructional adaptation. To help monolingual Spanish speakers participate in the creation of HyperCard stacks, Ms B provided monolingual Spanish speakers in her class with a teacher-created flow chart in Spanish. This visual aid allowed children to work independently and creatively. Further, it demonstrated to the non-English speakers that the teacher held the same expectations for them as for the English speakers. It permitted the Spanish-speaking students to participate in the technology-based learning activity with the rest of their class.
Similarly, by pairing native English speakers with non-native English speakers at the computer, Ms W affirmed the children’s native language, furnished equitable access, and demonstrated high expectations for student learning. At the same time, she encouraged peer collaboration and tutoring. Peer interdependence and assistance support a cultural preference of many Latino children to work with others. The proficient English speaker could read the menus and help the English learner to navigate the software. During whole-class activities, both of these teachers used an LCD panel to model software navigation. Thus, they offered non-English and limited-English speakers an additional visual assistance that increased their access to technology.

**Instructional Flexibility**

The fifth element, instructional flexibility, supports differences through varied modes of instructional delivery. The very diversity in our classrooms necessitates instructional flexibility (Villegas, 1991). Multi-modal teaching, in which the teacher provides for varied intelligences and learning style preferences, supports cultural and individual differences as well as expands children’s repertoire of ways to learn. When the teacher provides alternative ways to learn, the child develops “a sense of what it means to be an expert because an expert is able to think about things in more than one way” (Steinberger, 1994, p. 28).

Just as no one method of instruction can reach all learners, no one form of assessment can disclose every child’s learning. Hence, instructional flexibility includes using varied assessments for diverse learners. To precisely assess student achievement, teachers need to “provide all students with a variety of opportunities to demonstrate their knowledge and skills” (Lopez-Reyna & Bay, 1997, p. 36). Alternative assessment should focus on what the student has learned, rather than how well they take a test (Montgomery & Rossi, 1994), how well they can maneuver their body, or on how well they know English (Genesee & Hamayan, 1994). Objective tests may not reveal actual learning if they tangentially rely on knowledge or skills that are unrelated to what is being assessed. For example, a science test may rely on English reading ability or a reading comprehension test may require cultural knowledge about socially acceptable behaviors. Correspondingly, a science test that requires physical manipulation of equipment may be unsuitable for learners with physical disabilities. Instructional flexibility signifies that teacher instruction and the assessment of learning support multiple intelligences, varied learning preferences, learning abilities, and language differences. Therefore, teachers need a broad repertoire of strategies and a comprehensive knowledge of methodology that they can judiciously apply in the multicultural classroom (Tomlinson et al, 1997). They also need to know and use a variety of assessments, such as
portfolios, interviews, observations, public exhibitions, experiments, concept mapping, journaling, and performance (Lopez-Reyna & Bay, 1997; Montgomery & Rossi, 1994; Tippins & Dana, 1992).

Teachers who practice instructional flexibility in their classrooms give students choices in content, learning modes, and assessment methods (Wlodkowski & Ginsberg, 1995). Based on the literature, Tomlinson et al (1997) conclude that effective teachers in diverse classrooms offer learning options that invite students to enter the learning process at their particular level of readiness. Choices also permit the learner to approach learning from a culturally congruent perspective. Without choices, school becomes a series of pointless activities and tasks that one completes to please the teacher’s conception of what is important to learn (Yager, 1989). When there is instructional flexibility, students can select programs and media, choose topics, and pick partners with whom to work. They can also select how to demonstrate learning in ways that are culturally compatible and supportive of their learning preferences.

Ms P, a fifth-grade teacher, demonstrated high instructional flexibility by encouraging students to choose partners for their projects, allowing them to select an aspect of the class topic for a focus, and having them decide their responsibility for their share of the work. Although all students used HyperStudio to design their presentation, students progressed at different rates through the various stages of their projects. Another elementary teacher provided alternative ways of demonstrating learning. His students could choose to create a slide show presentation, create a graphic demonstration, or create a three-dimensional model. Thus, students could demonstrate learning through their strongest or most comfortable modality. Moreover, students with limited English did not have to depend on oral or written English to show what they had learned.

Instructional integration

The sixth element, instructional integration, refers to the degree to which technology becomes an integral part of classroom learning, student productivity, and information gathering for all learners across a variety of academic disciplines. Tutorials and drill-and-practice applications are not generally productivity-focused programs. Their purpose is to provide practice on specific content or skills. Although they can be useful for their specific purpose, they limit creativity, problem-solving, and higher-order thinking. Technology integration goes beyond such program uses to the application of computers for purposeful, productive, and challenging educational endeavors. Technology becomes an essential part of the curriculum and learning activities. Therefore, learning with computers becomes meaningful, practical, and transferable to the world beyond the school.
Instructional integration is evident in Mr L’s geography unit in which students used a map software program to locate US cities of their choice and gather information on those specific cities. Students then used a spreadsheet to compare the population of the cities and graph the results. They also created a treasure map on the computer and wrote directions for other groups to follow. As this example illustrates, the unit integrated social studies, language, arts, mathematics, and several computer applications. In addition, the students generated several final products, rather than engaging in rote skill practice. More importantly, the activities called for higher-order thinking, creativity, and interpersonal communication. In another unit for Ms D’s fourth-grade ‘remedial’ classroom, discussion of a child’s missionary parents’ visit to Rwanda resulted in the students’ desire to learn more about this country. Information was gathered through email communications with residents of Rwanda, CD-ROM encyclopedias, literature, and guest speakers. Students also created personalized stationery bearing their own digitized photograph. This stationery was then used for printing their word-processed letters to pen pals in Rwanda. In this instance, not only did the children choose what they wanted to learn and how they would learn it, but they also integrated technology in productive and authentic ways.

Discussion

The six multicultural elements for educational computer use presented here incorporate many of the practices identified in the multicultural literature as effective in teaching linguistically and culturally diverse students. Educational theory and sound pedagogical practices underlie the six elements presented here. The six multicultural elements include effective practices such as the incorporation of student language and culture, use of students’ prior knowledge and experiences, support for a variety of learning styles and multiple intelligences, active student participation and interaction, implementation of cooperative learning, and respect for diversity of opinions.

In addition, the elements presented in this article make use of the distinct capabilities of interactive technology to meet the needs of diverse learners. A report by SRI International (1997) on technology and educational reform affirms that technology integration supports student performance of authentic tasks, serves as a tool to accomplish complex tasks, and encourages collaborative involvement. In addition, technology supports process thinking, stimulates motivation, strengthens self-esteem, promotes equity, prepares students for the future, and allows them to explore the capabilities of technology (SRI International, 1997). When effectively used in education, technology can support differences in language, culture, ability, and learning.
“Teachers are often expected to do something different, but they don’t have the resources or the training to do it very well” (Chris Dede in O’Neil, 1995, p. 7). Indeed, the application of these six elements for technology integration in multicultural classrooms requires technology resources, effective training, and institutional support. However, school resources and technology training are not sufficient. If schools are to prepare children for the challenges of the next century, teachers and administrators need to implement educational strategies that help develop technological and interpersonal skills (D’Andrea, 1995).

Many scholars (see, for example, Garcia, 1994; Ladson-Billings, 1995a; Moll, 1986; Nelson-Barber & Meier, 1990; Snowman, 1996; Villegas, 1991) have indicated that teacher attitude, perceptions, and educational philosophy impact teaching in diverse classrooms. The centrality of the teacher in creating an equitable, challenging, and supportive environment for learning with technology needs no further elaboration. Unless a teacher believes that all students are capable and able to learn, integration of technology will be minimally effective for the historically underserved students.

Although the author successfully applied these six elements to the evaluation of computer-integrated instructional units for multicultural classrooms, the multicultural elements still need validation through additional research and application to a variety of classrooms. Does the practice described here transfer to other countries? Are they already in operation in another place? Once validated where they are, they will have direct application in the professional preparation and development of teachers. Teachers can learn to self-assess the cultural congruency of their computer use by utilizing the six elements as a checklist. Education faculty and student teacher supervisors might also use the six elements in observing student teachers use computers with a diversity of learners. Finally, in-service training on computers could incorporate the six multicultural elements so that teachers become culturally and technologically competent.

Further research on effective teacher use of technology in multicultural settings is needed. Researchers have investigated teachers’ computer training, perceptions and attitudes toward computers, and educational applications of technology. Nonetheless, there is an urgent need for further exploration of teachers’ understandings and their application of instructional compatibility strategies in working with diverse learners. The more we know about using technology in multicultural classrooms, the closer we will be to equitable, relevant, and effective education for all students. Moves towards increased educational use of computers in the absence of culturally compatible strategies will only widen the academic and socio-economic gap between those who have computers at home and those who, at best, gain experience with them only at school.
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