A User-Centered Methodological Framework for the Design of Hypermedia-Based CALL Systems

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ABSTRACT

The aim of this research is to improve the educational quality of hypermedia-based CALL systems. It is argued that many of the deficiencies of current systems can be attributed to an insufficient consideration of the needs of users and to the lack of an explicit educational philosophy guiding their design. Accordingly, a methodological framework has been developed which draws on recent developments in the field of human-computer interaction regarding interactive system design and a general constructivist approach to the design of computer-based learning material. The methodological framework involves a number of key features including use of learning scenarios to identify user requirements (Carroll, 1995), the development of prototypes embodying different design options, and a series of formative workshops to evaluate the prototypes. This article reports progress so far in the use of the methodology. The overall results provide broad support for the general approach of basing design on a constructivist model and confirm the general validity of the user-centered, scenario-based methodological approach.

KEYWORDS

User-Centered Design, Hypermedia-Based CALL System, Constructivism, Scenario-Based Prototyping, Formative User Workshops

INTRODUCTION

In recent years, the use of computers to assist students learning second languages (CALL) has become a matter of increasing interest (Barker, 1993; Atkinson, 1997) especially given the ready access to personal computers both at home and at work. The recent appearance of low cost multimedia PCs opens up even more promising potential for the use of computers in language learning. Although many packages have been developed, the quality of some of these CALL systems has been called into question. Rushby (1997) states that most packages contain content and software errors and do not realize their full potential as learning tools. In an informal survey of 13 CALL packages, Shin (1998) found that the overwhelming majority were deficient in terms of their concern for pedagogical design, their attention to linguistic factors (e.g., whether they exhibited a realistic range of phonetic differences and explained elision), the quality of the interface design, and the degree to which they exploited multimedia features. The criteria used in this evaluation were drawn from Howard (1989), Boyle (1997) and Rushby (1997).

Hemard (1998) has argued that CALL systems do not live up to their promise because of the unsystematic, experiential way in which they are designed. Levy (1998) contends that the design of CALL systems should be founded on a firmer base of theory with respect to language learning and instructional design. Moreover, he argues that CALL designers should draw on expertise in cognate domains, in particular that of Human Computer Interaction (HCI) because it has developed many tools and methods relevant to the design of interactive systems. The thesis of this article is that a rigorous framework for developing CALL systems is required. We argue that the framework requires two key elements: the design must be (a) underpinned by a solid educational model and (b) informed by a rigorous engineering approach ensuring that the design addresses the educational requirements of its potential users. Regarding the former, Levy (1997b) has shown that few systems embody such a model, and, regarding the latter, Hemard (1998) laments the lack of data for targeted student populations on which designers can draw.

In this article, we provide an overview of the methodological framework that we are developing and provide a short case study of its use in relation to the development of a hypermedia system for teaching English as a second language. The educational paradigm underlying the design process is that of constructivism, while the engineering approach follows the scenario-based design process of Carroll (1995), which has been highly influential in the field of HCI.

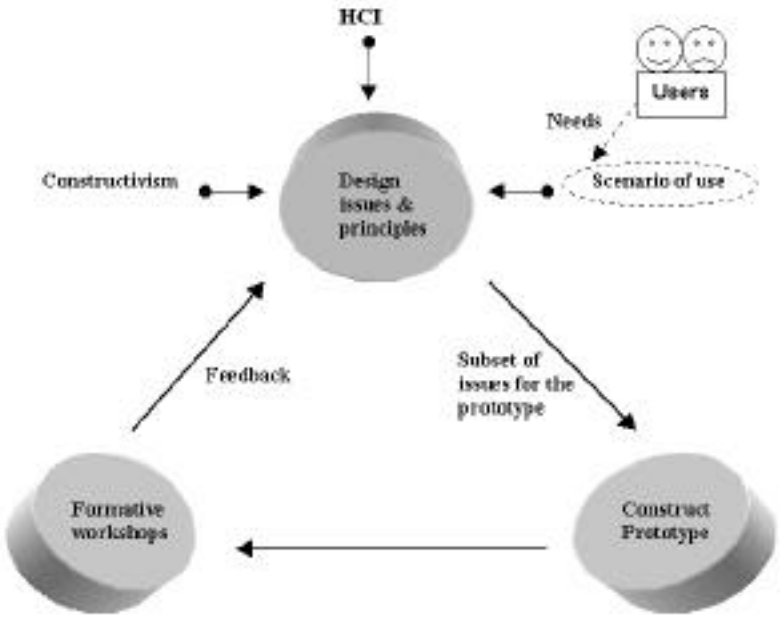
AN OVERVIEW OF THE FRAMEWORK: CONSTRUCTIVISM AND SCENARIO-BASED DESIGN

From a constructivist viewpoint, learning is not seen as a simple stimulus-response phenomenon, it requires self-regulation and the building of conceptual structures through reflection and abstraction. Problems are not solved by the retrieval of rote-learned "right" answers. To solve a problem intelligently, one must see it as one's own problem, an obstacle obstructing progress toward a goal. The desire to reach a goal is a very potent form of motivation, and to have searched for and found a path to the goal provides significantly more pleasure and satisfaction than simply being told that one has given the right answer (Glasersfeld, 1996). The essence of constructivism is to motivate learning by leading students to experience the individual and subjective satisfaction inherent in solving a problem that is seen and chosen as one's own. It is this view of learning that provides the general educational design philosophy of our methodological framework.

Regarding the design process, we have adopted a user-centered approach. The importance of involving users in the design of interactive systems has long been understood in the field of HCI. A great deal of research exists to demonstrate the benefits of user involvement (e.g. McKeen, Guimaraes, & Wetherbe, 1994; Amoako-Gyampah & White, 1993) and a substantial body of research in HCI has focused on creating a more user-oriented perspective in system design (Preece, 1993). Scenario-based prototyping provides the general approach used here (Carroll, 1995).

The idea of *prototyping* reflects an evolutionary approach to developing systems in which the design process progresses through a series of incremental versions embodying different features and levels of functionality. These prototypes can be seen as experimental, incomplete designs that can be built quickly and cheaply and are usually discarded immediately after use. Developing prototypes is an integral part of an iterative user-centered design process because it enables designers to try out their ideas with real users and to gather feedback on design issues. Various ways are available to obtain this input from users. In our research, the main method we employed involves *formative workshops* in which users are exposed to the prototypes and allowed to gain practical experience in using them. We observe and record their behavior, attitudes, and reflective comments. In designing the workshop prototypes, *scenarios of use* (i.e., simple narrative descriptions of operational settings reflecting a user's view of what happens, how it happens, and why) are increasingly being used in HCI practice to set design objectives (Mack, 1995). The relationships among scenarios, prototypes, and formative workshops are shown in Figure 1.

Figure 1
User-Centered Methodology



The first stage of the design process involves drawing up an initial set of design issues and principles from three sources: (a) user needs expressed through scenarios of use, (b) general principles of good HCI design (Preece, 1993), and (c) a general constructivist orientation to the design of learning materials. The distinction between *issues* and *principles* is crucial. Issues reflect unresolved questions regarding good design for CALL systems (e.g., whether students will find on-line dictionaries helpful, and, if so, how they should be made available). Principles, on the other hand, reflect those design concepts which are settled, either because they reflect established precepts of good design or because they have been derived from a previous workshop. Working from such a corpus of design ideas, the next stage of the process entails extracting a subset of issues from the list to inform the design of a prototype to allow these unresolved questions to be addressed empirically. A workshop is then held to solicit feedback on the specific design principles (reflecting those issues that have

been satisfactorily resolved) and on the current system design. Further iterations of this core design cycle then ensue to address additional unresolved or new issues.

The overall rationale of the design process is thus to construct a set of design principles through an iterative prototyping process in which design issues are progressively addressed and resolved. The final set of principles are substantially embodied in a definitive prototype which will provide the basis for the "production system," that is, the system to be built and marketed for real use. How these various aspects of the design process may be realized in practice will now be described using the development of a system for teaching listening skills to overseas students as our case study.

USER SATISFACTION SCENARIOS

The target users of the system are Korean teenage students (age 12 to 15) whose spoken English is not as good as their written English. Because of the lack of native English teachers and a grammar-oriented school system, many Korean learners of English as a Second Language have difficulties in listening and speaking. The major educational tool for this purpose has been audio and video tapes; no software packages specially designed to help learners to improve their listening skills have been developed. The case study below focused on providing listening skills for them, not to test their English listening abilities.

Five *user-satisfaction scenarios* drove the first cycle of the design process. They were derived from relevant data collected from interviewing a sample of second language learners and the first author's experience in teaching these kinds of students in Korea. Although scenarios are normally used to exemplify desirable features users might expect or want a system to provide, here the emphasis was rather different since the interviews showed that most users could recall very few positive features in the software systems that they had experienced. For this reason, we focused on users' dissatisfaction in our use of scenarios. Each of the scenarios captures a set of related sources of dissatisfaction (themes) that had been experienced with real systems.

First we note that the scenarios were driven by the following model of a typical student:

> M. Kim is a 14-year-old typical Korean boy who has his own computer at home and spends most of the time playing games with his computer. He is not an expert at using other software applications but has some experience in word processing. He also has little time to use his computer on weekdays because of doing private lessons after school, doing homework, preparing for exams, and playing basketball with his friends.

Five scenarios were defined of which two are given here.

Scenario 1: HCI and Usability

Kim is having problems in using his system, and he is getting very frustrated. It makes a funny noise whenever he makes mistakes or errors, and there is no way to stop hearing the sounds repeatedly when he is annoyed. He really wishes he could stop the sounds. (1.1)

There are lots of special buttons designed fabulously in the program. But every time he wants to click a certain button, he has to check which button is the right one. Some buttons are too creative to guess what the function is (e.g., a flower-shaped icon for printing), and some are irrational in relation to his expectations (e.g., clicking left button to go forward). So he has given up using several functions. (1.2)

It also takes time to check over some parts of the video clips at the end of the program. He has to go back to a certain page several times, and he can only do this by clicking the previous-page button several times until he finds the right page rather than by going straight to the page as in a book. It is much harder than using a real book; there is no way to skip unnecessary pages, and it is not easy to remember where a particular page is. (1.3)

Scenario 2: Frustration with the Self-Studying Environment

Kim is becoming very confused about what he is meant to be doing with the package. For instance, he finds an instruction button which explains several listening skills, but there is no way to see the text of the conversations while listening. The instruction says that listening with written scripts of the video clips does not help learners to improve their listening abilities. It sounds like nonsense to him. (2.1)

After studying with the package, he has become familiar with the voices of the native speakers. This makes it easy to understand the conversations. But, it is very hard for him to understand the different voices spoken in the final test of this program. He worries that he might not understand when he speaks with foreigners in the real world. (2.2)

These two scenarios suggest the following design issues and principles. Recall that principles are already resolved questions, whereas issues are open and therefore need to be formally investigated during the prototyping process.

Design Issue 1: How Much User Control?

Scenario one suggests that inflexible systems (paragraphs 1.1, 1.3) are frustrating for users and that users should be given more control over how they move around the system. This degree of flexibility is also consistent with a constructivist, learner-centered approach. But how much control should the user be given? Although Kim is frustrated by the rigidity of the package, might not having too much control lead to other problems? This uncertainty indicates that, at this stage in the design process, control is an issue not a principle.

Design Issue 2: To What Degree Should Students Be Able to Choose Listening Skills?

It is uncontroversial that CALL systems should provide access to a range of different learning strategies and reflect the diversity of the user population. From scenario two, it is apparent that learners should be able to choose any listening skills they want to study or learn all the learning skills directed by the program. However, what if some learners always want to use a certain skill because it is easier to learn but less efficient to improve their listening skills? Should they be forced to consider all or at least a sample of strategies. Again, we have an open issue here.

Design Issue 3: How Could Second Language Learners Cope with the Real World Regarding Voice Differences?

Another question in scenario two refers to whether it is helpful for second language learners to have the opportunity to hear as many different voices as possible while learning. Sometimes it is difficult to understand language samples spoken by different and unfamiliar voices even in one's native language. In order to understand the diverse voices of native speakers in the real world, it would seem desirable to use many different voices on the video/audio clips. On the other hand, using different voices in an application could make learners confused.

Design Principle 1: User Friendliness

The following principles of user friendly design are reinforced by both scenarios (Preece, 1993). These principles would appear to be relatively uncontroversial, hence they are classed as principles.

- control of video clips
  Options to control video clips improve usability. Hence, the means to stop/pause is a critical HCI need (scenario one, paragraph 1.1).
- comprehensible screen design
  Screen design should conform to human expectations (i.e., it should be intuitively meaningful). If not, users could feel confused or frustrated. Therefore, it is important to use meaningful icons and put them in sensible, accessible positions (scenario one, paragraph 1.2).
- error handling
  When learners make errors while studying, the errors should be handled to motivate learners; consequently, pedagogical concerns are paramount. This approach should make learners think they could learn more about the educational domain through solving these problems (scenario one, paragraph 1.1).

ADDRESSING THE DESIGN ISSUES: THE PROTOTYPING PROCESS

As mentioned above, the initial set of design principles/issues was driven by three sources: constructivism, HCI design, and user scenarios. These items were grouped into a number of broad design concepts, the five principal areas shown in Table 1.

Table 1
Top Five Design Concepts

Principal Design Concept	Main Source	Illustrative Issue(s)
The CALL software should provide a learner-centered, problem-solving environment.	Constructivism	How should this environment be implemented in software? Is there a role for teacher-centered methods within this approach? Is giving users full control always the best policy?
A range of listening strategies should be provided.	Constructivism	How should users be encouraged to explore the full range of strategies? Again, how much control should be exercised?
The use of hypermedia should be optimized.	HCI, Scenarios	What facilities are required in relation to the control of video clips: How should navigation be handled?
Exposure to cultural differences should be provided.	Scenarios	How should cultural differences be integrated into the CALL environment?
Exposure to a range of native speaker voices should be provided.	Scenarios	How much variety should be introduced and at which learning stage?

Each concept is classified as to its main source, and one or more unresolved issues are listed for illustrative purposes. For each cycle of the methodology, a subset of high priority design issues is selected, and one or more prototypes is constructed to enable these questions to be addressed in an evaluation workshop.

In this article, we present the results of the first evaluation workshop. This workshop addressed several specific issues relating to all five design concepts. The evaluation focused on three main areas: the degree of control given to users over the learning process, access to the listening strategies, the effectiveness of the interface to the video clips. (The prototype program will be described in greater detail below. In general, it represented an attempt to provide a learner-centered CALL environment featuring a range of listening strategies supported by video clips.)

Of the areas in question during the evaluation workshop, the control issue was the primary one. The degree of user control is a generic problem

in HCI design; striking the right balance between user and machine control is vital to the design of any interactive system (Wastell & Newman, 1996). This issue is particularly important in the domain of educational applications, and has been the subject of a number of research studies in the CALL area (e.g., Robinson, 1989). Control arises in relation to many of the design concepts in Table 1 and is central to the first concept in particular. Constructivists believe that learners build their knowledge by reconstructing their existing knowledge of the world (Glasersfeld, 1996), which implies that users achieve educational benefits more effectively when they have greater control over the learning process. On the other hand, in the traditional teacher-oriented approach, it is believed that learners achieve their educational goals when they follow the guided (or restrictive) learning process transmitted by teachers.

THE FIRST WORKSHOP: USER CONTROL

To investigate the issue of control, two hypermedia-based prototype systems were constructed for the first workshop. One prototype was a high user-control system in which users were free to direct the interaction in any direction at any point; the other permitted a much lower degree of control over the flow of the learning process. These two comparative systems were constructed with ToolBook (version 5.0), an object-oriented, hypermedia authoring environment manufactured by Asymetrix (now Click2Learn). Comparing two software prototypes has much to commend it as a way of making accurate evaluations and clarifying issues. The prototypes were constructed mainly to see whether the high user-control system would provide a more effective educational experience compared to the low user-control version. Each prototype provided 16 different listening strategies (Abbott & Wingard, 1981; Archibald, 1993; Little, Devitt, & Singleton, 1994; Lund, 1991; Oxford, 1993; Richards, 1990; Sheerin, 1987), but the strategies were presented differently in each prototype.

These initial prototypes divided the learning process into three phases: *pre-learning* (instructions and listening strategies using various voices of native speakers), *while-learning* (listening practice with conversations about music in several settings between teenagers), and *post-learning* (enjoyable tests and tasks related to cultural differences). The pre-learning phase was designed to help users to learn how to use the prototypes and to acquire effective strategies to improve listening ability. The while-learning phase consisted of four scenes of a video clip for practicing listening activities. Learners could use any listening skills they wanted in the high user-control system but had to follow a fixed sequence involving a subset of strategies with the low user-control system. In the post-learning phase, learners could check their achievements with two simple tests which were

designed to be enjoyable rather than threatening. Also in this phase, learners could extend their knowledge of the cultural differences between the U.K. and Korea to help them understand the target language more comprehensively. Two short problem-solving tasks were provided for this purpose. In terms of the first design concept, the high control version can be seen as an attempt to realize a learner-centered environment, while the low control can be said to be teacher-centered (see Figures 2 and 3).

Figure 2
High User-Control System

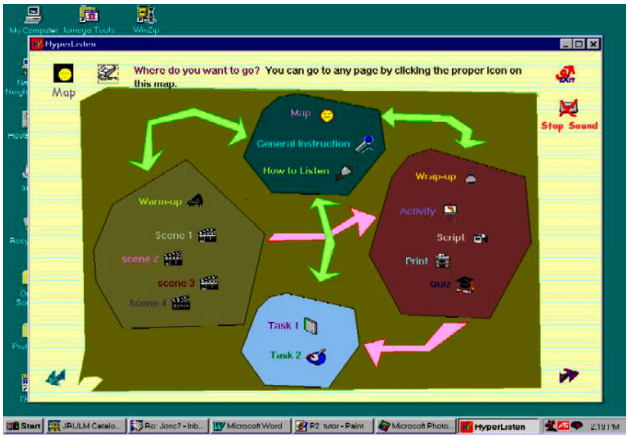
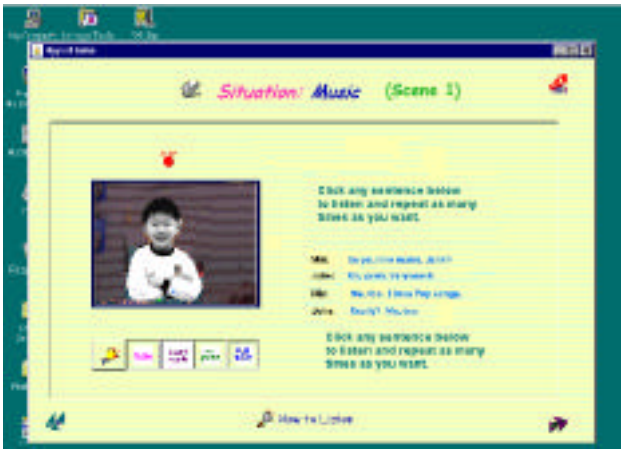


Figure 3
Low User-Control System



In the high control system, the map allows users to navigate the system without any restriction; in the low control system, users have to follow the recommended navigation route. Also, users can choose any listening skills with the high control system while learning, but the low control system only allows users to practice a certain listening skill if they have finished the previous skill provided. The other main difference between the two systems is in multimedia control. Users have full control of video clips with the high control system but only limited control in the low control version.

To summarize, the first workshop involved the evaluation of two prototype systems in order to gain design knowledge in relation to a broad range of issues touching on each of the design concepts in Table 1. With respect to concept 1, it was expected that the comparison would provide empirical evidence concerning the effectiveness of the learner-centered approach and would give general feedback on the best way to implement a constructivist approach in a software-based environment. Regarding concept 2, the presence of 16 different types of listening skills would allow users' choices and preferences for these strategies to be evaluated (e.g., whether they just use a single skill subset). For hypermedia capability (design issue 3), both prototypes incorporated hypertext features to look up vocabulary, a hyperlink to the listening strategies page, and controllable audio/video clips. Understanding cultural differences (design concept 4) is also important to improve learners' listening abilities, so several differences between English and Korean cultures were provided as a set of tasks at the end of the program. Finally, in consideration of linguistic factors, diverse voices of native speakers were used in audio/video clips (design concept 5).

Both prototypes were also designed according to those design principles that we had identified as pertinent and uncontroversial. For instance, the tests were designed to be enjoyable and both systems were designed to handle learners' mistakes positively and constructively so as to reduce stress and discouragement. Accepted principles of good HCI design were adhered to throughout (e.g., meaningful icons and intelligibly laid out screens).

FORMATIVE USER WORKSHOPS

Method

Hubbard (1996) has argued there are four stakeholders in relation to the design of CALL systems: (a) the learner, (b) the developer, (c) the evaluator, and (d) the classroom teacher. In order to represent the interests of the learners and the teachers, and to carry out the evaluation re-

quired by the developers, two panels of users were formed for the first workshop: a panel of learners (eight Korean teenagers [age 12 –15] who had been studying in England for 3 to 12 months) and of four teachers (including two native English teachers). All participants evaluated prototype systems individually under the authors' observation. Half of the participants tried using the high user-control prototype system first, while the others began with the low control system. This balance controlled for any influence from their previous experience of using the prototypes.

Pre- and postsession attitudes towards the systems were assessed using questionnaires. The presession questionnaire asked the users about their computer experience (e.g., games, CALL, and other software), how long they had studied English, and their expectations regarding CALL (whether they expected CALL to be fun, easy to control, useful as an educational tool, effective for studying learning strategies). The postsession questionnaire assessed their level of satisfaction with navigation and the learning experience in general during each phase (e.g., using listening skills, revealing the quiz answers and stimulating learner motivation), and with specific aspects of multimedia control. While the participants were using the prototypes, the entire history of their interaction (keystrokes and mouse clicks) was recorded in log files. Group discussion sessions involving two to four individuals were also held, and the language teachers were interviewed individually. A standardized set of questions for the interviews was used to provide a general structure. However, to allow conversations to flow freely, the questions were not used too rigidly. The questions focused on the main design issues: Did users find high control helpful? Did they find the systems user friendly or, if not, why not? What were their views on the control of video clips? Was the screen design and the use of icons meaningful? Did they find the map helpful and intelligible?

Results

We collected feedback data from three different sources: the log files, the questionnaire, and the discussion groups. At the time of this writing, only a limited analysis of the log files has been carried out. In general, the files showed no statistically significant findings, although several suggestive trends were found. For instance, the log files showed that users spent more time on listening strategies with the low control system than with the high control version. In the former, learners could not avoid the listening strategy page because they had to follow the predetermined learning process. In the latter, users were not required to visit this page.

Figure 4 shows the teachers' satisfaction with each system, and Figure 5 shows the learners' views for the same satisfaction categories.

Figure 4
User Satisfaction Results from Teachers

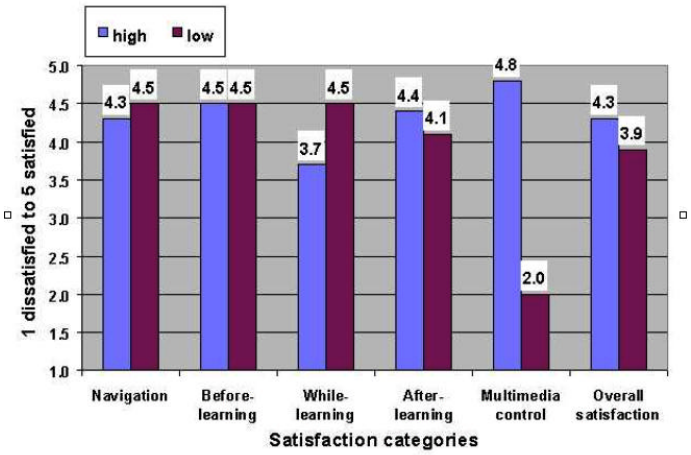
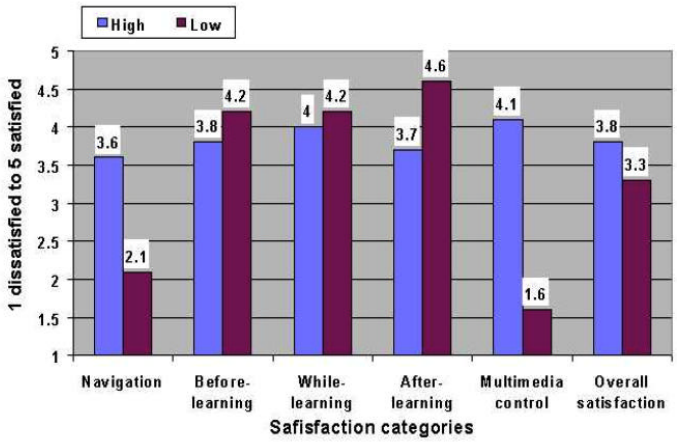


Figure 5
User Satisfaction Results from Learners



An interesting result was that the low control system generally led to greater satisfaction at all stages in the learning process, except for teachers' assessment of the after-learning phase. Although these differences were small, they nonetheless contradict our predictions of a clear advantage for the high control system during the language learning process. For the most part, the participants expressed high satisfaction levels in all categories; they expressed strong dissatisfaction only for low control over navigation (learners only) and for low multimedia control (teachers and learners).

We noticed some interesting disagreements between teachers and learners. While learners preferred the free navigation with the high control system, teachers preferred more guided and restricted navigation. The reason for this difference was that teachers were concerned about students failing to follow what they saw as the logical sequence of the learning process. User satisfaction at the after-learning stage showed another difference between teachers and learners. Although learners wanted more control during the learning process, they were more satisfied at the after-learning stage with the low control system. This result implies that the learners felt greater achievement after learning with restricted navigation. The teachers, on the other hand, were satisfied for both systems, but they wanted more user control on this stage. The teachers indicated that learners should be able to go back to check what they had learned before doing tasks or taking tests. Consequently, they felt that students should be free to navigate during the after-learning phase.

Finally, user feedback was analyzed from the user discussions and interviews. The general view was that although a high control system was a good design aspiration (from both usability and educational perspectives), the low control system was felt to be more helpful for inexperienced learners to become familiarized with the program and for learners whose second language proficiency was low.

DISCUSSION

The results of the workshop can be summarized as follows. Learners expressed an overall preference for the high control prototype. This preference was largely due to what we may call the HCI aspects of the system, that is, the learners enjoyed the freedom to navigate without constraint and to exploit more multimedia control afforded by the high control prototype. In terms of their educational experience, advantages for low control were apparent. For inexperienced learners in particular, the greater structure provided by the prototype was beneficial. Given the widely recognized difficulty of using hypermedia systems, namely the possibility of getting lost or disoriented (Last, O'Donnell, & Kelly, 1998), the disadvan-

tage of using the high control system is that learners can miss important educational points. For teachers, the overall results were similar, but they were generally more critical of the high control system.

In terms of our broad expectations, the results at first sight appear to be disappointing in the sense that a clear advantage did not emerge for the high control system, as might have been argued from both HCI and constructivist standpoints. Similarly, Robinson (1989) failed to find significant advantages for "student" versus "program" control. Control in her study referred to freedom over the selection of menu choices. Robinson argued that students were not able to diagnose their errors when given full control over their progress through a lesson because they appeared to lose time reading and responding to the help menu choices. On the other hand, she argued that high "program" control decreased students' motivation to respond to the educational opportunities afforded by the lesson.

Although the results regarding control seem to be negative, it is important to see the findings in the context of a formative design process. The workshop was not conducted to confirm a strong hypothesis that high control would be superior but rather to determine the *right degree* of user control. Level of control had been identified as a key issue (i.e., an open question), and the workshop was held to advance our understanding of what we knew to be a complex phenomenon. That the findings were, to a degree, contrary to our implicit design philosophy provides a salutary demonstration of the importance of adopting an empirically based, user-oriented approach to design. This is the main message of this article, and the unexpected nature of the results simply reinforces the importance of taking this approach and not founding design on the basis of intuition and prejudice.

The idea of learner controlled environments is a popular one in which the computer functions as a resource to be explored and exploited. However, as noted by Chapelle and Mizuno (1989), few empirical data exist regarding students' actions in such environments. The workshop shows how critical this information is from a design perspective. The findings are very clear and provide a strong indication that the level of user control is not something that can be globally defined but that different levels of control are appropriate to different circumstances. Although it is arguable that there should be a general bias towards greater user control, for inexperienced learners a more teacher-centered mode is clearly preferable in order to provide a stronger overall orientation to the learning experience and to ensure that pedagogical concerns are properly addressed.

Designing CALL systems is a challenging enterprise. As the workshop results show, simple design prescriptions are likely to be naive and simplistic. In the case of user control, the different disciplines bearing on design are partially in conflict. Whereas a concern for usability argues for more learner control, concerns for pedagogy argue for less learner con-

trol. Good design is thus a search for the right balance, and our workshop was of enormous benefit in clarifying this question and in suggesting a better design idea. The solution suggested was to provide a CALL environment with two distinct learning zones: a teacher-centered *tutorial zone* (in which the program presents and explains learning strategies) and a learner-centered *experiential environment* (in which learners make use of the tutorial knowledge to solve problems in a constructivist spirit). This key design idea has been incorporated in our second prototype.

We accept that the outcomes of the workshop are not particularly novel from an educational perspective in that the need for greater structure (depending on context) will not be surprising to educational professionals and theorists. However, the originality of the findings presented here is not the primary point of this article; we wish to demonstrate the importance of taking a systematic approach to designing CALL systems. Only a single cycle of the process has been described. Nonetheless, the workshop provides ample support for our case that the design of CALL should not be based solely on intuitive or theoretical principles but, instead, a blend of theory plus rigorous user-centered empiricism. The workshop confirms the benefits of taking such an approach and shows the contribution that tools and methods from HCI can make to the design of hypermedia-based CALL systems optimized for usability and educational effectiveness.

Scenarios play a particularly useful role in our design approach. The advantage of scenarios is that they provide a readily understandable way (not only for developers but also for users and even for young learners) of visualizing requirements for a not yet realized software system. In this research, scenarios have proved themselves to be of enormous value in clarifying design issues and providing important ideas for the first workshop. A second workshop has recently been held and scenarios played a key role in designing the prototypes for this workshop, drawing together findings from the first workshop together with additional ideas from the literature on CALL(Brett, 1997; Chapelle, 1998; Field, 1998; Lee, 1998; Levy, 1997a, 1997b, 1999). In the second prototype, a tutorial program for listening skills (low user-control) has been combined with high user-control of the main lesson elements. Also, a speaking dictionary has been hyperlinked to offer linguistic assistance. The results of the second workshop are currently being analyzed, and initial findings suggest that major improvements in both usability and in educational effectiveness have been obtained. These improvements provide further validation for our general methodological approach and promisingly suggest that as our design process unfolds, we are steadily building up a core of valuable design knowledge for the development of future CALL systems.

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