Chapter 2   Computer Assisted Instruction and Learning issues

2.1   Introduction

This chapter considers Computer Assisted Instruction (CAI) in general as there are many characteristics in common between CALL and CAI. It also reviews general learning issues such as learning styles and strategies, learner autonomy and the factors that affect the efficiency of the learning process. Where appropriate, reference is made to the EL environment and to how current knowledge of CAI may be applicable to the EL situation.

Section 2.2 provides an introduction to CAI (Computer Assisted Instruction) and its related concepts. Section 2.3 gives an overview of Educational Philosophies and learning styles. Learning strategies and their importance are discussed in section 2.4. Section 2.5 explains Learner Autonomy and discusses the effect of locus of control (learner or program controlled). Section 2.6 looks at CAI, culture and ELs. The impact of these topics on the proposed framework is discussed in section 2.7, while section 2.8 summarises the contents of this chapter.

2.2   CAI - a Brief Overview

2.2.1   CAI - Terminology

As with any field of learning, acronyms abound in the computer assisted instruction/learning domain. Terms vary in the breadth of their definition, or their specificity. Figure 2.1 shows a brief list of some of the main terms that are used in CAI related field.

CBT	Computer Based Training
CAI	Computer Assisted Instruction
CAL	Computer Assisted Learning
CALL	Computer Assisted Language Learning
WBI	Web Based Instruction
WBT	Web Based Training

Figure 2.1   CAI related acronyms

The term CAI will be used in this document as an inclusive term (i.e. it includes CALL, especially in this chapter) unless specifically stated. Many of the concepts that prevail in CALL also pertain to CAI. I believe that it is helpful to look at the common concepts before focusing on the CALL specific ones.

CAI, as the name suggests, is the use of a computer to provide instruction. The format can be from a simple program to teach typing to a complex system that uses the latest technology to teach new keyhole surgery techniques. CAI draws on knowledge from the fields of learning, cognition, Human Computer Interaction (HCI) amongst others. Many of the major themes in CALL are reflected in the field of CAI. Themes common to both are explored in this chapter and themes specific to CALL are explained in chapter 3.

2.2.2 History

CAL started in the 1950s and 1960s, mainly in the USA. Pioneers such as Suppes (Stanford University), Kemeny and Kurtz (BASIC, 1960s (Kemeny and Kurtz, 1968, 1985)) and Bitzer (PLATO, University of Illinois (Hart, 1981, 1995)) were among the first to use a computer as part of the learning process. The early CAI programs were rudimentary by today's standards, with mainly text-based interfaces. Bitzer was one of the first to realise the importance of graphics and sound in the teaching process. Initially, CAI programs simply tried to teach a particular topic without a basis on any particular educational philosophy. The TICCIT (Time-Shared Interactive Computer Controlled Information Television - (Merrill, 1983; 1988)) at the Brigham Young University was based on a specific instructional framework that dictated the actual hardware. The Logo project (Papert, 1980; 1993) was probably the first CAL system that was based on a specific learning approach (the experimental, discovery learning approach). More detail on the history of CALL is given in History (2000) and Levy (1997).

2.2.3 Benefits of CAI

CAI brings with it several potential benefits as a teaching/learning medium. These include self-paced learning, self-directed learning, the exercising of various senses and the ability to represent content in a variety of media.[1] As these topics will be explored in greater detail throughout this document, only a brief overview will be given here. Although CAI has not been studied in the EL community situation, many of the benefits in the general CAI context should also be available in the EL one.

With self-paced learning, learners can move as slowly or as quickly as they like through a program. If they want to repeat some task or review some material again, they can do so as many times as they choose. The program will not tire or complain about repetitions. Learners can skip over a topic if information is already known, making the learning process more efficient.

With self-directed learning, learners can decide what they want to learn and in what order. As will be shown later in this chapter, learners have different learning styles and use different learning strategies. Various studies (Entwistle, 1981; Schmeck 1988; Ford and Chen, 2001) have shown that when learners can learn in a way that suits them, improvements in the effectiveness of the learning process normally ensue.

Humans are multi-sensory animals. The more senses through which we receive information, the easier it is to remember. According to Fletcher (1990), people remember 20% of what they hear, 40% of what they see and hear and 75% of what they see, hear and do. The fact that the computer can exercise various senses and present information in a variety of media can enhance the learning process.

Meskill and Mossop (1997) report that computers encourage learning as they provide a stimulating environment and promote enthusiasm. Computers may help the reticent student who is afraid to make mistakes in a classroom situation (Chun, 1994; Meskill and Swan, 1996). They are good for online reference which useful in a language learning situation (for example, online dictionaries (Leffa, 1992))

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[1] Ancillary benefits, such as freeing up teacher time, will not be discussed here.

and can cater for students of different abilities. Also, the ability to provide quicker (and perhaps more directed) feedback is a further benefit of CAI.

2.2.4   CAI is Not Perfect

CAI is not without its problems. With self-access programs, learners can be left on their own too much and may feel overwhelmed by the information and resources available. On the other hand, there may be too much direction from the computer if classroom methods are transferred to the computer. Section 2.5 discusses the issue of Learner Autonomy and Learner Control.

Dawson (1997) states that the tendency to use multimedia "gimmicks" should be avoided and that due attention must be paid to current theories on language acquisition. However, this does not mean that multimedia should be avoided. Some researchers (Levy, 1997; Meskill and Mossop, 1997) believe that meaningful multimedia practices are possible and can result in more learning. Malfunctioning equipment can not only result in lost time but also create a negative attitude towards CAI. While the ability to follow links in a Web-based learning system can be of benefit, learners may lose time in navigation.

CAI is not yet a mature field. While various CAI models exist, not all CAI programs offer all the benefits of CAI. Sometimes what is theoretically advocated is not implemented in practice (either due to lack of knowledge or technological unfeasibility). Sometimes, the effective or good practices are not easy to identify. Continuing research will help to advance the field of CAI. One interesting research area is that of Web-based Adaptive Educational Systems (WAES), where the system adapts to the learner, providing different levels of information, help and feedback (Brusilovsky, 2000).

2.2.5   Types of CAI

CAI systems fall into two basic types: tutor or tool (Levy, 1997), although the term CAI often refers to computer tutors. In the tutor classification, the computer has the information to be learnt and controls the learning environment. A CAI tool enhances the teaching process, usually by focusing on one particular learning task and aiming to improve it.

Within the tutor classification, there are four modes: drill and practice, tutorials, simulations and games (Gloor, 1990). Drill and practice (also known as "Drill and Kill") is suited to the behaviourist model, with repeated practice on lower-level cognitive skills. Although often frowned upon, it can be useful in certain contexts. The tutorial mode is probably one of the most common ones within CAI. In this mode, the computer presents the information, guides the learner through the system, allows the learner to practise and then assesses the learner.

In simulation mode, the learner works with a simulation of the real world. Simulation is used where it is not practical or feasible to provide the learning in "real-life" (for example, pilot training). In games mode, there is generally a competitive element (e.g. time constraints or a race). The idea is to reinforce knowledge that the learner is assumed to have. While it is often more difficult to develop CAI programs in the simulation and games modes, learners tend to find them entertaining and challenging.

2.2.6   CAI - Does it Work?

It is still unclear exactly what type of instruction is suitable or preferable in a given situation. However, several findings for CAI are generally accepted. CAI students have improved attitudes to the learning process (Bielefeldt et al., 1997). Students using CAI have performed moderately better than the control group (using various testing methodologies) (Kulik et al., 1984). They take about 30% less time to complete their tasks (Fletcher et al., 1990).   Schmitt (1990) reports that CAI is at least as effective as non-computer based instruction. Kosakowski (1998) summarises the observed benefits of CAI, which are:

- the effective use of educational technology for drill and practice of basic skills (Kulik, 1994),

- that students learn more, and more rapidly in CAI courses (Kosakowski, op. cit.),

- that the complex multimedia technologies available give learners have more control over the learning process,

- that students feel more successful, are more motivated to learn and have increased self confidence and self esteem (Bialo and Sivin-Kachala, 1996),

- that teachers and administrators can use computers and information technologies to improve their roles in the education process.

2.2.7   Testing the Effectiveness of CAI

Tests to evaluate the effectiveness of CAI usually follow the psychometric tradition. This involves using standardised proficiency tests to measure the effects of instructional programs or methods on student learning outcomes and comparing the results. In the psychometric tradition, there will typically be two groups of students: one group will use a CAI program and the control group will be taught in the traditional classroom setting. Sometimes a pre-test is carried out whereby each group is examined on knowledge before partaking in the learning process. At the end of the instruction period, the two groups undertake a test to determine what has been learnt. This type of evaluation of the CAI process is perhaps the most common because it follows traditional methods and is easiest and least labour intensive to perform.

However, it has been recognised that the psychometric tradition alone cannot fully analyse CAI effectiveness as it is often too simplistic. With interaction analysis (Chaudron, 1988), the interaction between the learner and the CAI program is observed. Interaction analysis can be either pedagogically-motivated or psycholinguistically-motivated.   Pedagogically-motivated research tries to determine what works. What resources does the learner use? Is the program being used in the way that the designer intended? Psycholinguistically-motivated research aims to find out what learning strategies learners use.

Clark (1987), however, argues that any learning gain cannot be unambiguously attributed to the use of computers. He claims that it is very difficult to separate the computer from the other variables such as practice and reinforcement that affect the learning process. However, as it is generally agreed that CAI programs are at least as effective as traditional methods, it will be assumed that they are of benefit, especially where the traditional methods may not be available.

2.3 Learning, Education Philosophies and Learning Styles

One of the criticisms of CAI in general is that it sometimes tends to focus on what is technologically possible, without taking into consideration pedagogical issues. This section briefly reviews the topic of Educational Psychology, learning style and learning strategies. For a more detailed review, see Doyle (1999). Second Language Acquisition (SLA) provides insight into how learners learn second languages and the impact of different learning situations on the language learning process. SLA is important in the field of CALL and is discussed further in chapter 3.

Definitions of what learning is abound and it is difficult to find one that scholars agree with. Mayer (1982, p. 1040) defines learning as a "relatively permanent change in a person's knowledge or behaviour due to experience". Chance (1988) defines learning as that which occurs when information is understood and remembered by an individual, and can be presented in various ways. However, Cantania (1992) suggests that determining that learning has occurred and what has been learnt may depend on one's perspective.

2.3.1 Educational Psychology

Connor et al. (1999) report that CAI should be based on educational theory, otherwise the learning is left to chance. Although there are no clearly defined boundaries between the various different educational psychologies, there are four basic groups. Behavioural psychology (Skinner, 1968) focuses only on objectively observable behaviours and discounts mental activities. The cognitive model (Merrill, 1991) holds the view that knowledge is constructed and is not simply a learned response. This model considers the active mental processing that occurs and the setting (individual, group and environment) when acquiring knowledge. The constructivist approach (Jonassen, 1991) considers the nature of knowledge, the mental activities of learners and how knowledge develops in learning. In this model, learners use their intuitions to link prior understanding and new knowledge, which can be acquired by new experiences and interaction with the physical world. The humanist psychology of Maslow (1954) and Rogers (1969) is complex and based on personality. It is founded on generally accepted principles of human nature (Merriam and Caffarella, 1991) and argues that learning occurs as a result of intrinsic motivation and reflection on personal experience.

The behavioural psychological model fits well with lower-level learning activities such as rote learning, while at the higher end of the spectrum, for more complex learning tasks, the humanist model works better. Many of the available CAL applications focus on the lower-level learning activities and in some respects could be deemed to fall into the behavioural model. The behavioural model has fallen out of favour for many years because its assumptions are deemed to be too simplistic. However, as more experience is gained with CAI and better technology becomes available, CAI applications based on more advanced educational psychologies have been developed.

2.3.2 Learning Style

There is no one clear definition of what constitutes a learning style. Each model groups learners according to different criteria, but a common theme is that people with different styles have different approaches to learning. One generally accepted definition is that of Curry (1987). His model is known as

the onion model and is composed of four layers: personality dimensions; information processing; social interaction and instructional and environmental preference. The personality dimensions layer accesses the influence of personality on preferred approaches to learning. The information processing layer tries to understand the learners' preferred intellectual approach to assimilating information and the processes by which information is obtained, sorted, stored and utilised. The social interaction layer deals with classroom interaction and the instructional and environmental preference layers considers the learners' preferred learning environment. More details on each layer and the various different models within each level are given in Appendix H, p192.

2.3.3   Learning Style and CAI

CAI has the potential as an instructional medium to individualise the learning process (Rasmussen and Davidson, 1996). It may be more beneficial to some learners than others. For example, graphics and visually active instruction helps field dependent learners. Motivated learners who require specific instruction in a sequential format and enjoy frequent feedback, will generally benefit for CAI. Kinaesthetic, peer-oriented learners (such as the Abstract-Random of the Gregorc Mind Styles, Gregorc (1985)) will not gain as much from CAI (Dunn and Dunn, 1979) as there are limitations regarding what a learner can physically do with a computer (as least with the current technological restrictions).

Each model can be used to identify those learner types that will benefit most from CAI. In the Kolb model (Kolb, 1984), it is the concrete learners (i.e. those that learn from direct involvement in a new experience) that benefit (Enochs et al., 1984). In the Gardner model (Gardner, 1983), different techniques can be used to accommodate each type of intelligence (e.g. moving things around with a mouse for bodily intelligence, paint for spatial and telecommunications for interpersonal intelligence). With the HBDI (Herrmann, 2001), it is the right-brain learners who will gain most from CAI. Under the Gregorc mind styles, the Concrete-Sequential (hands-on) and Abstract-Sequential (logical) learners are suited to CAI whereas the Concrete-Random (risk takers) and Abstract-Random (holistic) learners can often become flustered (Gregorc, 1985).

Ideally, the aim is to create an interface that can accommodate all learners, but this may be hard to do. Also, it may be difficult for people that cannot adapt their learning style to CAI. Some degree of style flex (i.e. when the user learning style is adapted to match the CAI application) may be required (Butler, 1984). This is not necessarily a bad thing as it may expand the learner's style range but it should not be such that it causes undue stress on the learner (Gregorc, 1985).

However, the studies are not conclusive. Ross (1997) found that CAI may not be suitable for all learning styles. Interestingly, Liu and Reed (1994) report that while cognitive style groups interacted differently with a CAI program, comparable achievement levels were attained by field dependent and field independent learners. Wood et al. (1996) noted the need to cater for a variety of learning styles by providing different modalities. Cordell (1991) points out that further research is required into interface design in order to foster style matching.

Theories of learning styles and the testing of the interaction between learning style and CAI have mainly been carried out in developed countries and with learners familiar with traditional educational environments. Most EL community members would have limited formal education. Very little is known about the learning styles of those with minimal exposure to the traditional education setting. Culture may also play an important role. Cultures that have a well-established hierarchical system may foster field dependent learners, for example. People who live in an environment in which learning usually takes place by doing, may tend to have a concrete-sequential mind style. While there may be no specific information about the learning style preferences of people from EL communities, it cannot be assumed that they have a homogenous learning style. It is more likely that they will probably show somewhat similar variation to people from non-EL communities.

2.4   Learning Strategies

Learning strategies are steps taken by students to enhance their own learning (Oxford, 1990). They are operations employed by the learner to aid the acquisition, storage, retrieval and use of information (Rigney, 1978; Dansereau, 1985). This section gives a brief outline of learning strategies and their effective use. Chapter 3, which deals with CALL, will focus on strategies that are effective in the language learning environment.

Oxford (1990) identified six major groups of (language) learning strategies: memory, compensation, cognitive, meta-cognitive, affective and social. Meta-cognitive strategies include organising, evaluating, and the planning of learning. Typical instances are setting goals and objectives and self-evaluation. A cognitive strategy, which is the most common in language teaching programs (Chamot et al. (1987); Nyikos and Oxford (1987)), would entail analysing, reasoning, transferring information, taking notes and summarising. Practising and highlighting are cognitive strategies. Compensationary strategies involve guessing and inferring.

The grouping and structured reviewing of information would be described as a memory strategy. Other memory strategies include applying images and sound and employing action. Affective strategies are used when learners control their emotional state (for example, lowering anxiety). When learners work with others and ask questions they are using social strategies.

2.4.1   Why Strategy Use is Important

Learning strategies are keys to greater autonomy and more effective learning. Learners use various learning strategies and these strategies are differentially effective depending on the situation. If learners are aware of learning strategies and their effectiveness, they will be able to enhance the learning process (Oxford, 1990). However, if they are not aware of these strategies, they are missing out on potentially useful aids in the learning process. For example, language learners often underestimate how essential practice is (Rubin, 1975; Bialystok, 1981; Ramírez, 1986). If they are aware of the importance of practising (cognitive) strategies, they will be able to employ them during the learning process. Learning can be a stressful process for some, and anything that can reduce learner stress is to be welcomed.

2.4.2   Factors that Affect Strategy Use

There are several factors that affect the use of strategies by learners including learner ability, gender, culture, attitude, motivation and learner ability to manage the learning process. Higher proficiency learners tend to use more strategies than lower-proficiency learners and the same holds true for females compared to males (Oxford, 1990). Different cultures use different language learning strategies (Reid, 1995; Harshbarger et al., 1986, Willing, 1988).   Motivation, which is affected by cultural beliefs and attitude, also affects the use of learning strategies (Oxford, 1990). The ability of learners to manage their attention efficiently and appropriately is also a determining factor in the effective use of strategies (Ridley, 1997).

2.4.3   Impact

Ideally, learners would already be aware of learning strategies and their effective use. However, even if they do use them, their use will generally be subconscious (except in higher-ability learners). The teaching of strategies can either be explicit (informed) or covert (blind) (Brown et al., 1983). However, it has been found that explicit instruction is more effective (Perkins and Solomon, 1987). Learners can be taught about learning strategies before undertaking a course of study. Indeed, there are various courses specifically designed for this purpose. However, incorporating strategy training exercises into regular classroom activities rather than as a separate activity, was more beneficial to learners (Oxford, 1990).

A good CAI program should be aware of the different learning strategies that exist and which ones are more effective in a given situation. It can aid the learner by informing them of the various strategies and presenting them at the appropriate points throughout the program. For example, the BBC Online Language Web site (BBC, 2000) has a page on successful learning tips. Many modern language textbooks give hints to their learners about how to learn (e.g. Sueños, 1996). The framework developed in the project will provide the learner with such tips and hints as part of the program.

This project is aimed at EL learners. The sense of community may be stronger amongst these learners than in the mainstream language learner. This may impact the learning strategies used by the learners and determine those that are culturally acceptable for the learners. For example, social strategies that involve working with others may be suitable for EL learners. If writing does not play a big part in the life of the EL community, it is possible that the learners will have quite advanced memory strategies available to them if they are accustomed to memorising information as part of their daily life.   On the other hand, taking notes and summarising (a cognitive strategy) may not be immediately applicable. While EL learners may not have much exposure to traditional education methods, this does not imply that they may not use learning strategies. Indeed, it would be interesting to observe the transfer of learning strategies from other domains to the language learning domain.

2.5 Learner Autonomy, Learner-Centredness and the Locus of Control

2.5.1   Learner Autonomy

Learner Autonomy is seen as one of the most important elements of CAI. It has been widely discussed in the research literature (e.g. Little 1990, 1997). It is generally defined as an ability to take charge of one's own learning (Dickenson, 1995; Littlewood, 1996). Learner Autonomy occurs when the learner has the

"capacity for detachment, critical reflection, decision-making and independent action" (Little, 1991 p4). Independence and individual responsibility are core notions of LA. With the increased use of modern communications technology (email, discussion groups) and co-operative approaches to learning, most noticeably in CALL, the notion of learner interdependence (between a group of learners and teacher) has emerged (Little, 1990; Blin, 1999).

In the traditional classroom situation, all the learners must follow the teacher and often LA is not encouraged. The task to be learnt is decided by the teacher, who also controls the pace of a lesson. This makes it hard on many learners, whose ideal learning pace is different from that established by the teacher. With a CAI program, learners can work at their own pace. The learner can spend more time on those topics that are causing difficulty. Information can be reviewed and tasks can be repeated until the learner is happy to move on to a new topic. The learner feels in control and that usually enhances satisfaction levels with the learning process.

LA – the Benefits and Problems

LA has many benefits. It increases the motivation to learn and thus the learning effectiveness (Ulitsky, 2000). Self-esteem can be raised and often actual/perceived proficiency (in the learning task) is enhanced. Little (1990), however, cautions against assuming that learner autonomy equals self-instruction, in that self-instruction is not the only or sufficient condition under which learner autonomy can occur or be exercised.

Learners can gain greater autonomy when they are aware of different learning strategies and their effectiveness and know how to use them. Despite the accepted benefits of LA, its potential has not been fully realised. Many educational systems do not explicitly teach their students how to be autonomous learners and this gives rise to problems with some CAI programs. LA can be very powerful if used correctly, but if not handled correctly it can negatively affect the learning outcome, as learners can become confused and frustrated by their new found freedoms.

2.5.2   Learner-Centred CALL

The concept of Learner-centred design is an important one in education. It means focusing on the learner and his/her needs and motivations. Arizona (2001) discusses learner-centred education, defining it as placing the student and the learning process at the centre of the decision making process. The concept of learner-centredness is also important in the area of curriculum/syllabus design.

Various authors have proposed Learner-centred principles. APA (1997) list 14 principles grouped into cognitive and meta-cognitive factors, motivational and affective factors, developmental and social factors and individual difference factors. Hoven (1999) proposed the following five principles for learner-centred CALL

1. A socio-cultural methodology provides a suitable paradigm.
2. Learner-centred features include recognition of features and their propensity to change. Depending on its potential to be modified, a feature will either be identified as less amenable to change (e.g. sex or age) or somewhat/more amenable to change (e.g. learning style) and dealt with accordingly.

3. Learners must be taught how to manage control in a learner-controlled environment (see next section 2.5.3).

4. Task-based pedagogy (e.g. one that recognises that language learning is a developmental process – Kumaravadivelu, 1993) is a good framework to use.

5. Models of good practice from SLA and CALL should be used.

Hémard and Cushion (2001) point out that learners should be more involved in the CALL development process. Blin (1999) refers to the benefits of a learner-centred approach, which works in tandem with the promotion of LA.

2.5.3   Locus of Control

Definition

The locus of control refers to what controls the learning process. A program is defined as either program controlled or learner controlled. Learner-controlled programs (as opposed to program-controlled programs) allow learners to decide what and how they are going to learn. Learner control can refer to many different factors. It may refer to the learner's ability to control the amount of practice, feedback and review. It can also refer to the method of instructional delivery (lecture, discussion). The amount of instruction may also be under learner control. Under learner control, learners can tailor instruction to their own needs and preferences. We have seen that learners have different learning styles and the ability to tailor a program to their own style should improve the learning outcome. Learner control over the learning environment is pedagogically compelling (Meskill, 1991, 1996).

Benefits

CALL literature refers to the benefits of learner-controlled programs. In a learner-controlled environment, learners have increased levels of motivation (Kinzie et al., 1988). Learner control can alleviate boredom, anxiety, and frustration while maintaining learner attention (Steinberg, 1977). Students report greater satisfaction levels (Schnackenberg and Sullivan, 2000).

Increased Learning?

Goforth (1994) states that the potential of learner control has not been empirically proved. Different studies have produced different answers to the question of whether or not learner control actually increases learning. In theory, the ability to tailor a program to one's own style preferences should enhance learning. Some studies (Ross and Rakow, 1981; Pollock and Sullivan 1990) have shown that learners learn less with learner controlled programs. However, other studies (Gray, 1987; Kinzie et al., 1988; Ross and Morrison, 1989) have reported that learners learn more with learner controlled programs.

The Learner Control Paradox

On the one hand, the increased flexibility and customisation offered by learner controlled programs fits well with the "each learner is an individual" and learner autonomy philosophies. However, sometimes the switch to a learner-driven approach does not work well. Why would this be the case? Surely allowing learners to determine what, when and in what order they learn, would enhance the learning outcome?

One explanation is that the learner does not know "how to learn".   While the advantages of such an approach may work for higher-ability learners, this may not be the case for lower-ability learners. Schnackenberg and Sullivan (2000) contend that learner-centred programs may not be suitable for all types of learners.   The underlying philosophy in learner-centred programs is that learners are aware of their needs and know how to achieve them. While this may be the case for higher-ability learners, is does not always hold for lower-ability learners.   Lower ability learners need the guidance provided by a Program-Centred program to get the maximum benefit from a CAI program. A program that makes a relatively high amount of practice available to learners as the default route is likely to be more effective than one that offers less practice opportunities.

Several researchers (Salomon et al., 1989; King, 1991) refer to the value of providing online learning guidance to students lacking (language) learning skills and strategies. Well-designed instruction in learning strategies is the most effective method in assisting all learners to control their own learning process. However, up to now, the whole process of learning strategy instruction has not been extensively integrated into the teaching process, perhaps because it is a relatively new element in the whole process.

The locus of control should be viewed as a spectrum rather than an either/or dichotomy. A CAI program can be considered to allow more or less learner control. With lower ability learners, the presentation of more (rather than less) information and exercises should be provided as the default option. Learners tend to stick with the default settings (eventually, if not initially) and thus the program should guide the learner through the system in a "fuller" (more information) rather than a "leaner" (less information) mode.

2.5.4   Factors that Affect the Efficiency of the Learning Process

Various studies (Ford and Chen, 2001; Toyoda, 2001; Lee, 2001) report that there are various factors that affect the learning process. Such factors include courseware characteristics (manner of presentation and locus of control) and student characteristics (gender, attitude and learning style). The factors can be broken down in to two groups, computer factors and learner factors. Figure 2.2 shows a list of the main factors involved.

Computer Factors	Learner Factors
• Fit with the topic • Fit with the target user group • Presentation format • Locus of control • Accessible and reliable technology	• General factors (motivation, attitude, stress management and background knowledge) • Fit with learning style • Knowledge and use of appropriate learning strategies • Adaptability to the computer environment • Sufficient computer literacy

Figure 2.2 Main computer and learner factors involved in the learning process

Computer factors

Consideration must be given to how well the topic maps onto the computer environment. Tasks that demand a lower-cognitive level (e.g. simple exercises) are well suited to CAI applications, as they are good for reinforcing basic fact-oriented learning. It is important that the CAI software fits well with the

target user group. CAI is usually beneficial to lower achievers and those from lower economic strata. This is due to the fact that features that are offered by CAI applications are those which suit these types of learners including drill and practice, privacy and immediate feedback and reinforcement. The target users of the template would typically share these characteristics.

In order to cater for different learning styles, different presentation formats and multimedia formats should be used where appropriate. Learners who live in developed countries and are used to traditional learning methods, may like to see textual information, along with visual and audio elements in CAI material. However, EL community members may have low literacy levels and thus may prefer the visual and audio elements over the textual information. Moreover, different cultures may prefer different presentation styles, with some preferring loads of information on the screen while others may prefer less information, presented in a more spacious manner.

CAI can offer the learner control over the learning process. The degree of freedom or control available to the learner must be considered. Sufficient guidance must be provided for the lower-ability learner. Given the limited education exposure available to the EL community members, familiarity with learner controlled programs cannot be assumed. It is therefore important to provide information on how to use CAI materials. Cultural considerations are important in this context. For example, some cultures may want just guidelines and prefer a "try-it-and-see" approach, while others may prefer to have more detailed instructions.

In a CAI environment, it is important that the CAI program is easy to use and reliable. Studies have shown that initially students accept that there will be problems with a CAI program but as the "wow" factor disappears, there is less tolerance for computer related problems. While some 'techno-savvy' students may relish the opportunity offered by such problems, they are more likely to arouse negative sentiments in less 'techno-savvy' learners (Toyoda, 2001). In an EL context, it is imperative that the technology is accessible and reliable. Familiarity with computers cannot be assumed and anything that could cause learners to feel insecure, such as the computer failing or crashing, must be avoided if at all possible.

Learner factors

Learner factors include motivation, attitude, stress management, and background knowledge. If motivation is high and the student has a positive attitude, it is more likely that a successful learning outcome will be achieved. There is always a certain amount of stress associated with the learning process, but if the learner can handle this properly, it should not negatively affect the learning outcome. Obviously, background knowledge can also affect the learning process. In the EL environment, the motivation may be different from that of a non-EL environment and may have to be fostered (see section 6.6.2.2, p102). While EL community members may not have background knowledge on languages and linguistics, they may have hidden knowledge about the EL via words for plants, animals and place-names. Phrases and structures from the EL may also have been borrowed into the dialect of the locally dominant language.

It has been shown that people have different information processing strategies and different learning styles. Also, different strategies can be more (or less) effective in different situations. If people are presented with information in a manner that suits their learning style, the learning process will be more effective. Ford and Chen (2001) report that matching/mismatching between teaching and learning styles can have significant effects on learning outcome. Thus, it is important to cater for different learning styles so as to accommodate successfully as many learners as possible.

Knowledge of learning strategies and their use is a factor that affects the efficiency of the learning process. Oxford (1990) reports that more adept learners know a range of different learning strategies and their appropriate use. Learners can be trained in strategy use. It is unlikely that EL community members will be aware of learning strategies and it is therefore desirable to provide learning strategy information in an explicit manner.

Not all learners adapt equally well to the computer/web learning environment. Lee (2001) reports that with Web Based Instruction (WBI), not all students learn uniformly. Lee identifies four different adaptation styles, based on perceived ability and satisfaction levels with a program. Model learners are those who perceive themselves as high-ability learners and report satisfaction with a CAI system. The disenchanted, although of high-ability, report dissatisfaction. Maladaptors, although not of high ability, report satisfaction. Finally, the fanatics are low ability learners who report dissatisfaction. While a CAI program cannot cater for each type perfectly, it should take dissimilar adaption styles into account. Further research is needed into why learners have different adaptation styles and what can be done to help support different adaptation styles.

To use a CAI program, one must be able to use the computer. A minimum level of keyboard/mouse skills is required. People accustomed to using a computer may underestimate the computer-related anxiety and frustration among learners who are novice computer users. This causes two problems. Firstly, this anxiety can inhibit knowledge acquisition in some learners (anxiety is not conducive to learning, whatever the medium). Secondly, they must allocate cognitive resources to actually using the computer (for example, wondering how to select an option as opposed to considering which is the correct option). These resources are therefore not available for the processing required to learn the current topic. Toyoda (2001) found that sufficient computer literacy in students is a necessary condition for successful autonomous learning in a CALL environment. This is an important consideration in the Endangered Language context, where literacy levels may be quite low. It means that extra care must be taken with the clarity and presentation of information and implies that attention must be paid to non-textual information (e.g. sound and audio elements).

2.6   CAI, Cultural Issues and Endangered Languages

CAI has generally, although not exclusively, been studied in a Western setting. Culture and language learning are much more inherently intertwined than other CAI applications. This section looks at some of the culture and CAI issues while the interaction of culture with the CALL domain is addressed in chapter 3. Findings about the benefits and effectiveness of CAI must be understood with its predominant Western cultural orientation in mind. This is not to imply that they will not carry over to non-Western cultures,

but rather that some adjustments may be required. Geres (1997) notes the scarcity of information on cultural approaches to CALL design and suggests that learners from non-Western cultures, studying in a Western environment, should be made aware of the Western way of learning. One of the reported benefits of CAI is the ability for the learner to work at his/her own pace and manner. This ties in neatly with Western democratic ideas (Geres, op. cit.). However, Geres (op. cit.) recommends that non-Western students must be provided with explicit information about Western ways of knowing, learning and teaching if they are to avail of the benefits of CAI.

Two examples from non-Western cultures serve to illustrate this point. Asian students (e.g. Chinese or Japanese students) are generally accustomed to an educational environment in which the learner is a passive participant in the learning process. If the CAI program has been developed from a Western cultural perspective, the Asian students will need to be made aware of the learner control approach and given guidance as to how to avail of it, perhaps on a gradual basis. Another example, given by Geres (based on research of Lakoff (1987) published by Driscoll (1994, p228)) comes from the Dyribal speakers of Australia. In their system of classification of words, males, kangaroos and fish would be in one group, while females, dogs and birds would be in another. Thus, in a hypothetical CAI program which asks the learner to pick the odd word out of the group (woman, man, dog, bird), the Dyribal speaker would choose man, based on his/her cultural epistemology, rather that the bird (as would be the case with Western cultural epistemology). This has implications for how feedback is given when students answer questions incorrectly. In this case, for example, the "error" does not arise due to the learner's misunderstanding of the words "man" or "bird", but rather their intrinsic understanding of classification. Vance (1997) and her team at the British Columbia Institute of Technology have developed a curriculum that explicitly incorporates cultural information into the English as a Second Language (ESL) curriculum. It includes information about working cooperatively in groups and how to handle team meetings.

Information about CAI and Endangered Languages is also very scarce. While ELs share several characteristics with Less Commonly Taught Languages (LCTLs - see section 3.7, p52), the lack of formal education and the generally low social and economic position of the learners sets them apart from mainstream CALL learners. The lack of formal education implies that the learners may not have experience of the sequence of a lesson and therefore may not be able to navigate around the system without guidance. While drill exercises are out of favour amongst some educationalists, they are suitable for learners who lack confidence and gain from the straightforward testing approach. One disadvantage that those without exposure to foreign or second language learning have is that they may not have a repertoire of learning strategies available to them. Therefore, explicit provision of learning strategy information would be of benefit to them.

Learner Autonomy has been recognised as being important in the learning process. However, it is often difficult to foster and achieve amongst learners. This is often due to the fact that learners, who are used to being passive learners in their previous educational settings, find it difficult to take control of their own learning. This is only a speculation, but it may transpire that Learner Autonomy is not so difficult to achieve amongst learners with limited formal education. This is because they have generally taken control (albeit unconsciously) of their own learning by default (due to the lack of formal or directed

learning). From my limited experience of Pipil community members and people from low-income backgrounds in El Salvador, I would imagine that they would have less reticence in asking questions and have less inhibitions about the (non-formal) learning process. Whether or not this would translate to the CAI learning situation is an interesting question.

2.7   Impact on the Proposed Framework

It is hard to draw conclusions from the literature review in sections 2.3, 2.4 and 2.5 as in each case the findings reported are relative to a particular scenario, task or learner type, theoretical assumption. However, several broad trends can be identified. Nearly all of the CAI related studies have sought to show that the CAI learning progress is at least as good as, if not better than, the traditional approach. Generally, the results have shown that CAI is beneficial or neutral in terms of learning outcome.   Thus, in an environment where perhaps the traditional approach is not even available (as may be the case for ELs), it can be hoped that a CAI /CALL program has the potential to be beneficial.

The design of the framework should bear in mind the factors that influence the effectiveness of a CAI program, while at the same time considering the special constraints of the EL context. The program should aim to cater for various different learning styles and make use of multimedia where possible. It should try to reduce user stress with the use of the computer. Care must be taken to minimise the extra cognitive load imposed on learners, who are not proficient with the use of the computer and the related computer anxiety they may experience. The framework should try to keep the user interface as simple and as clear as possible.

While it would be great to teach learners about learning strategies and their use in general, the cognitive load associated with learning new strategies explicitly, on top of the intended learning goal (i.e. the language), would be too off-putting for the learners. The learners are not computer specialists and have little no or language learning experience (chapter 6, section 6.5.2.1, p102 provides a learner profile). Thus, learning strategies, especially language learning strategies, will be presented to the user as a tool within the program, which can be viewed when the user wishes, rather than as a "format, must do" part of the program. The framework, while allowing learner control, will provide guidance to the learner throughout the use of the program. It will have a web-based interface with hyperlinks, which provides flexibility and learner control.

2.8   Summary

This chapter explained the purpose of the project, which is to create a template for a CALL program for Endangered Languages. It presented the background to CALL in the EL context. The objectives (template development, CALL material development and language documentation) were stated, along with the requirements (ease of use, modifiability and the production of a CALL program) and the constraints (both technological and time based). The interdisciplinary research methodology used in the project was presented. It draws on CALL, EL and Software Engineering domains. CAI was introduced, with its benefits and problems and an outline of different CAI types. A brief summary of learning styles was provided along with their preferred presentation formats (from the field of Educational Psychology). The use of learning strategies and their effectiveness was shown to be important. The potential of

Learner Autonomy and the importance of locus of control were discussed. While learner control is rightly espoused as being of benefit to the learner, the need for guidance, especially for lower ability learners, was highlighted. The factors that effect the learning outcome, both computer and learner related were reviewed. The interaction between CAI, cultural issues and ELs was also explored. The impact of each of these elements on the framework was outlined.