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Students' Preferences on Web-Based Instruction: linear or non-linear

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ABSTRACT

This paper reports the findings of a study conducted on a foreign language course at a large mid-west university in the USA. In the study a web-based tool which supports both linear and non-linear learning environments was designed and developed for this course. The aim of this study was to find out students' preferences pertaining to the learning environment and to address the factors affecting their preferences. The results of this study showed that the individual characteristics of the students affected their preferences on the learning path (linear or non-linear).

Keywords

Linear instruction, Non-linear instruction, Web-based course, Individual differences

Introduction

In traditional classroom settings, instructors present information by using a linear model. For example, a video may be shown from the beginning to the end or a textbook is covered from one chapter to the next. Generally, most of the early applications of modern technology were also based on structural and linear instruction through an electronic platform and mainly based on the delivery of course material (Roblyer & Edwards, 2000; Dalgarno, 2001, Simonson & Thompson, 1997). On the other hand, according to Howell, Williams and Lindsay (2003), instruction is becoming more personalized: learner-centered, non-linear and self-directed. Social-constructivist pedagogical approaches have introduced different (active, learner-centered and community-centered) models and pose strong arguments against the structured knowledge consumption approach (Koper & Oliver, 2004).

As Silva stated (1999, p.1.), "The use of technology is important for Second Language courses, more important for Foreign Language courses and even more important in the curricula of the less-commonly taught foreign languages ...". Several studies found that computers have positive effects on teaching language. Stepp (2002) summarized some positive effective benefits of technology for foreign language learners. Research results of Computer-Assisted Instruction (CAI) showed a significant increase in students' scores in both reading comprehension and vocabulary and spelling (Stone, 1996; Kulik, 1994; SIIA, 2000) in the classrooms where computers are used. Students using computer software designed for developing spelling had significantly higher scores than the others (Stone, 1996; Anderson-Inman, 1990 cited in SIIA, 2000). Researchers have found that when students use word processors, they show a higher level of writing skills (SIIA, 2000). Hirata (2004) also shows that native English speakers who used the Japanese pronunciation training tool have improved their overall test scores significantly. However, there are some other studies showing that there were no significant differences between the classrooms using computer applications and those using traditional lecture-based courses (Wilson, 1996 cited in Gilbert & Han, 1999; Goldberg, 1997, Hokanson & Hooper 2000). For example, Cuban, Kirkpatrick, and Peck's study (2001) show that investments in infrastructure and increased access to technology did not lead to increased integration, instead, most teachers remained "occasional" or "non-users" of classroom technology (p. 813). They state that limited time to learn and implement new technology was

considered a serious barrier as well as poorly implemented professional development and defects in the technology itself. In parallel to this finding, Hokanson and Hooper (2000) pointed out that the expanded use of computers in education continues despite research having failed to accrue definite benefits in learner's performance. According to Gilbert and Han (1999), the main reason for finding no significant difference between the traditional education system and the system using technology is the instructional methods. Barker, Giller, Richards, Banerji, and Emery (1993) reported that early implementations of computer-assisted language learning (CALL) also had several limitations. They were mainly built on text-based instruction with very limited end-user interaction and participation.

For some researchers, presenting the information in a linear form was not a problem when the information being presented is well structured and simple. Often, however, as the difficulty of the material increased so did the lack of structure. When the knowledge domain to be taught is complex and ill structured, the use of traditional linear instruction becomes ineffective (Spiro, Feltovich, Jacobson, Coulson, 1991). In that context Barker (1997, pp 5) states that:

> *... for one reason or another, many academic organizations are now therefore exploring the possibilities of using these new technologies to support student-managed, self-study activities in a more extensive way than they have in the past.*

However research findings on learner control have proven contradictory. Some findings show learner controlled environments lead to higher performance, whereas others show no significant difference, or even that instructor or program controlled systems work better. These findings illustrate that although learners' control over the learning environment is important to improve the learning process, there should be some factors affecting their learning and preferences in such an environment.

The existing studies outline the trends in the evolution of CALL and the development from the perspective of pedagogy and language learning (Warschauer & Kern, 2000), however more research into CALL is needed (Chambers, 2001; Davies, 2001; Levy, 2001). CALL assists language learning and is intended to enhance the way in which a language is taught and learned (Decoo, 2003). Decoo (2003) summarizes some of the levels of language teaching methods such as the label method, program method, textbook method, teacher method and student method. Decoo (2003) conclude that CALL is used to strengthen and improve these existing methods. As Chan, and Kim reports (2004), there is a shift in the second language curricula from declarative knowledge or "what we know about" to procedural knowledge or "what we know how to do". This causes a greater emphasis on learners' learning process (Chan, & Kim, 2004). They believe that, appropriate use of suitably designed Internet-based materials can make a significant contribution towards facilitating autonomous learning (the ability to take charge of one's own learning) (Chan, & Kim, 2004). Accordingly developers now try to design interfaces that give learners more autonomy (Lonfis & Vanparys, 2001). They also claim that any foreign language curriculum that aims to promote autonomy must focus on putting learners in control of their linguistic and learning process (Chan, & Kim, 2004). However there is very limited research which examines students' preferences and performance in such a learner controlled learning environment.

In this study, a web-based tool was designed and developed for an entry-level foreign language course, which supports both linear and non-linear learning paths. The aim of this study is to find out students' preferences regarding learner controlled environments and address the factors affecting these preferences. The next section examines the factors affecting students' preferences regarding learner controlled learning environments. Different instructional approaches such as direct instruction and indirect instruction are also discussed in this section. In the third section, the research method is discussed. The fourth section reports the results of this study while the final section presents the conclusions and discussions of the current study.

Background

This section tries to investigate the factors affecting students' preferences in a learner controlled environment. It also gives a brief explanation of direct and indirect teaching.

Factors affecting students' preferences on a learner controlled learning environment

Individual Differences

One prominent theory of individual differences is Howard Gardner's Multiple Intelligences. Gardner suggests that all people have varying degrees of innate talents developed from a mixture of biological factors, evolution and culture (Gardner, 1983). Each intelligence represents an area of expertise with a specific body of knowledge,

as well as a way of approaching learning in any domain. Students may experience new ways of expression, helping them individually, to understand multiple perspectives. In parallel to Gardner's theory (1983), studies on learning and information processing suggest that individuals perceive and process information differently (Hitendra, 1998). According to Gilbert and Han (1999), how much individuals learn is related with the educational experience geared toward their particular style of learning. Mcmanus (1997, p1) argues that:

> *One of the great promises of computer based instruction is the idea that someday the instruction could be adapted to meet the specific needs and styles of individual learners, thereby enhancing their learning. In order for this to happen, educators need to know which instructional and presentation strategies, or combination thereof, is most effective for individuals with certain learning styles and differences, in a given learning environment.*

Hitendra found that, certain cognitive styles might suit certain types of test tasks (1998). Cho also found that individual learning styles and preferences are presumed to affect the moment-to-moment selection of options in non-linear learning environments (1995). For example, several studies showed that the field-independent (FI) learning style seems to facilitate understanding the structure intended by the designer of the instruction more than those with a field-dependent (FD) style (SIIA, 2000). Kelley and Stack found that learners having an external locus of control usually tend to perceive reinforcements from other people (Kelley & Stack, 2000). According to Kelley and Stack, people with an internal Locus of Control (LOC) seek more control over life's circumstances, and like to have more personal responsibility for outcomes (Kelley & Stack, 2000).

Age

Additionally, there is some evidence to suggest that the age of the learner may be an important variable in learner control. Shin, Schallert and Savenye (1994) indicated that students (seven or eight years of age) who were given only limited access through a hierarchical hypertext structure answered more questions correctly in the post-test than students in the free access network hypertext structure. Hannafin (1984) concluded from a review of the relevant research that learner control compared with program control is likely to be most successful when learners are older.

Gender

Research studies also show that gender is an effective factor on learner control. For example Knizie et al. (1992) found that the use of a program controlled environment resulted in better post-test performance for male students. Similarly, Braswell and Brown (1992) show that in interactive video learning environments females had a better performance than the males.

Student's prior knowledge and familiarity with the material

Research studies also show that a student's prior knowledge and familiarity with the material to be learned and the subject domain to be learned are the factors affecting students' success in a learner-controlled instructional environment. For example, students whose prior understanding of a topic is low should be provided with more structured information whereas students whose prior understanding of a topic is high can be given more control over the instructional system (Gay, 1986). According to the findings of Charney, students who are new to the subject domain and non-linear learning systems may sequence the information poorly or omit important information altogether (1987). Cho reports that learners make poor decisions about what to study and in what order (i.e., selecting links) because they have insufficient knowledge about the new content (1995).

Therefore, students vary in their cognitive or learning styles and would benefit from teaching techniques that appeal to their individual styles (Brown & Liedholm, 2004). By providing several different instructional methods, the use of technology in education will significantly improve educational performance (Gilbert & Han, 1999) and web offers a rich environment for this purpose. Accordingly, as Internet technology is improved, Gardner's theory has gained more popularity. The web offers a variety of instructional materials that could be incorporated into effective learning environments.

Direct Teaching (Teacher Instruction)

Direct teaching or direct instruction is a systematic way of planning, communicating, and delivering in the classroom. This method provides the students with strong structure that helps them to concentrate on their academic task. The direct instruction approach assumes that all students learn at the same speed and at the same way. The role of the learners in direct instruction is to stay on the task and perform. In this context program controlled learning environments are considered to be "direct instruction".

Indirect Teaching (Indirect Instruction)

Indirect instruction is mainly student-centered. Indirect instruction seeks a high level of student involvement. It takes advantage of students' interest and curiosity. It is flexible in that it frees students to explore diverse possibilities. Students often achieve a better understanding of the material and ideas under study and develop the ability to draw on these understandings. The current interoperability specifications have to be extended to include the multi-role interactions and the various pedagogical models that are needed to provide real support for learners and teachers in more advanced and newly developing educational practices. In our study, the learner controlled environment of the tool is considered as being "indirect instruction".

Several research efforts have shown that computer programs offer students greater control over their learning environments and have beneficial effects on students (Shoener, & Turgeo, 2001; Wooyong & Robert, 2000; Hargis, 2000; Kemp, Morrison & Ross, 1994; Hannafin & Sullivan, 1995; Shyu & Brown, 1992; Santiago, & Okey, 1992; Knowles, 1975). According to Schank students should control the educational process; not the computers (1993). In order to increase the learner's control over the learning environment, organizing the instruction in a non-linear manner becomes important. In such an environment students have a higher degree of freedom regarding the method of study and the study material.

However, there are studies showing that some students do not succeed in learner-controlled learning environments. For some it is hard to make decisions about what to study and in what order. They may have trouble in monitoring their own learning (Cho, 1995). In support of this, the findings of McNeil's study (1991) show that a learner-controlled program is less effective than a computer controlled program in CAI at the elementary level. According to McCombs (1988 cited in Sleight, 1997), since students don't know how to use strategies in a non-linear learning environment, they are having adjustment problems. Chang (2003) found that teacher-directed CAI was more effective in improving students' achievement than student-controlled CAI, given the same learning content and overall learning time. Results from this study also revealed that students in the teacher-directed CAI group showed significantly more positive attitudes toward the subject matter than did those students in the student-controlled CAI group (Chang , 2003). According to Ellis and Kurniawan (2000) the flexibility in non-linear learning paths may increase complexity.

Method

This study was not designed to examine the effect of the web-based tool on students' learning, instead its purpose was to reveal some factors effecting students' preferences pertaining to linear and non-linear learning paths. In this sense, the tool for this study was designed and developed to support both linear and non-linear instruction.

By addressing the factors that affect students' preferences in this environment, the study also aimed to guide other research studies to gain further insight on the different behaviors of the learners. Accordingly the following factors were analyzed:

(a) Individual differences among the students (age, gender, preferences on instructions (preferring teacher-based instructions (direct instruction) or self-paced learning (indirect instruction)), perceptions on problem solving (whether they are a good problem solver or not) and their learning preferences such as visual and audio)
(b) Student's prior knowledge and familiarity with the material (e.g. computers, computer experience, familiarity with windows-based applications and their backgrounds)

This qualitative case study focuses on the perspectives of the participants of the study in order to uncover the complexity of human behavior in such a framework and present a holistic interpretation of what is happening in this context. As McMillan & Schumacher (2001) advocate case studies focus on phenomenon ". . . which the researcher selects to understand in depth regardless of the number of sites or participants" (p.398). Qualitative

case studies also yield to better understanding of abstract concepts as this is the case for this study. Therefore, in this study the critical point is not the number of subjects but the depth and the quality of presenting the subjects' learning experience with the system.

The Course

This study was conducted on an entry-level Turkish language course at a mid-west university in the USA. Turkish is a less-commonly taught foreign language in the USA. This course is offered as an elective for students with different backgrounds. The number of students registering in this course in each semester is usually very limited. Turkish instructors whose native language is Turkish, but who have no formal language education offer these courses. Accordingly, the instructor turnover rate is very high. Additionally, new instructors sometimes need additional information and sources to prepare the lectures and to find out the answers for some of their questions.

The course was organized in the form of 45-minute lessons five days a week. In general, on Mondays the instructor would introduce the topics, on Tuesdays she would introduce the grammar issues related with that lesson, the next day she would do different exercises related with the topic, on Thursdays she would introduce some songs, audio-visual materials related with the topics and finally on Fridays she would help the students in group exercises. The course instructor also organized after-school conversation hours every three weeks. The students were free to attend these conversation hours. For these after-school conversation hours, the course instructor invited some people interested in talking Turkish, to help students communicate with native Turkish language speakers while talking about topics related to daily life.

The Tool

In this study, a web-based learning tool was developed for the entry-level Turkish language class (available at http://clio.dlib.indiana.edu/~ncagilta/tlepss.html and http://www.princeton.edu/~turkish/practice/tlepss.html). Several different forms of instruction such as sound, image and text were also provided. The contents of the tool were all adapted from the course textbook. The first unit of the course textbook bound the scope of this study. The contents of the tool were also enhanced with some sound files. There are 480 sound files in the system. The contents of the tool were fostered with some pictures (images) as well. Most of the images used for the lessons and examples were taken from Microsoft's clip art gallery (Microsoft, 2000). 307 images were used for this system. To assist the students in different applications, some tools such as text boxes, simulated Turkish keyboards, and indexes were also provided within the tool. The tool includes some instructions, examples and exercises. In Figure 1 an example page is shown.

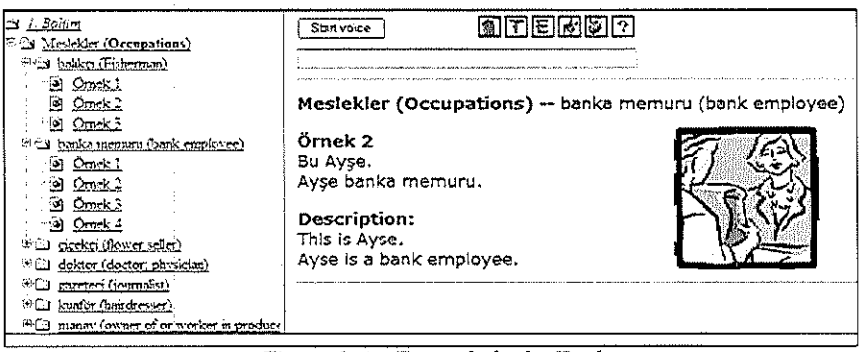

Figure 1. An Example in the Tool

The tool was designed and developed to support both linear and non-linear instruction and several practice alternatives.

Non-linear instruction

Non-linear instruction was provided through the Indexes (organized as Turkish or English) (Figure 2) to help students to select any topic from indexed list, to initiate their own learning and direct it. Students may choose to select and study a concept, or go through the instruction and the examples using the index.

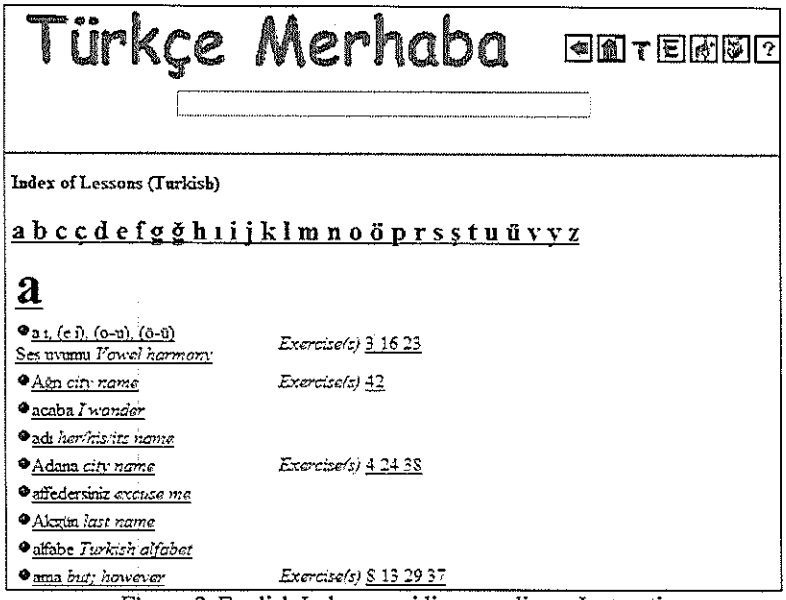

Figure 2. English Index providing non-linear Instruction

Linear Instruction

Linear instruction was provided through the main menu shown in Figure 3. In this menu, the content is organized in the same order as introduced in the classical classroom environment. Students may follow the instructions in this linear order.

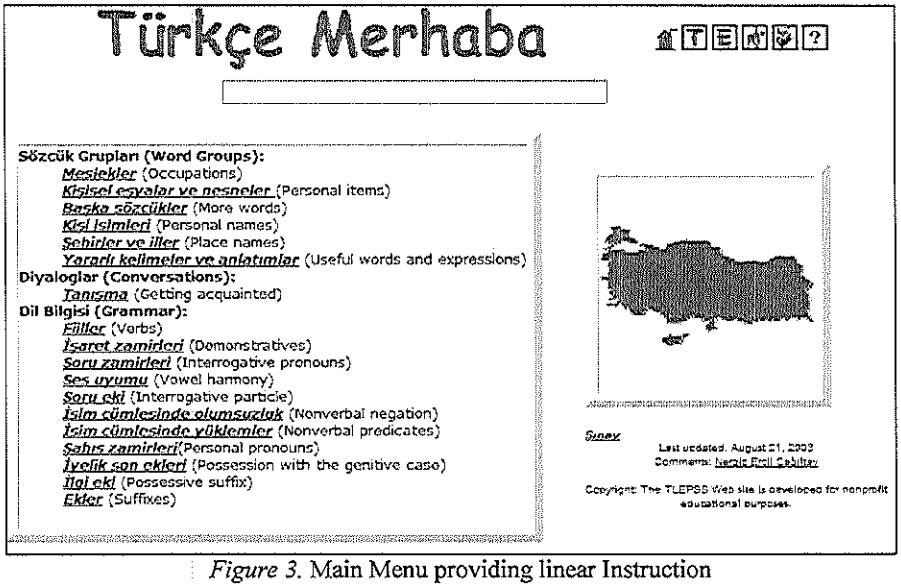

Figure 3. Main Menu providing linear Instruction

Data Collection

The actual data collection process for this study was conducted during the first six weeks of the semester. The content of the tool covers the first three weeks of the course. At the beginning of the semester an orientation session was organized to introduce the main purpose of the research and how to use the web-based environment.

Afterwards, students used the tool in parallel to their regular classes. The tool was not used during the classroom activities; rather students were provided with a CD version of the tool and were also able to access it via the Internet. During this period, students were asked to use the tool whenever they needed help. They had

opportunities to choose any subject within the tool and study it, or practice a chosen subject. In this sense, students had to decide when to use the tool, how long to use the tool and how to use it according to their preferences. They had opportunities to repeat sounds, lessons and any activities in the tool whenever they needed help. After three weeks, an interview was conducted with each student in the classroom and with the course instructor.

After the individual interviews, an observation session was also conducted with each student. During the observations, each student was asked to use the tool as if they were alone. The observer recorded each step that the student followed. The observation sessions took approximately half-an hour. The main purpose of the observation session was to find out the students' preferences regarding the tool and to investigate their preferred learning path (linear or non-linear). These interviews and observations were all conducted within five days.

During the second half of the six week period, students followed the lessons without the support of any specific web-based tool designed for these lessons.

After this three week period, the next round of interviews was conducted with the students and the course instructor to obtain comparative feedback on the benefits and weaknesses of the tool. These interviews were all conducted within three days.

During the first and the second interviews several questions were presented to the students and the instructor to get a better view regarding the major variables analyzed in this study. During the interviews with the course instructor, a different session for each student was conducted.

Students

There were ten students in the classroom. For the sake of anonymity, each student was assigned a different code, such as S1 and S2. Students were from different age groups and had different backgrounds. Meanwhile, there was a wide range of distinction among their preferences and their expectations during the learning process. Only S4, S5, S6, S8, S10 were a little familiar with the Turkish language because of a Turkish person whom they knew. The others were not familiar with the course content at all. There were four male students in the class; only three students had very low computer usage but not much familiarity with the web-based applications. Five students preferred to study by themselves (self-study) while others preferred to have teacher instruction. Tables 1 & 2 summarize students' profiles. All the data shown here was collected by means of interviews and observations, as mentioned in the data collection section.

Table 1 Students' Profiles (I)

Code	Age	Gender	Problem Solving?	Studying with teacher/ self-studying	Learning preferences
S2	25	M	Good	Self	Visual learner
S3	21	F	Not good	Self	Learning by listening
S4	53	F	Not good	Self	Learning by writing and repetition
S7	25	M	Pretty good	Self	Audiovisual,
S10	18	F	Good	Self	
S1	42	M	Excellent	Teacher	Drill-and practice, hands on, strode it on the board, do the exercises, verbalize it
S5	25	M	Very Good	Teacher	Learning by talking.
S6	50	F	Good	Teacher	Group learner, learning with traditional methods, Writing, talking and reading.
S8	22	F	Good	Teacher	Watching, writing, talking and listening
S9	61	F	Good	Teacher	Talking and listening, learning with traditional methods

F: Female
M: Male

The students' learning preferences were different from each other. Some students preferred to learn by drill & practice and doing exercises. On the other hand some students preferred visual illustrations. This group felt that visual illustrations helped them to learn easily and remember what they had learned.

Table 2 Students' Profiles (II)

Code	Likes Computers?	Computer experience (years)	Familiarity With windows based applications	Background
S1	Not always	30	Very high	Central Eurasian Studies
S3	Very much	3	Very high	Computer Information Systems
S2	Very much	8	High	Criminal Justice
S7	Yes, but cannot sit in front of a computer for several hour	19	High	Law, Mathematics
S8	A lot	10	High	Biology
S4	Yes	3	Middle	Psychology
S5	Very much	3	Middle	History
S6	Yes, but cannot sit in front of a computer for several hours	10	Low	Educator
S9	Not very much	16	Low	MS on education
S10	Not very much	3	Low	Chemistry
	Average	10		

Limitations of the study

Since the tool developed for this study is not a professional one, it has some limitations in the sense of the content included and user interface issues. Additionally, only ten subjects participated in the research.

Results

In this section, the data collected for this study is presented to provide evidence for the students' preferences on the provided environment. Thus, first how students used the tool was analyzed. Then, students' preferences pertaining to linear and non-linear types of instructions, according to their individual differences and their background regarding the environment were analyzed.

How students used the tool

Results indicated that, each student used the tool in several different ways. While some of them preferred linear instruction, others preferred non-linear instruction. One student who preferred to use the tool in a non-linear order stated that:

> *If the teacher gives me a specific example, I go through the assignment; otherwise, I try to find the topic that we are learning in class and I study the topic simultaneously on the computer with the class. ... I liked to use the system interactively. My preference was going through the index and looking for the specific things there. If I found something interesting I would explore it...*

Similarly, in that context another student stated that he used the tool in a non-linear way to get a better view about the tool. He also stated that, if it was like an exam, he would prefer to use it in a linear order. He stated:

> *I like to play with things first and then when I get tired I go through each. I kind of experiment with it first and then go through each item randomly. But for an exam it helps to have it in linear, run through it from the beginning to the end.*

However, one student stated that, in some cases she preferred the linear instructions where some other cases she preferred non-linear instructions. She stated that:

> *I liked to search through the content independently. I liked to study the tool by using the indexes. But, I preferred to look at different Turkish books while studying grammatical components, instead of studying it through the tool. I believe that manual methods work better for me while studying grammar.*

With regard to this issue, one student stated; even though she preferred non-linear instructions, she liked seeing linear and non-linear instructions together:

If everything had been designed in a non-linear form, it would have been like a dictionary. Having the structured menu is very helpful. I preferred the dictionary part mostly, but I also liked seeing the content of unit one, and sometimes I went through it. After I studied the first unit, I wanted to come back to Main Menu. But if everything had been just like in the dictionary, it would have been harder.

On the other hand, some students preferred only the linear instructions. One student stated that:

I just started from the Main Menu, then I clicked on each one, I kind of way down the list, I did not get a chance to do the exercises in the book, but I worked the exercises on the CD.

Another student who liked linear instructions reported that she followed the instructions in the book, and then went through the CD:

I like some linear instruction because I am not trained completely [to be an] independent learner. The younger generation [is] yes. So I need some instruction. But I can do a little bit of independent searching. I just need practice.

While some of the students preferred mostly to study the lessons, others did the exercises. Some of them used the tool on a daily basis after the lessons whereas others preferred to use it during the weekends. Most of the students studied the lessons from both the tool (web-based environment) and the course textbook. Only one student preferred to study the lessons from the web-based environment and not to use the textbook at all. Some students preferred to use the tool by reading the instructions and studying the examples. Some students preferred to study by means of exercises and went through the instructions as necessary.

All students reported that they used the tool easily. All students found the user interface easy to use, easy to learn and self-explanatory. They said they could easily reach the answers of their questions using the tool. However, S6 reported that she encountered difficulty while studying the lessons using the tool. For example she needed some help from other people while using the tool, but when she needed help she could not find anybody. Additionally, while she was using non-linear instruction she was lost in the application. She reported,

I should have followed the book but I did different things on the CD. So, I was lost on the CD. I blindly clicked on this that and was lost in the computer.

As the course instructor describes, the technology is not her (S6) favorite. The course instructor declared that she helped S6 in using the tool 4 or 5 times in the computer laboratory. She added that other students did not ask for help. The instructor reported that,

Sometimes she becomes intimidated because technology is something that she is not familiar with. It took some time for her to get used to the technology. After she got used to it, she liked it. But still technology is not her favorite thing. She likes studying by traditional methods. For this reason we study together with her to correct some mistakes in her homework. She prefers studying by writing, speaking and grammar; it is her preference.

Individual differences

According to the course instructor, using the tool in conjunction with the course curriculum improved classroom performance. She believes that the individual differences among students affect the classroom's performance:

The individual differences among students affect class performance seriously. In general freshmen are better in audio than the more senior students whereas the more senior students usually have problems in hearing the words and understanding the words in an audio exercise. If the students' individual characteristics and their preferred ways of learning of in the classroom are similar, then they can become more active in the classroom [and] learn a lot. They are motivating each other as well as helping each other. If these individual characteristics are not similar, then I need to spend more time to building a common instructional style, which will be helpful for all [/most]of the students in the classroom. Most of the time, this also affects the general classroom performance. For example, sometimes, some students distract the others by asking a lot of questions and by not following the common preferred way of learning of the classroom.

According to the course instructor, when students used the research tool, they were more prepared for the lessons. She did not spend much time on repeating those lessons. The instructor also reported that, students did not ask as many questions during the lessons in parallel to the tool as during the other lessons. She believes that

students found answers for most of their questions from the tool. Using the tool was time saving for the course instructor as well and she gained more time to organize her lessons and do other activities in the classroom.

Students' preferences on the provided environment were analyzed according to the data collected by means of interviews and observations. Accordingly, Table 3 and 4 summarize students' preferences on the linear and non-linear ways of using the tool in the sense of individual differences.

Table 3. Students preferring linear paths of instruction

Code	Age	Prefers teacher or self-study	Problem solving	Preferred way of learning	Gender
S10	**18**	**Self**	Good		Female
S8	**22**	Teacher	Good	Watching, writing, speaking and listening	Female
S6	50	Teacher	Good	Group learner, learning with traditional methods, Writing, speaking and reading.	Female
S4	53	**Self**	Not good	Learning by writing and repetition	Female
S9	61	Teacher	Good	Talking and listening, learning with traditional methods	Female
Average	41				

Table 4. Students preferring non-linear paths of instruction

Code	Age	Prefers teacher or Self-study	Problem solving	Preferred way of learning	Gender
S1	**42**	**Teacher**	Excellent	Drill-and practice, hands on, strode it on the board, exercises, verbalization	Male
S5	25	**Teacher**	Very Good	Learning by speaking	Male
S7	25	Self	Pretty Good	Audiovisual	Male
S2	25	Self	**Good**	Visual Learner	Male
S3	21	Self	**Not Good**	Learning by listening	**Female**
Average	28				

Age: In this study, "age" was a factor affecting students' preferences on selecting the linear or non-linear paths in the tool (Table 3 and 4). For example, the average age of the students who preferred linear instruction was 41 where the average age of the students who preferred non-linear instruction was 28. In this context, during the interviews the course instructor said that "age" is an important factor affecting the way how students learn a language. She further reported:

> *"Age" is also an important factor, not personally how old they are but when they learn a language, what system they use, what materials and techniques they use. So, when I say subject pronoun, the older students know what I am talking about. But I have to introduce these terms for the freshmen because they did not learn it that way. Similarly when I give them an Internet exercise, the freshmen can use it easily, but I have to spend hours with the older ones.*

Accordingly, while using the tool, mostly the students belonging to the younger generation (S2: 25 years old, S3: 21 years old, S5: 25 years old, S7: 25 years old) preferred to use non-linear instruction. On the other hand, the more senior students (S4: 53 years old, S6: 50 years old, S9: 61 years old) preferred to use linear instruction in the tool.

Gender: All male students preferred to use the tool through non-linear instruction. Only one female student (S3) preferred to use the tool through non-linear instruction.

Preferred way of learning: Students who preferred to use the tool through linear instruction (S4, S6, S8, and S9) preferred the following ways of learning: writing, repetition, watching, group-learner or traditional learning methods. Other students who preferred to use the tool through non-linear instruction (S1, S2, S3, S5 and S7) preferred the following ways of learning: Drill and practice, visuals, listening, speaking and audiovisuals.

Teacher or self-study preferences: Most students who preferred self-study (studying on their own) (S2, S3 and S7) also preferred to use the tool through non-linear instruction. On the other hand, other students who preferred studying with the help of the teacher (S6, S8 & S9) also preferred to use the tool through linear instruction.

Perceptions on Problem Solving Capacity: Most students who preferred non-linear instruction described their perceptions on their problem solving capacity as very good, pretty good, or excellent (S1: excellent, S5: very good, S7: Pretty good).

Prior knowledge and familiarity with the material

Tables 5 and 6 summarize students' preferences on the linear or non-linear way of learning with the tool according to their prior knowledge and familiarity with the material. Since they were not familiar with the course content before entering to this course, students' prior knowledge on the course content will not be discussed here.

Table 5. Students preferring linear paths of instruction

Code	Familiarity With Window Applications	Likes Computers?	Computer Experience (years)
S8	**High**	A lot	10
S4	Middle	Yes	3
S6	Low	Yes, but cannot sit in front of a computer for several hours	10
S9	Low	Not very much	16
S10	Low	Not very much	3
	Average		8.4

Table 6. Students preferring non-linear paths instructions

Code	Familiarity With Window Applications	Like Computers	Computer experience (years)
S1	Very High	Not always	30
S3	Very High	Very much	3
S7	High	Yes, but cannot sit in front of a computer for several hour	19
S2	High	Very much	8
S5	**Middle**	Very much	3
	Average		12.6

According to these results, only the familiarity with windows-based applications was an effective factor on students' preferences. We could not find any relation between liking computers or not and their computer experience.

Familiarity with window-based applications (FWWA): All students (except S8), whose FWWA is low or middle, preferred the linear learning path. Other students (except S5), whose FWWA is high or very high, preferred the non-linear learning path.

Classroom Performance: Although this study is not organized to investigate the effect of the tool on students' or classroom's performance, according to the course instructor it improved the classroom performance. She reported that she did not spend much time on repeating those lessons included in the tool. According to the instructor, students did not ask as many questions during the lessons studied parallel to the developed tool as in the other lessons. She believes that students found answers for most of their questions from the tool. She declares that using this tool was also time saving for her: she gained more time for organizing her lessons and doing other activities in the classroom. According to the instructor, this tool helps students to study on their own:

> *They [students] can study on their own, or study with the tool. It [the tool] will also, perhaps help develop a skill on using other technological tools, to learn a language. Again, you make it for them more fun and easer. [It helps] most of them to study on their own, so they are not always dependent on the teacher. So, upon that point of use, it is [the tool] very useful.*

Computer Experience: The average computer experience of the students who prefer linear path of instructions (8.4) is slightly lover than that of who prefer non-linear path of instructions (12.6).

Computer Affinity: Most students who prefer the non-linear path of instruction like to use computers very much (S2, S3, S5). The students who do not like to use computers (S9 & S10) also preferred the linear path of instruction.

Discussions and Conclusion

The results of this study underlined that the learners' preferred learning path (linear or non-linear) depends on their personal characteristics such as their age, perceptions on problem solving, teacher or self study preferences, familiarity with the windows based computer applications, gender and preferred way of learning.

Earlier studies show that young students of age 7 or 8 are more successful on structured learning materials (Shin, Schallert, Savenye, 1994). Also, learner controlled programs are more successful than the program controlled when the learners are older (Hannafin, 1984). In our study, we have found that older students of age around 40 also prefer linear and more structured instruction. However middle age group students of age around 20-30 usually prefer non-structured and non-linear instruction. This shows us that while younger students and older students prefer more structured and linear way of learning, middle age group students prefer non-linear way of learning.

We believe that, such tools can be used in the or outside the classroom to support current methods of instructions. The following section offers recommendations for instructors, designers and for further research.

Implications for the Instructors

Since students' preferences on the learning path of instructions (linear or non-linear) differ, it is not always possible to provide an appropriate method for each student in the classroom. In such cases, the instructor has to choose a method which is common for most of the students. Accordingly, technological tools providing several different alternative ways of instructional methods could help to guide students according to their individual preferences.

Implications for Further Research

The factors analyzed in this study need to be evaluated in other learning environments with a different group of students. For example, learners' familiarity with the most recent technological innovations and older technological applications should be analyzed as separate factors to get a better understanding of the design issues for such tools.

Implications for the Designers

The studies carried in the last 20 years showed that older students benefit most from the direct instruction (Volet, 1995). In our study even the average computer usage score of students is 8.4 (Table 5), still the older students preferred direct instruction and they preferred to follow a linear path of instruction. Additionally, the students who have preferred non-linear path of instruction were more familiar with the windows-based computer applications. This shows that the students are not always well prepared for the new technologies, since technological developments occur very rapidly. This could be a big barrier for adapting technology into the traditional educational systems. In order to handle this problem, while designing new instructional systems, involving both the previous technologies and the current new technological approaches at the same time could be helpful. For example, in our study, we have found that individual differences among the students affect their preferences pertaining to linear and non-linear paths. The linear way of learning is more traditional. In that sense, it is not always easy to move learning from linear to non-linear organization. In order to benefit more from the non-linear way of learning and to ease students' transition between these approaches, providing both methods at the same time and leaving the choice to the learner could be a good strategy. Such an approach helps students to

go between these two approaches and to get use to the non-linear instruction. This approach could be applicable to any instructional tool involving more recent technologies.

In our study we could not find any relation between students' previous knowledge on the course content, if they liked working with computers or not as well as their computer experience and their preferences on linear and non-linear instruction. Additionally, these factors need to be tested in other research studies, and further the results of this study need to be supported by other qualitative and quantitative research.

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