New Ways of Learning and Teaching: Focus on Technology and Foreign Language Education

Judith A. Muyskens
Editor

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Cognition, Context, and Computers: Factors in Effective Foreign Language Learning

Judith G. Frommer
Harvard University

Introduction

While the dilemma of how students learn and what teachers can do to facilitate the learning process arises in all disciplines, it is especially crucial and complex in the case of foreign or second languages. Confronted by new subject matter in their native language, college students approach the material using a code—their native language—that they have already mastered, to varying degrees. When learning a second or foreign language, they must simultaneously learn a completely new code and new subject matter. This is a daunting task for teachers and students alike: in this era of communication-based, proficiency-oriented language courses, learning a foreign language is more than memorizing vocabulary and structures and repeating sounds.

The question is, now that computers exist, can they—or rather, *how* can they—facilitate foreign language learning? It has become almost commonplace to say that presenting material in context helps students to understand and remember meaning and structures in the new foreign language they are studying. The goal of this article is to show that context makes an essential contribution to cognition and that the computer provides more of a context for the foreign language than was previously possible. To support this claim, an explanation of cognition and memory will be presented, followed by a taxonomy of context, concluding with a description of the role of the computer.

Cognition

In a recent textbook on cognitive science, Stillings states that cognition "refers to perceiving and knowing." The author writes that cognitive scientists seek to understand "perceiving, thinking, remembering, understanding language, learning, and other mental phenomena," all of which are related to learning a foreign language, and that the research of cognitive science includes "studying the principles of neural circuitry in the brain" (Stillings 1995, p.1). Starting in the mid-nineteenth century, through study of aphasics, or people with language disorders caused by accidents or strokes, doctors and scientists discovered areas of the brain associated with various speech functions and drew brain "maps" listing functions such as motor control of voluntary muscles (Frontal Lobe), memory of visual and auditory patterns (Temporal Lobe), and visual capabilities (Occipital Lobe). During the last twenty years, technological advances have allowed researchers to use sensitive computer equipment to document brain activity much more precisely on normal subjects, revealing the areas of the brain involved in specific activities. The new technology allows neuroscientists to "see inside the human brain . . . to study how the human mind is organized" (Blakeslee 1993, p. C1). Ongoing research, in turn, allows the periodic redrawing of more detailed brain "maps" which increase our understanding of the brain's functions. Recent research has established a relationship between the physical brain and functions that previously were not only excluded from, but were also considered in opposition to the concept of "mind"—all of which was grouped in the category of mental activity or cognition.

The attitude toward cognition, or at least to "mind," is changing to include emotions as well as thinking. Goleman, in a book entitled *Emotional Intelligence*, claims that we have two minds, "one that thinks and one that feels" which, although they are "two fundamentally different ways of knowing[,] interact to construct our mental life" (1995b, p. 8). According to research reported by Goleman, likes and dislikes are created as perception occurs. In a study investigating preconscious reactions before the individual reaches a state of awareness, tests indicated that English speakers find the word "juvalamu" intensely pleasing and "bargulum" moderately pleasing, but loathe the word "chakaka" (Goleman 1995a). The article mentions the phenomenon of "emotional memory," implying that a new word takes on an emotional value that is forever associated with it.

The possibility that the separation between what was formerly called cognitive and the affective may not exist is also discussed by Winograd and Flores, who question the assumptions of the rationalistic tradition that thinking, as

expressed by "sentences and representations, concepts and ideas . . . can serve as a basis for understanding the full range of what we might call 'cognition'." Based on the writing of Heidegger and Maturana, they suggest that cognition is not just an activity in a mental realm but is a "pattern of behavior that is relevant to the functioning of the person or organism in its world" (1987, p. 71).

In a recent article ("Cognition Plus: Correlates of Language Learning Success"), more closely related to language learning, the authors report on the effect on an individual's ability to learn a foreign language of a number of variables: aptitude, age, sex, motivation, anxiety, self-esteem, tolerance of ambiguity and risk-taking, language learning strategies, language learning styles (Ehrman and Oxford 1995). Although cognitive aptitude was found to have the highest correlation to success in language learning, they found that affective factors and personality variables are also important. These results suggest that the atmosphere of the classroom and the teacher-student relationship are important learning parameters that are sometimes ignored on the college level.

While native language learning is complicated by the simultaneous learning of concepts (already possessed by adult second language learners), the sensory aspects may be more significant in adult second language acquisition. Philosophers and psychologists, reacting to the behaviorism of the 1930–1970 period, are fond of pointing out that: "Humans are characterized not only by sensory, but also by *rational* cognition" (Luria 1982, p. 18). That is, speech production and comprehension are physical and emotional as well as mental activities, or rather the physical, emotional, and mental activities of language—when language is considered as communication—cannot be separated.

Memory

The preceding discussion of cognition has suggested the complexity and the multiplicity of factors involved in the process of learning a foreign language but has not touched on one aspect of cognition mentioned in our original definition and without which learning is impossible: *remembering*. Traditionally, it was thought that there was a single area in the brain where information was stored, but the current dominant theory is that memory involves the entire brain and is a process, as well as information.

Remembering involves both retention and recall. There is not yet any consensus on how these occur, but the numerous ways of interpreting memory proposed by psychologists and cognitive scientists all involve processes of one

kind or another. For Piaget, "memory involves an active *construction* at the time of exposure and an equally active reconstruction at the time of recall" (Phillips 1981, p. 22). According to Piaget, there are two kinds of memory: images, or recall of a scene, for example; and "conservation of schemes" which refers to the operative aspect of memory (Philips 1981, p. 24). Johnson-Laird differentiates between permanent and long-term memory: permanent memory is for essential skills, while long-term memory is for experiences and knowledge (1988, p. 156). Anderson divides memory into declarative and procedural memory, the former covering facts and events and the latter for enactment of rule-governed behavior (1983, p. 19). In this case, the lesson for the teacher may be that procedures for reinforcement of skills (i.e., sentence formation) may be different from those that reinforce declarative memory (i.e., vocabulary and culture). Gardner suggests that it may be impossible to generalize about memory because retaining and retrieving may work differently depending on the memory type, e.g., visual, spatial, or verbal (1987, pp. 131–134).

Experiments have shown that "the memorizing of a meaningful text presupposes its analysis, its deconstruction into 'meaningful supports,' and that, in essence, retention implies its processing (and the further reconstitution of that meaning rather than its mere reproduction) . . . at the basis of memory there lie processes of reiterative stimulation of closed circuits of neurons" (Leontiev 1981, pp. 49–51). "Stimulation" is key because memories must be activated.

According to Johnson-Laird, remembering is a five-step process. The brain must: 1) register the fact, rule, experience, or event and make a decision as to whether it is worth remembering; 2) lay "down a representation of the experience;" 3) maintain "the memory, perhaps for a long period of time;" 4) retrieve the memory rapidly and efficiently, either deliberately (when you must remember something) or spontaneously (when all of a sudden you think of a past event); 5) retain "the retrieved memory for a short time in consciousness while it contributes to thought" (Johnson-Laird 88, p. 143). One notes in the second step that one keeps a "representation" of what it is one wants to remember; it does not say that specific information is stored. A remembered fact or action is the result of a process consisting of the dynamic fusion of the several components of the retained representation. The role of the teacher in this process is to: 1) inspire students to think the item is worth remembering; and 2) provide enough input so that the representation can be as rich as possible. Here, also, one notes again the importance of stimulation, mentioned above.

What are the mechanisms that allow remembering to occur? When neuropsychologists talk about the brain, they use words such as neurons, axons, and synapses. Cognitive psychologists are more apt to discuss memory in terms of schema, a set of interrelated concepts that correspond to an individual's experience. "Whereas a concept can be viewed as a single unit of information, a schema may be described as an interconnected set of propositions or elements; a schema is a more holistic segment of knowledge" (Goldstein 1994). For example, "a restaurant . . . specifies the behaviors required for restaurants, cafeterias, and fast-food outlets" (Glass and Holyoak 1984, p. 88). The concepts, on which schemata—plural of schema—are based, can be imagined as composed of nodes and associations; a node is a concept linked to an association. For example, if the word "waiter" is the node, it is linked with various associations, such as the written representation of the word in one or more languages, the sound of the word in one or more languages, what a waiter looks like, and what he does. Groups of nodes linked together form a schema or a script. The previous example of a node, "waiter," fits into a schema of "restaurant" along with other nodes such as waitress, menu, table, ordering, and tip. Therefore, regardless of the system or terms used to describe the workings or structure of memory, the definitions almost always refer to making connections.

Context

The discussion of cognition and memory suggests that retention and retrieval of information and procedures occur because of multiple stimuli. These stimuli of different types and strengths arise from various contexts without which remembering would be virtually impossible. In fact, it is difficult to overemphasize the importance of context in foreign language learning, and in learning, in general.

Considering foreign language learning in a classroom setting, one can analyze context on six levels. The first three of these relate to the subject matter, and the other three to the learner. The six levels are the following:

1) the lexical-semantic context in which words are presented;
2) the context of discourse;
3) the cultural context of an utterance or a text, with regard to the target culture;
4) each student's personal context—personality and background—which

determines his or her reactions and relationship to the material and the classroom situation;

5) the expectations that both students and teachers have for the learning context; and
6) the classroom atmosphere.

All of these contexts are directly related to what is done in the classroom. Each context will be discussed, keeping in mind the advantages of creating connections for understanding and memory retention.

1. *Words in context.* Some teachers still have a tendency to think of language learning as a simple task: memorize the vocabulary and the structures and repeat the sounds. Those teachers often present vocabulary in uncategorized word lists, structures as grammatical explanations, and both of them in groups of unrelated sentences. They adopt the Augustinian notion of the meaning of a word as the object for which it stands. As Wittgenstein has said, this notion "does describe a system of communication; only not everything that we call language is in this system" (Bialystok and Hakuta 1994, p. 161). Until the 1980s, most foreign language teaching had followed the Augustinian notion, presenting lists of vocabulary with non-contextualized one-to-one native language equivalencies. If words are to be remembered, however, they must be presented in a meaningful context.[1] For Winograd and Flores, objective definitions of words are like those in mathematical texts or legal documents but do not account for "the normal use of language"(1987, pp. 112–113). In order to engage in an exchange of meaning, knowledge of background and context, or "pre-understanding," is necessary. It follows that all utterances should also be meaningful, which requires that they be contextualized in coherent conversations or activities that in turn fit into an overall framework having a significance understood by students.

   On a practical, classroom level, words should be presented in both a syntactic and semantic context in order to become meaningful to students. Meanings will be remembered much more effectively if they are presented with a visual stimulus or in semantic groupings and models illustrating use of the words in an appropriate target language construction (Cohen 1990; Glass and Holyoak 1986; Carrell 1988). More and more frequently, textbooks illustrate concrete vocabulary—for example, the rooms in a house or furniture in a home—in such a way

that students will be able immediately to associate an image with a new word. Presenting verbs in a syntactic semantic context facilitates production along with understanding and retention. For example, the English verb "to bear" in the sense of taking a certain direction might be hard to learn if presented as an arbitrary term in an arbitrary list; how is it distinguished from "to turn" and in what tense should it be used? You can say, "I turned right," but is this meaning of "to bear" used in the past tense? Presenting the verb in a conversation about giving directions, accompanied by a line drawing, gives a concrete situation in which the verb is appropriate and provides a memory link for both meaning and usage.

2. *Discourse context.* This term refers to the use of words in sentences and situations corresponding to target culture language use. However, the context that teachers establish for the language that they use in the classroom often bears no relationship to the context in which the language is actually used. For example, usually when you use the question-word "where," you are seeking vital information. But when the teacher, in a lesson on question words, asks students, "Where is the pencil?" and the pencil is in clear sight on his or her desk, the question becomes a non-question. While it does give the students an idea of the meaning of the word, i.e., identification of a location, it does not give them any substantial memory hook and does not give them an idea of how "where" questions are actually used by native speakers (Bialystok and Hakuta 1994, pp. 161–162). As speech act theory tells us, language is used for purposes, and these purposes exist in the classroom; if the target language is used instrumentally to express them, it will be learned by the students. As opposed to the "where" non-question presented above, students can ask real questions using "where" to request critical information, such as where they should meet to do group work outside of class. With the question word "when," instead of asking the quasi-rhetorical or nonsense question, "When does the sun shine, in the morning or at night?" they can ask when a test will be given or when homework is due. These questions involve simple structures that students learn at the beginning of the first year of language study and, if asked and answered in the target language, question forms will be learned very quickly.

3. *Target culture context.* Words and expressions denoting concrete objects should be presented to students in the context that they would have in the target culture. An example of what happens when this is not done, is to imagine giving American students the sentence, *Il a pris le pain, il l'a mis sous le bras, et il est sorti de la boulangerie* (He took the bread, put it under his arm, and left the bakery), without any explanation of its cultural connotation. If you are an American teenager who has seen nothing but Wonder Bread, what kind of sense do you make of this sentence? Can you imagine someone walking around with a loaf of Wonder Bread under his or her arm? Knowing the generic definition of a word is often not sufficient for comprehension of its significance in the target culture.

With regard to abstract concepts, the cultural context can be viewed externally or internally. The external viewpoint attempts a certain objectivity: an event, custom, or place is explained in full as if describing an image. The internal perspective concentrates on the meaning of the cultural phenomenon to those associated with it. For example, you can say that the French baccalaureate exam is the culmination of a certain type of secondary school education in France, but this explanation does not express the social and economic significance of the experience that is automatically felt by any native speaker. This interpretation of culture is based on shared knowledge: ". . . cognitive anthropology . . . has come to stand for a new view of culture as shared knowledge—not a people's customs and artifacts and oral traditions, but what they must know in order to see as they do, make the things they make, and interpret their experience in the distinctive way they do."[2] Helping the students to understand the appropriate context with regard to the target culture will help to promote meaningful learning. Conversely, without the relevant target culture background information, students will not grasp the meaning of texts or the vocabulary and idiomatic expressions. For example, when presented with the following sentence with words missing—"He put in _____ and pulled out _____ and said _____.—most Americans would think of the nursery rhyme "Little Jack Horner" while a non-American, not having this cultural reference, would fill the blanks with anything logical, such as: "He put in his credit card and pulled out the money and said "Thank God for ATM's."

4. *Personal context.* No matter how well the cultural context is presented to students, they will not fully appreciate it unless they can fit it into their own personal context. Dunn, in an article entitled, "If we can't contextualize it, should we teach it?," presents the constructivist idea that an individual's experiences are embedded in his or her personality, and that all reality is individually constructed (Dunn 1994, p. 84). The individual's experiences include psychological and real-life experience, cultural background, awareness of non-similar cultures (even if not the target culture), and exposure to certain modes of thinking or discourse. Students from homogeneous environments may have more difficulty relating to aspects of the target culture, whereas those who come from or live near ethnically diverse communities may have less difficulty understanding new concepts and practices. A very basic example of this is a student from a rural area attending an urban university who was at a loss when he was supposed to talk about the type of cuisine he liked; he claimed to have eaten only American or German cooking and had difficulty understanding the concept of appreciation of a variety of ethnic cuisines.

   Personal context includes an individual's personal beliefs that may correspond to or differ from those of the social group. People hold beliefs that may be "part of [their] sense of self and sense of place, cherished and held dear in spite of changes in the world's fashions and, if ever abandoned, set aside only with reluctance and a sense of lost comfort." Personal beliefs can prevent a student from adapting to a new classroom context or from absorbing input from the teacher or materials. A student with strong religious beliefs might find it difficult to learn from a text that had an anti-religious bias. A conflict between course materials and personal context can impede learning in any discipline, but the effect is intensified in foreign language study. At the early stages of foreign language-learning when college students do not have the linguistic preparation to express their thoughts which, intellectually, may be quite sophisticated, controversial documents while apparently stimulating discussion may actually be counterproductive.

   "Social representation," the individual's relationship to a social group and the roles he or she assigns to others, is another aspect of personal context. According to Goodnow and Warton, "Social representations are commonsense theories about aspects of the world . . . and are strongly influenced by one's social position" (1992, pp. 164–165).

Years ago, American children formed their concept of a police officer by learning a song in elementary school that began, "Go up to a kind policeman;" this image of the policeman as a kindly, father-like figure whom a child can trust probably does not correspond to most contemporary inner-city children's impression of law enforcement personnel, whom they more often see as the "enemy."

Another example of the relationship between personal context and social representation is students' perceptions of the role and place of their instructors. The way students view teaching fellows or part-time instructors—often the deliverers of language instruction, especially in large universities—depends on the students' own ideas about teachers and, at the same time, on the instructors' ideas about their role. Students who have been taught to respect teachers and not question their authority (admittedly a smaller and smaller number) will have a tendency to make no distinction between a teaching fellow and a professor. Other, especially older, students may question the authority of a younger instructor regardless of rank (i.e., even if he or she is an assistant or associate professor). On the other hand, instructors may use dress as a visual means of controlling distance, never wearing jeans and wearing a jacket as a means for younger instructors to establish authority or dressing more casually, in the case of older professors, to encourage a more relaxed atmosphere. Here, the individual's idea of social representation is iconic, associated with what the person playing a role should look like, rather than with a social position or a set of functions. Social representations also encompass ideas about ethnic and racial groups and are particularly important in foreign language courses where students' attitudes toward non-English speakers and their cultures can influence their feelings about foreign languages in general and their interest in specific languages and cultures.

The individual's perception of him or herself and of society affects student-teacher and student-student interactions. Some teachers, recognizing the importance of understanding students' perceptions, make an effort to know them individually, holding short, individual interviews with each one at the beginning of each semester. Knowing something about students—to use the current familiar expression, knowing "where they're coming from"—makes it easier to establish contexts that will facilitate their learning. Teachers can capitalize on the students' own personal experience to allow them to relate new information to already stored information in order to reinforce retention.

5. *The context of expectations.* Although we may not always verbalize our expectations, we approach our life situations with a preconceived idea of the attitudes and actions of the various players. There are unwritten rules of discourse for what the interlocutors understand is expected of them in a given conversation. Cultural conventions govern the interaction in situations in which an interchange takes place and, in this context, the adjective "cultural" refers more to microculture than to macroculture. That is, rather than being determined by national or macroculture, interaction occurs between individuals in the framework of a variety of subgroups (microcultures) which may have different cultural practices and even different underlying values.

This variation is evident when one considers the student-teacher relationship and the students' ideas of how teaching and learning take place. Both students and teachers have expectations about how the other should act. Some students come from high schools where they were expected to be passive, while others were expected to contribute to discussions and were rewarded accordingly. As for teachers, many conceive of their role as an authoritative font of knowledge, while others attempt to be facilitators of learning. If they are teaching in a different country, it is evident that their teaching style may not correspond to what the students expect from a teacher. Likewise, teachers from another culture may expect students to know what students in their own country know and not pay attention to aspects of education that are important in the country in which they are teaching.

Students often have a preconceived idea of how learning should take place and will judge a course on these expectations rather than on whether or not they have actually learned something in the course. Even if their language skills improve, students who are used to a teacher-centered classroom may be dissatisfied in courses in which student participation is emphasized, or they may want more explicit error correction than the teacher thinks should be given (McCargar 1993).

Expectations can also influence grades. In discussing the effect of context on cognition, Light and Butterworth write that ". . . children's success in tests of logical reasoning depends much more on their awareness of a set of cultural conventions for interpreting a task and communicating an answer than on any ability to handle abstraction" (Mercer 1992, p. 33). In the same way, students who expect that rewards (i.e., good grades) are given for repeating what is said in class will have difficulty adapting to an academic situation

in which they are expected to analyze and interpret texts and information.

6. *The classroom atmosphere.* What happens in the classroom is perceived by each student individually based on the aspects of context just discussed, personal context, and the context of expectations. There is, however, a classroom context, environment or atmosphere independent of the individual, which affects learning. The environment of the classroom depends on the teacher, the setting, materials, and group dynamics. It includes the physical conditions (i.e., movable chairs, windows, air conditioning/heat, decoration); length of time of class period (the academic framework); the other students; the syllabus and the texts (set before the course begins); and type of testing. The teacher is, at the same time, part of the environment and the creator of the environment. The teacher sets up an expressive (or emotional) environment that will inspire students to communicate with each other or to retreat into their own shells.

It is not always possible to separate the linguistic, cultural, mental, and environmental contexts mentioned above. In an article on context and cognition, Mercer writes that "Pupils accomplish educational activities by using what they know to make sense of what they are asked to do" (1992, pp. 31–32). He adds: "The success of the process of teaching and learning depends on teachers and learners using talk and other joint activity to build a *shared contextual framework* which will support future joint educational enterprises" (p. 32, italics added). Here, the author is talking more about the context of the classroom with regard to children understanding what is expected of them. His main focus is on disadvantaged or bilingual children who may not understand references made by the teacher, or who have no prior experience to relate to topics of conversation or classroom tasks (e.g., discussion of family trips if children come from low income single parent families). A clear parallel exists, however, with college classrooms, foreign language or otherwise, in which students are asked to participate in activities for which they have no corresponding script. According to Newton, "novel things are understood in terms of things already understood" (1996, p. 152), but our students do not already understand the "other things." We often ask students questions, assuming that they possess the same background knowledge that we do—in foreign languages with regard to the target culture, in literature with regard to understanding of genre or parallel texts, in history with regard to historical awareness—and are disappointed by the blank stares or a few inappropriate answers. One possible explanation for this situation is

that, in Mercer's terms, students cannot make sense of what they are to do because they do not share our framework of previous study of the field or experience with the target culture.

Computers

Computers are relevant to language learning, for when used appropriately, they can provide the meaningful contexts or the background information that students need to understand the full cultural meaning of the foreign language they are learning. Computers allow context to be integrated into learning in a way that corresponds to cognitive processes; they allow for immediate access to information that makes context make sense.

The preceding discussion of cognition has pointed out the multisensory and affective nature of language learning, the related experiences necessary for creating and accessing memory, and the importance of contextualization in all of its various meanings with regard to foreign language teaching and learning. With language learning as a goal, the teacher's challenge is to teach to enhance cognition, adding to the students' store of available contexts while using their existing schemata to foster comprehension, retention, retrieval, and recall. That is, we want to broaden students' horizons and increase their knowledge base, reinforcing existing connections while establishing new links and networks of the type mentioned in our discussion of schemata. We also want students to develop their own personal meanings and schemata, which they can do only if they become more involved with their learning.[3]

Although there have always been resourceful, enthusiastic, energetic teachers who have inspired their students and provided them with meaningful learning experiences using nothing but paper, pencil, blackboard, and chalk, today computers and new multimedia technology—such as interactive videodiscs, CD-ROM, the Internet and the World Wide Web[4]—can offer a way of learning that corresponds to cognition, which was not previously possible. Three dimensions that the computer and new technologies add to the learning environment that did not exist previously, or existed in only the most exceptional cases, are:

1) exposing students to larger quantities of text, images, and authentic materials;
2) increasing time on task in an efficient way; and
3) allowing students to assume responsibility for their own learning.

We can break these dimensions down into features that can be shown to provide context and aid memory and cognition whether the computer is used in the tutorial (directed) or the exploratory ("browsing") mode, as follows:

- The computer is *multisensory* and can display text and project digitized images and sound simultaneously to offer a "binding" experience linking meaning to form (Terrell 1986, p. 214). As students simultaneously read a printed word or expression in the foreign language, hear it spoken (digitized sound), and see it in an image or acted out (digitized visuals and motion video), the schemata necessary for understanding and remembering form in their minds. The multisensory computer can do what cannot be done on a printed page in the case of idiomatic or conversational expressions, since the situations in which these expressions are used and the significance of nonverbal communication can be presented to students in a dynamic way. The computer can draw attention to the dynamics of communication, such as timing and intonation. According to Nakita Newton, thought is based on mental images, which are not only visual. She states that "images are activated traces of sensory experiences, they can occur in any modality" (1996, pp. 145–148). It is precisely because the computer presents materials in more than one modality that it can provide students with richer mental images to support language learning.
- The computer can be programmed[5] to allow users to *control* both the conditions of viewing and what is viewed. In other words, with specially designed computer programs learners can tailor information and tasks to their own level and adapt material to their individual interests. While using tutorial software (which gives explanations, provides practice, and offers feedback), students can study whatever they want for as long as they want, working on all aspects of the language until mastery. With both interactive videodiscs and digitized video (on a hard disk or a CD-ROM), motion video can be controlled so that students can easily find exact locations for reviewing sequences and simultaneously obtain transcripts and explanations that facilitate comprehension. Although video tape can theoretically provide the multimodal material necessary to form mental images, as mentioned above, it is often not transformed into a personal experience, because students cannot apprehend it—the VCR keeps playing and the salient details that could form a mental image are not perceived by students. The computer allows students to control the video to an extent not possible

with a VCR: they can start it and stop it at will, access glosses or not, or take advantage of other aids.

While aids are available in hard copy workbooks, the key to the advantage of the computer is that students can make the decision as to the amount of help they need and when they need it. This is one way in which they take responsibility for their own learning. When using non-tutorial or exploratory software students direct their own learning (much as when doing research in a library), building associations and schemata as they follow their interests and seek out information.

- The computer is *multidimensional* and extensible. The exponential increase in computer storage capacity and the advances in networking technology have made it possible to access more material in more ways. With "hypertext," the computer technique that allows the creation and representation of links between discrete pieces of data, teachers can transform opaque texts into transparent readings for students. Different from the glosses that have always appeared on the printed page, hypertext references are not limited by physical space and can be presented in non-text form as either visuals, motion video, or sound. At the same time, the computer can present material in a non-linear format so that students can establish relationships among parts of a work, discover analogies, and test theories. Users can see different parts of a text simultaneously, or view text along with video or images simultaneously. Here, rather than insisting on the multisensory aspect of the computer—that more than one sense can be stimulated—the emphasis is on the multiplicity of stimuli. That is, the user can see more than one example or manifestation of the same or different material at the same time, comparing and contrasting, establishing relationships and hierarchies. In well-constructed computer materials students can access computer aids at will, according to their own personal learning styles. Depending on whether they are left- or right-brained, analytic or global, they can use on-line glosses, images, video as desired. Thus, with a computer students can fit the material to be learned into a context to which they can relate.
- The computer serves as a tool for *authentic communication* and as a resource for authentic *culture* via the Internet and the World Wide Web. (See, for example, the articles in this AAUSC volume by Kern or by Bernhardt and Kamil.) Much has been written about the computer's capacity to provide experiences in virtual reality, duplicating all of

the sensory stimuli of a given situation, but doing this can be costly and cumbersome (as in virtual reality machines which require users to wear special gloves or goggles) and, regardless of what is done, the experiences remain "virtual," that is, artificial. On the other hand, thanks to the Internet, students can engage in electronic mail conversations with native speakers, using the new form of discourse midway between spoken and written language. On the Web, learners in schools and universities and those who are studying independently have access to information produced by individuals, cultural institutions, businesses, and governments for an audience in their own countries, disseminating a wealth of information that is, like the e-mail exchanges already mentioned, intrinsically authentic and natural. By familiarizing themselves with this authentic material, learners can gradually construct their own contexts. This is an incremental process, with each acquired context facilitating comprehension of all new information.

- The computer, an inherently active medium, offers students an *interactive* learning experience. While it is true that reading and listening are not "passive" skills, as was previously thought, because they involve interpretation by the reader or listener, it is possible to read without thinking and to listen without hearing. In contrast, when using a good computer program, whether educational or general, the user must make choices or give some sort of input for the computer activity to proceed; that is, the user must think and must act. The learner, knowing that the computer will require an action on his or her part, must pay attention, which is one of the basic criteria for learning. (See, for example, the articles in this volume by Beauvois, Kern, and Scott.) Research on hearing perception has shown that unattended input is not processed cognitively and does not enter into memory (Glass and Holyoak 1984, pp. 66–67). Audio tape or video tape are certainly improvements over exclusively print-based language instruction, but students can still "tune out," whereas computer-based instruction requires active attention which, according to Vygotsky, "is a correlate of the structure of what is perceived and remembered" (Vygotsky [1934] 1986, p. 169).

  The inherent interactivity of the computer also enhances learning because the reaction of the computer to the student's action allows learning to continue by providing information or evaluation, whether

in the browsing or tutorial mode. Most important, the interactive nature of the computer allows it to be used independently of the teacher, increasing exposure to subject material in addition to class hours, providing meaningful feedback which prevents error-laden learning and corrects misconceptions (depending, of course, on the quality of the software), and offering the possibility of learning outside of the traditional classroom setting.[6] This advantage of the computer, which has been cited since the inception of computer-based learning, should be mentioned because of its importance in decreasing anxiety and adapting the parameters of the learning situation, such as length of time and frequency, to students' learning styles. (For a further discussion on personality and motivational factors, see the article by Meunier in this volume.)

Practical Applications

Even a cursory glance at journals devoted to foreign language teaching and learning reveals that, at the end of the 1990s, the use of computer materials has become, if not ubiquitous, nearly commonplace. As opposed to early efforts to use computer-based instruction for non-contextualized pattern-practice drills, an increasing proportion of the available software takes advantage of the potential of the computer to promote cognitive processes and to enrich context. Publishers are becoming more active in this area, while individual instructors are becoming more informed, sophisticated consumers. A certain number are learning to use authoring systems[7] and the Internet to create customized software for their students, and many have integrated the use of the Web into their courses. In survey results reported on the Internet, Carolyn Fidelman found an increase of 300% in Web use from 1994 to 1995.

Many culturally authentic, multisensory, multidimensional, and flexible foreign language computer materials could be cited, all of which contextualize information allowing students to make the associations necessary for retention and learning. While there are many ways of classifying software, for the purposes of this article examples will be presented in two categories. The first consists of prepared software packages, immutable and used "as is," which provide context and virtual experiences. In the second category, the Internet and the World Wide Web offer dynamic, temporally evolving real time exposure to language in which students find opportunities for negotiation of meaning and contact with cultural authenticity. The cognitive

relevance of this second category is reinforced by its close relationship with students' personal context: This generation is at ease with computers, e-mail, and Web-browsing, so using the Web or e-mail for learning a foreign language takes place in a real-life context similar to other student and leisure activities. In both categories the contexts can be both linguistic and cultural, that is, they may reinforce use of the foreign language in an appropriate pattern or foster understanding of the importance of a document in the target culture. The following are suggestions for computer use and examples of computer materials currently in use in French courses, illustrating the use of the computer to enhance context.[8]

- *Category I:* Virtual experiences through multimedia stand-alone software (CD-ROMs, locally distributed packages). In all of these examples, sound and text are associated with a visual context, forming a schema of the type described above. They all require that students manipulate the data or at least navigate, ensuring attention to and involvement with the context.
- Vocabulary is presented thematically with students reading the printed French definition of a word, hearing the word pronounced, viewing a corresponding digitized image, and having the option of seeing and hearing the word used in a short conversation.
- In the interactive videodisc, *À la rencontre de Philippe*, students control the unfolding of a narrative by making decisions at key points in the story, based on their understanding of the conversations and on their preferences.
- Another interactive videodisc, *Dialogues: Les Français parlent d'eux-mêmes*, allows students to simulate the role of the roving reporter by finding out how a variety of native French speakers, from France and francophone countries, answer questions about their personal values. The software provides an extensive system of linguistic and cultural glosses, thus explaining the context to students.
- A map of Paris has a selected number of sites on which students can click to see a video and hear an explanation, as they would on a guided visit.
- Digitized film clips are presented with cultural and linguistic glosses.

- *Category II:* Authentic materials from target culture Web sites and authentic communication via the Internet or e-mail.
- The World Wide Web is like an "open sesame" into previously distant cultures for the majority of students who were not bilingual or had not had the opportunity to live, travel, or study abroad. Accessing authentic sites (i.e., created for French or German people, for example, rather than for students), now possible via the Web, gives students a target culture context for learning the target language. They can find materials created in another country for its own citizens, which are truly authentic and usually up-to-date. Web activities can provide context in the form of general cultural information, current events, and everyday life in a target language country. Examples of some such activities are:

    1) In the *chasse au trésor* (treasure hunt) students are given a list of Web sites among which they must search for specific items of information. This is done in a computer classroom, and the first group of students to find all of the items is the winner.

    2) In another activity, *L'agence de voyages* (The Travel Agency), students choose a region of France or a francophone country and search the Web for information that they can present to other students who play the role of prospective tourists.

    3) Students access the Web sites of newspapers or magazines and, in some cases, radio stations (only extremely short clips can be used at present because of technical limitations) to find out about social or political activity.

    4) Since a number of mail-order, entertainment, and tourist businesses have Web sites, classroom activities can be based on authentic information. That is, rather than students' imagining the movie they would like to see during a trip to Paris, Madrid, or Rome, they can choose what is actually being shown there. In addition to using the target language, the authentic data makes it possible for them to do cross-cultural activities by comparing the French, Spanish, and Italian movie offerings with what is playing at home.

- Using electronic mail on the Internet in the target language offers students a real, as opposed to virtual, experience. When an exchange of messages can be arranged between learners and native speakers of a language, the computer establishes a context of real communication, rather than providing cues and missing information, as in the case of glosses and visuals in the virtual software described above. (See the article by Kern in this AAUSC volume.) In a recent project, American college students engaged in an e-mail correspondence with their peers at a French university, receiving messages written by the French students in the language as they used it naturally, expressing their own ideas which, by definition, were culturally authentic.[9] The American students discussed topics of interest to them, coming in contact with attitudes and ideas that they would never have discovered in any other way. The French students gave their views on American cultural imperialism, interpreted the "loi Toubon" (a code which restricts the use of English in public discourse), and explained colloquial expressions (*À la prochaine!—c'est une expression pour dire : à la prochaine fois*).[10] In some cases, students were obliged to negotiate meaning as they tried to determine the differences and similarities between French and American thinking on certain points.

These activities are just an infinitesimal sampling of the possible utilization of the computer in foreign language courses. The common denominator of all of the examples is the involvement of the student with authentic language in a truly or virtually authentic linguistic and cultural context which, according to what is currently known about cognition, adds new effectiveness to the acquisition of a foreign language and the understanding of its culture(s).

Conclusion

At the very least, the computer and technology can increase student exposure to a foreign language and culture (or to any subject matter) outside of class; optimally they can provide the contexts that will inform meaning and create an interesting, anxiety free learning experience that will foster foreign language acquisition and cultural understanding. Achieving these positive results creates an enormous task, however, for teachers who must be computer literate and must find the time to acquire or produce materials, or must spend long hours locating appropriate Web sites (with regard to both

content and level) or e-mail partners for their classes. Also, just as with any other materials, students have to be prepared to use computer materials or the Web. As mentioned in Meunier's article in this AAUSC volume, students need specific instructions for operating the hardware and for using the software, and a clear explanation of the educational task that has been assigned. Material to be used must be contextualized by pre-computer use materials and must be reused in a learning context after exposure. While the computer activity may include material that establishes the context for specific tasks, the teacher must nonetheless provide pre-listening and previewing activities so that the students will understand the relevance of the computer activity to the course content and so that their memories will be primed to assimilate the material with which they will come in contact. Task-based or information-gap activities should follow computer activity, so that students will reuse the information in personal and varied ways, thus reinforcing learning.

While little quantitative data is available to prove that computers increase the rate or depth of language acquisition, increasingly, there are studies to this effect, such as one recently reported showing that hypertext glosses with visuals on the computer, an enrichment of context, can increase comprehension (Chun & Plass 1996). (See also the articles by Bernhardt and Kamil, Kern, Beauvois, Scott, and Meunier in this volume.) There is also much anecdotal evidence, especially in the form of feedback from students and teachers, that technology has enriched and facilitated the learning process in those places in which it is currently used on a significant scale. The computer is effective because of its capacity to create and expand contexts, but its effectiveness depends on teachers who, along with competence in their field, must show enthusiasm for the subject matter and demonstrate sincere interest in and concern for their students individually and collectively.

Notes

1. Rather than saying that words are learned *through* context, which suggests a *process* of learning vocabulary, the author's intention is to suggest that the meaning of a word cannot be appreciated when the word is presented in isolation.
2. Quoted from Quinn and Holland, 1987, p. 4, by Goodnow, Jacqueline J., and Pamela Warton, "Contexts and Cognitions: Taking a Pluralist View," in *Context and Cognition*, edited by Paul Light and George Butterworth, p. 162. London: Simon and Schuster-Harvester Wheatsheaf, 1992.

3. As opposed to the Audio-Lingual Method of the 1960s, based on repetition and memorization, today's Proficiency-Based Approach relies on the techniques of task-based learning and information-gap activities, both of which require that students take an active role in seeking and sharing new material.
4. A videodisc consists of 55,000 individually numbered frames, or about 30 minutes of motion video. Showing a sequence of frames is comparable to showing a film sequence, while showing a single frame is like showing a slide. Depending on the hardware, the videodisc image may be seen on the computer terminal or on a separate monitor. A CD-ROM can contain up to 600 megabytes of computer code or digitized visuals, audio or video.
5. I have specifically used the word "programmed" here, to emphasize that the computer has no magical powers but does only what human beings tell it to do.
6. This is not intended to suggest that the computer will make the teacher superfluous. On the contrary, with well-constructed software the computer can supply information and offer opportunities for language use, while the teacher's role becomes even more important with regard to interpretation and discussion.
7. An authoring system is a template program allowing those with no programming knowledge to plug their own content into a variety of formats in order to give their students computer materials customized to their syllabus and ability level.
8. The list of software suggests the ways in which the computer can function to further real language learning and is in no way intended to be an exhaustive list or catalog of available materials or possible uses.
9. During the Spring Semester 1996, an intermediate French class exchanged messages informally, but under the guidance of their teaching assistant, with a group of students from the *École Normale Supérieure* in Paris. The teaching assistant and the course head analyzed the messages for content, but no quantitative studies were done and no official report was published.
10. Translation: "Till next time."

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