ARABIC SELF-LEARNING: A Module of a Recearch-Based Computerized Curriculum [1]

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ABSTRACT: *Research-based, computerized curriculum, metacognitive learning*
*   We discuss a research-based, computerized curriculum in Arabic. Self-Learning of Arabic as a foreign language (AFL) at the college level is presented as one module of this curriculum. Computer simulation of communicative and structural Arabic are intended to facilitate metacognitive learning or higher order thinking of Arabic and Arabic language learning strategies.*

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Arab Women's education.

I. INTRODUCTION

Ziadeh and Winder (1957:20) wrote: "The most characteristic feature of the Arabic language is that the great majority of its words are built up from (or can be analyzed down into) roots each of which consists of three consonants or radicals.   By using these radicals as a base and by varying the three vowels and adding prefixes, infixes, and suffixes, according to certain patterns, the actual words are produced."

A team of computer scientists, linguists, and Arabists at the Higher Institute of Applied Sciences and Technology (HIAST) in Damascus, Syria have capitalized on this feature of the Arabic language, namely the root system, and developed a computerized knowledge base for Arabic language as a first step towards building an "Expert System of Arabic." [2] They have, so far, created both, the data-base for lexical structures (dictionaries) and the rules for Arabic morphological and syntactical structures.   These structures are part of a knowledge base for a potential Expert System of Arabic and, hence, we refer to them as "ESA knowledge base" or "ESA." [3]

ESA is utilized in this project to develop computerized curriculum with Arabic as the environment. This curriculum proposes a paradigm shift for both language learning and acquisition, and computer assisted instruction (CAI). It places the learner at the center of the curricular process and the computer as the medium of the curricular design. The goal is to relief Arabic learners from the "traditional" focus on grammar (structure or form) and from the present dichotomies in foreign language learning and Arabic as a Foreign Language (AFL), in particular.   Alosh (1997:2-8) summarizes these dichotomies as sources of tensions: innovation vs. regularity, written vs. Oral/aural material, learners' latitude vs. Teachers' lock-step expectation, and structural vs. functional techniques.

We have considered these tensions and other issues related to CAI, and grouped them under the five determinants of Arabic computerized curriculum listed below. The focus of this long-range project is how computer simulation of natural Arabic settings may aid learners in consciously sailing through these tensions and issues. The immediate objective in this paper, however, is how computer may aid learners' acquisition and transfer of higher order thinking and language skills or, as Lantolf & Appel (1994) suggest, to enhance a conscious learning process of Arabic.

Another goal of the project that is discussed elsewhere [4] is how computer simulation may aid, and be informed by the human learners, instructors, researchers, curriculum developers, and knowledge base builders in formulating a new paradigm for computerized curriculum in the Arabic environment. Shahri et al. (1997:442) discuss how Neuro-Fuzzy Compliance control may capture the non-linear, complex physical phenomenon, such as compliant motion by observing the actual human

physical motion at each step of a task. They call this process, "the ability of skill acquistion [by the artificial intelliegent control] from human expert." The aim of this

project is to maximize this exchange in human and artificial intelligent interaction for more consciounsous learning.

In this computerized curricular design, simulations and scenarios, in Di Pietro's words (1987), are used for language learning and teaching, and, hence, are the base for learners' interaction with the contents and the structure of Arabic as a system. We do recognize that computer simulation and expert systems do not capture, what Clancey (1997:3) calls, the "situational knowledge or cognition." That is why we are proposing a paradigm shift in language learning and Computer Assisted Language Learning (CALL). In our paradigm, we maintain the interest, as Clancey suggests, in the "collection of facts and rules in an expert system," and capture the "full flexibility of how perceptions, actions, and memory are related in the brain." We call this collective, integrated process a metacognitive learning, moving beyond the behaviorists stimulus-response process that relies on teaching grammar and vocabulary (see Figure 1).

The learning structure in this curricular design combines both some principles of computer-assisted instruction (CAI) with the intelligent tutoring system (ITS) in a principled way.   Although provide interaction-centered structure, available CAI models alone do not allow for learner's flexible interaction since they largely rely on pre-determined input and consequences.   In addition, CAI models generally assume the behaviorist stimulus-response learning approach, while computer-based curricular design requires careful theoretical and methodological analyses similar to what was outlined by Gay and Mazur (1989). Conversly, though ITSs provide knowledge-centered structures, they alone do not allow learner's perceptual input.

We begin by introducing the research project, explaining the five determinants and summarizing the emperical study that informed the evolution of the research-based computerized curriculum of Arabic.   The first application of this curriculum is the interactive multimedia AFL module, "Arabic Self-Learning."

Second, we describe how the basic character of the ESA system lies in the fact that its algorithmic, computerized lexical, analytic and derivative parts are linguistically based on the Arabic root system , and how this is especially beneficial to the AFL learner.

Third, since the learner is the center of the curricular process, we discuss how the process of building the Arabic Self-Learning prototype allows for interfacing with ESA as well as access to other culturally-based computerized material (texts, graphs, videos).

We conclude with some of the findings and their pedagogical implications. The catalyst of these implications will be to understand the relationship between language learning patterns and strategies and the actual learning of AFL as pereceived by the learners.

II. RESAERCH-BASED COMPUTERIZED CURRICULUM

Some principles of the Conceptual Change theory of learning (Barazangi, 1988; Posner 1983; Strike, 1979), such as the plausibility of the new conception, constitute the underlying

epistemological and methodological foundations that guide this research. Combined with the Participatory Action Research approach (Greenwood et al., 1993), these theories, approaches and notions produce a pedagogical program that is research-based. In this program, learners become researchers of their own learning process. The following five determinats represent the research questions, purpose and the findings related to the AFL module. Since the present forum does not allow a dtailed description of this research, we will only summarize some of the steps to orient the reader as to what we mean by the research-based computerized curriculum.

A. The Practical Research

The purpose of this research and computerized curriculum activities is to facilitate the acquisition of Arabic efficiently. Though efficiency may result in speed of learning, it is intended here to make learners aware of their own metacognitive strategies while learning Arabic. Metacognition means learners' awareness of their own cognition (interaction of procedural and declarative knowledge) in the specific language-learning environment (interaction of the Arabic language system and its uses). Making metacognitive strategies explicit is assumed to help learners understand, and eventually eliminate or change their own "non-efficient" learning strategies. Making AFL learners' metacognitive strategies explicit through computer simulation of Arabic is also assumed to aid researchers, computerized curriculum developers, instructors and learners of Arabic to moderate the discrepancies in the instruction and acquisition of AFL. By shifting the focus from the tensions in foreign language learning and/or acquisition , as described by Alosh (1997:2-8), into the participatory learning process, the paradigm for AFL and for foreign language learning, in general, may shift. Participatory learning means that learners have a stake in identifying needs, devising meaning and form, and designing tasks as well as self-assessment constructs. Meanwhile, instructors, curricular developers, linguists, and computer specialists collaborate with the learners to facilitate Arabic Self-Learning. Hence the name of the AFL module prototype.

B. Arabic as a Foreign Language (AFL) Learners' Participatation

The preliminary AFL prototype and research design were based on a pilot study findings, working with (7) students who were involved in learning AFL at both Elementary and Intermediate levels. This empirical aspect of the research was conducted to help in formulating and evaluating the two stories/lesson plans of the AFL prototype.

Resulting from the pilot study, and based on what learners were instructed in the elementary Arabic classroom, the AFL prototype was developed. The design assumed that learners who have (3) weeks of instruction, or the equivalent introduction to the sounds and alphabet in elementary Arabic, should be able to use the prototype successfully. The pilot study

was followed by an evaluative study directed towards making learners' strategies explicit. The pilot study was conducted with the (7) learners of AFL during the Summer and Fall of 1994 at Cornell University. The principal investigator, the first author, applied a participant observation method in the Arabic classroom. She also conducted individual interviews with each of the volunteering seven students at the end of the Fall semester, 1994.

During these observations, she recorded some of the learners' interaction with the instructor, focusing on repeated patterns in their attempt to communicate in Arabic. During the interviews she probed each learner about his or her learning strategies as outlined by Oxford (1990), focusing on how each learner was strategizing their deployment of Arabic. At the end, she held a focus-group interview with some of the learners to probe them further about certain strategies.

The principle investigator also conducted informal interviews with the instructor at different intervals after certain participant observation sessions, focusing on some aspects of the instructor's approach to teaching AFL, such as his integration of the spoken dialect (Educated Levantine) and the written Modern Standard Arabic (MSA), and his perception of proficient learning and of "errors" that learners encounter as they attempt to interact in Arabic.

The evaluative study was conducted with (14) AFL learners--4 of whom were from among the 7 in the pilot study--in the Fall of 1995-96. Arabic Self-Learning software prototype was developed during the Spring and Summer of 1995. The prototype was designed to be used for independent self-learning as complementary and/or as part of a classroom setting with instructors as facilitators. This prototype was also designed to serve, and has been used by the principle investigator as a diagnostic tool to answer the remaining research questions. These answers are being incorporated into the determinants of the computerized curriculum of AFL in the United States, and hence the names, evaluative study and research-based computerized curriculum.

C. Five Determinants of the Computerized Curriculum

Arabic Self-Learning prototype is designed to examine the interactivity of five determinants in the field of computerized language learning of Arabic as some American learners become aware of their own metacognition of Arabic. These determinants are:

1. Procedural and declarative knowledge of Arabic, [5] including issues of Arabic diglossia, or what Alosh (1997: 9) calls "multiglossia" (MSA and dialects), and form and function. For

example, the challenging diglossic properties of Arabic, can be turned into a positive outcome instead of a dichotomous polarization.   Arabic diglossia lends itself easily to the introduction of multiple representations in language learning/teaching functions; the spoken (voice, in dialects and MSA), the written (text, mainly in MSA), and the cultural context (video, in dialects and MSA).   Through these interactive processes, a learner may be able to understand the relationship between the written and the spoken, as suggested by Biber (1988), on one hand, the

different dialects, and the relationship between the dialects and between them and MSA, on the other. Once such processes are understood, the learner will be able to transfer knowledge of these procedural principles to other linguistic functions in different subject and contextual areas.

2. Text comprehension and textual reproduction (reading and writing), individually reproduced and socially contextualized (speaking and listening), and the relation between them. Learners will acquire understanding and application of procedural knowledge of Arabic as a means of communication and also as a subject matter (grammar and/or literature). Also, Arabic can be taught in the context of other subject areas (e.g., math, history).   This means that learners need to understand and acquire the systemic structure and functions of Arabic in order to apply them in new contexts.   Thus, Arabic grammar will become the supportive rather than the central skill to be acquired.

3. "Natural" and "classroom" language, including issues of access to "authentic" resources, of literary and socio-anthropological evolution of Arabic, and the history of teaching and learning Arabic. This kind of learning, as described also in determinant (2) above, is called conscious learning to mean acquisition and transfer of higher order thinking skills. (Lantolf and Appel, 1994: 1-32)   It calls for a change in the conception of the structure and function of school/college as an organization, in the conception of teachers'/instructors' roles and behavior in the classroom, and in the conception and planing of curriculum, as well as learning outcomes among students.

4. "Instruction" and "self-learning" or acquisition, including issues of learners' latitude to manage their learning vis-à-vis teachers' tolerance to change their role and the paradigm of Arabic language teaching. In self- learning model, teachers and instructors will be promoting learning and the use of problem-solving skills in one subject area (Arabic) and the subsequent transfer of those skills to problem solving in other subject areas.   Successful transfer means that students are learning and understanding the linguistic and cognitive concepts underlying the problem-solving procedures and can then apply those same procedures appropriately in different contexts**.** (Mandinach, 1994) Consequently, classroom dynamics will also be different.

5. "Computer-assisted language learning programs of AFL , therefore, give way to computerized curriculum in the Arabic language environment, including functionality, proficiency, the purpose of learning, prior language learning patterns, and perceptions of computerized learning.

In this paper, we briefly analyze one aspect of the fifth determinant: the effect of previous knowledge and language learning patterns.

D. The Research Pedagogical Questions

Through their participation in the pilot and evaluative studies, AFL learners presented some answers to the following research questions:

1. How does a non-Arab adult accommodate Arabic language structural and communicative attributes into his/her schematic patterns(s) of acquired languages other than Arabic?   More specifically, what kind of learning patterns and strategies expressed during the exercise in the two stories of the prototype, across the questions asked within each story, and across cases of learners?

2. Do these patterns relate to learners' perception of computer-assisted learning?

3. Does a learner's gender and his/her goal of learning the language make a difference? (Swann, 1992).   Also, what are the specific learners' patterns of deploying Arabic gender case-marking?

4. Do the above patterns relate to learners' response concerning their use of metacognitive strategies (centering, arranging and planning, and evaluating their own learning) and to their awareness of their own learning process? and How?

5. Is there a direct interference and what is the learner's strategy (ies)? In other words, what is the relationship between learners' prior language learning style and strategies and their deployment of Arabic. Does the integration of MSA and the dialect (s) in the dialogue affect such a relationship? and How?

In this paper, we only briefly report on the fifth question. Discussion of the effect of prior language learning patterns will be discussed in Section V.

III.   EXPERT SYSTEM OF ARABIC (ESA) KNOWLEDGE BASE

Basing the 'artificial' computer language program on the characteristic features of 'natural' Arabic language (Barazangi et al., 1997; Al-Bawab et al., 1994; Al-Bawab and Al-Tayyan, forthcoming) gives the system a pedagogical credence for Arabic language consciously-enhanced self-learning.   More importantly, the ESA system contains the fundamental facts and assertions necessary to solve a specific problem in the Arabic environment. The ESA system may also serve as one of the theoretical foundations for computer-based curriculum development. The primacy of Arabic functionality over grammatical structure in this system presents a fertile foundation for an interactive learning process that relies on the use of problem-solving strategies and reflective higher order analysis of these strategies, as suggested by Oxford (1992/93).

A. From Computer-Assisted Instruction to Learning Through Interactive Multimedia (IMM)

Developers of computer-assisted instruction (CAI) and developers of intelligent tutoring systems (ITS) have promoted the use of computers in learning, and they have developed sets of principles of learning and application in computer instructional programs.   Yet, despite the fast introduction of computers in the classroom, several language educators are still concerned that computer technology is not like human instruction (Schofield et al., 1994). This is particularly the case when the developed software reflects a certain linguistic or pedagogical theory, such as

"philosophy of efficient production, dissemination, and control of knowledge, and that such products may not provide flexibility for other perspectives to be introduced." (Muffoletto, 1993: 1-2) The same concerns seem to transpire in the teaching of Arabic, particularly when computerized programs are not directly accessible in Arabic.   That is, programming is usually done in English or another language and is applied to Arabic with only Arabic fonts and grammatical structures being integrated into the system.

By the early 90's, the use of interactive multimedia (IMM) began to provide answers to some of these concerns.   Latchem et al. (1993:11) present a definition and the use of 'Interactive multimedia': An umbrella term for a range of videodiscs-, compact disc-, and computer-based systems that allow the creation, integration and manipulation of text, graphics, still and moving video images, sound and feedback clues for many diverse applications in education and training. End-users can control the links, determine the paths of navigation, set their own speed of information handling and construct the contents in accordance with their needs. In addition, Ambron and Hooper (1988:36) ask what better way to have a multi-author work created, annotated and linked in text form, with graphics, timelines, and video, than what hypermedia systems offer.

Multiple authors, which is very critical for curriculum design, can add commentary to the same corpus at the same time.   The hypermedia systems can symbolize and organize links, and present visual rendering of the entire network of links, which is also important to links between teacher and students, on one hand, and between procedural and declarative knowledge, on the other. The greatest advantage of hypermedia systems is that a browser needs only a limited amount of learning to be able to use the program.

ESA as the Arabic "declarative" knowledge base provides the alternative perspective to computerized teaching without having to rely on other languages and their philosophical and linguistic underlying assumptions.   By combining ESA with IMM, the diglossic property of Arabic could also be partially resolved by integrating the spoken and written skills of Arabic learning, as discussed earlier in section II.C.1.

B. Language Teaching and Learning Through Computers

Language teachers wanted to improve on language teaching labs and, thus, began the movement of adding computerized tutorial material to the audio-tutorial tapes known in the 1950s and 60s.   With the aid of computers, they introduced written exercises to taped language conversation scenarios in the 1970s. (Altman, 1989)   Video tutorial was introduced in the early 1980s to present the cultural context of the target language. (Gay, 1987)   Thus, the paradigm for language teaching and learning, as shown in figure II, moved from a two-dimensional interaction in the traditional models into a three-dimensional interaction in video-inspired modles [6] (see Figure 2).

We propose moving the paradigm further into a four-dimensional interaction in the computer-based model.   As new theories of language learning and acquisition were debated, several techniques and teaching strategies were under experimentation in classrooms (e.g., functional vs. Structural) . With the utility and accessibility of computers, and the invention of C-D ROM, computerized language instruction took a lead in combining all four representations (text, graphics, still and moving video images, and sound) into one integrated program.   With the recent emphasis on learner-centered curriculum, as suggested by Nunan (1992, 1988), the introduction of IMM, and the changes of language teaching and learning paradigm, computer-based language instruction became a computer-based interactive strategy for communicative and grammatical learning. (Nunan, 1988:3) We have extended this move into the design of the AFL module by adding the interfacing link to ESA and cultural knowledge-bases.   Not withstanding the production of *From the Gulf to the Ocean's* laser video component (1989), almost every other computerized Arabic program, that we know of, relies mainly on written text, with some that have audio dialogue, such as the case in Kileen and Iskarous's (1990) *Electronic Al ˤArabiyah*, and some that have added to the audio dialogue and digitized graphics, such as the case of Alosh and Alama's (forthcoming) *Ahlan wa Sahlan*.

C. The Interactive Multimedia and ESA

The Expert System of Arabic (ESA) not only provides the declarative knowledge, but could be used as an organizing principle.   Combining the Conceptual Change theoretical rationale with the functionality approach to language learning, and psycholinguistic with pedagogical knowledge of Arabic has transformed our paradigm of computer-based curricular and instructional design. We call the combined scheme "Metacognitive learning" to indicate a reconciliation of the following three epistemological and methodological assumptions in addition to the assumptions underlying the educational hypermedia, and language acquisition and learning. They are:

1. Computer is the medium of curricular design, and the learner is the center of the curricular process.

2. Programming language and the natural language (Arabic in this case) are integrated in the presentation of the concepts.

3. Language structure and other declarative knowledge are facilitators to procedural knowledge. Thus, the instructional module(s) constitute both the subject matter (grammar, syntax) of the declarative learning, as well as the target of the procedural language (the application of the rules to solve problems linguistically or conceptually).

Conceptual change theorists assume prior perceptions of a concept as a determinant in the learning of new concept (s) (Barazangi, 1988). Thus, meaningful, effective learning requires reflective (metacognitive) process in one's own conception and practice of a particular concept. As new concepts and meanings are introduced, or made directly accessible to the learners,

learners reconstruct their own learning scheme and meanings, and create new activities and insights.

D. The Expert System of Arabic (ESA)

The development of ESA in Syria coincided with a wide surge of activities in the USA concerning the teaching of Foreign Languages in the early 80s, particularly less-commonly taught languages, such as Arabic. [7] As interest in Arabic escalated with recent changes in global political and economic policies, further interest in learning Arabic also raised more concerns among Arabic instructors to find better means to teach a communicative, functional Arabic. Coupled with interest in improving Arabic instruction as a first language, this project became a means to answer both interests.

The Expert System of Arabic (ESA) contains the knowledge base and inference engine. Unlike other Arabic computer programs, ESA through its derivation part, triggers the dictionary search that results in a display of the syntactical and morphological rules starting from the most general--such as listing of augmented and unaugmented verbs--and running through to the most specific--such as the combined conjugation rules of the letter Hamza (~), and idgham (i.e., gemination or doubling). Through its analytic component, ESA is also distinguished by its ability to cue the user who does not have a sound knowledge of Arabic roots into the different possible roots of a word that he or she may input. A Vax-11 computer was used to prepare ESA. A PC, and eventually a Macintosh, version is under construction now, taking into consideration learners needs and the interfacing modules of the curriculum. A PC-Based Conjugation of Arabic verbs is accomplished using IBM PC compatible computer, and Turbo Prolog version 2 as a programming language.

The morphological and syntactical processing structures of ESA--the Derivative, which generates and produces vocabulary, and the analytic, which retrieves a root of a word along with its vocalization and prefixes or suffixes--operate independently as well as interactively. Each part

guides the user through an elaborate multiple-box and multi-window sub-system, from defining the original letters of a root or entry in its different patterns and categories to specifying all grammatical and morphological forms and derivatives.

The ESA is comprehensive in that it uses entries from all available Arabic-Arabic dictionaries as compared, for instance, to Bishai's (1994) Dictionary that relies mainly on Muhit al Muhit. And yet at the same time the System is capable of being very specific and accurate, possessing 7,280 roots that produce more than 11 million words, including over 23,400 verbs, (augmented and unaugmented) in different combinations of voices, tenses, vocalization, etc... ESA also contains more than 200, 000 derived nouns--Bishai's Program, in comparison, has only 5, 000 roots, and his Dictionary only 50,000 total entries, nouns as well as verbs.

The ESA knowledge base, therefore, provides the concepts in addition to applications for the user.   For a learner-centered computerized curriculum, as shown in Figure 3, the accessibility of both the solutions and the principles that underlie them produces an integrated, comprehensive model of systemic thinking in Arabic. The long-range product of this project, the computerized curriculum and the instructional modules, should be understood in this new framework (see Figure 3).

IV. EDUCATIONAL OBJECTIVES OF THE AFL MODULE

In the first phase of building the AFL module, the first author developed the Arabic Self-Learning software prototype program for AFL learners to build their own scenarios, models and simulations on personal computers. This prototype was evaluated (used by learners) and the findings are being incorporated in the second phase of the curricular design. We present here only the first phase with some pedagogical examples.   The prototype, in C-D ROM, is an interactive multimedia implementation based on the concept of consciousness enhancement (see Figure 4).

By viewing, listening and responding to the dialogue within the two stories of the prototype, learners went through a dynamic, analytic, problem-solving procedure and reflective analysis of their own learning strategies (Oxford, 1990).   During this exercise, the principle investigator, the first author, observed each learner as he or she interacted with the prototype. Each of the 14 learner who participated in the evaluative study spent between 45-115 minutes going through each story. Every step of the learners' interaction was digitized automatically on a specially designed Excel program for individual and collective evaluation. Also, audiotapes were provided to record the learners response in the drill and other interaction. These tapes also recorded the learner's conversation with the principle investigator as she probed each learner to "think loudly" his or her mental process while going through the exercise.

In the second phase (not reported here, in-progress) the findings from these multiple data will be incorporated to further develop the Arabic Self-Learning module. Once connected with the ESA and other knowledge bases, the module will allow learners to interact with Arabic grammatical and lexical structures as the supportive skill rather than the central skill to be acquired. The module will also be connected to the culturally constructed uses of Arabic. [8] Such interactions enable learners to develop their own schema (Situational Cognition, or SC) of Arabic and determine their own learning activities. In Participatory Action Research (PAR) and SC, instructors and researchers become facilitators, while learners become researchers of their own learning and developers of their own activities. [9]

Based on learners' statement of purpose from learning Arabic, and other perceptions of language learning, the prototype was designed to further learners' input. This input, represented above will help in furthering the development of learning objectives of the AFL module. Figure

4 represents one screen of the computerized interactive multimedia prototype. Each part of the screen was designed as follows:

1. The video, consisting of live dialogue, is the center of the learners' interaction with each of the two stories (each story consists of five scenes, and for each scene 2-5 questions are raised). This interaction helps the learner recognize the meanings and the concepts within the new learning environment, Arabic language and discourse.

2. The questions and their purposeful answer choices are designed for specific educational objectives. Purposeful answers are intended to help the learner evaluate her own understanding of the dialogue rather than merely find the "correct" answer. Learners' instructions may be replaced linguistically and conceptually as the nature of the learner and her familiarity with Arabic changes.

3. Pausing the question in English is an indirect lead of the learner to the meaning of a specific segment in the dialogue. For example, in story 1, Question 1: "This conversation took place in the city of?" repeats the meaning in "Hadha hiwar wa-yadoor fi bayt bi-madinat dimashq". The goal is for the learner to recognize the whole meaning rather than rely on translating vocabulary and constructing sentences. In addition, the interacting learner is able to distinguish sounds with every choice and, then, relate each answer by making sense of the context. Thus, answering a question does not only mean giving the "correct answer." Rather, it focuses on the ability of the learner to understand the meaning and to distinguish the sounds and texts even when the words appear similar. For example, the three choices: Dimashq, DesMoines and Dallas all start with the sound "D." Also, during the "verify" mode, the place of the purposeful answer is switched in order to make the learner aware of the variations in sound, text, and usage. This is what we call the process of conceptual change. That is, the learner finds herself before a different learning approach from what she is used

to, in addition to the new learning environment of Arabic. The learner, therefore, recognizes her own strategies and attempts to modify or change the unhelpful ones.

4. While answering questions under each of the five scenes in each story, learners are given the opportunity to write comments (in Arabic or English) about their understanding of the dialogue, the question (s), and/or their mental processes and learning strategies. The entire exercise helps the learner to indirectly realize the grammatical structure of the Arabic language. That is, through writing and modifying her own comments, the learner is able to reflect on her understanding and evaluate her own conception of the context, the concepts, and rules.

5. Stories, scenes, and questions can be accessed within and outside the exercise for a holistic understanding of the program.

V. IMPLICATIONS AND CONCLUSIONS

One finding, for example, suggests an answer to the fifth research question. AFL learners are unable to realize at first that by moving from first to second person, unlike the English

pronoun, the Arabic pronoun is split into feminine and masculine. Such an obstacle may be attributed to their inability to accommodate the new structure in their prior linguistic and cognitive scheme. This inability to accommodate the new structure not only produce inconsistent accuracy, but the pronoun split also raises few conceptual difficulties, such as how would learners recognize the gender, and consequently the case-marking of an utterance in order to affix the"proper" pronoun. Another conceptual difficulty lies in realizing the variation in the first and second person pronoun in relation to agency, for example.

The issue here is not limited to whether or not learners know the meaning, but whether or not they have access to Arabic functionality. This access resembles that which permits the intuitiveness of native speakers, leading learners to the determinants in the gender of an utterance, and what variations there might be in its use. Thus, historical as well as socio-anthropological linguistics play a role in determining the level and the nature of the content in a computerized curricular planning of Arabic. The matter is not only that of spiral difficulty and or level of proficiency, but also a matter of what and how much of other related knowledge one may or can include, and how to integrate it with learners' need and interest as well as with cultural themes. These latter issues could be addressed by the learner's direct access to computerized knowledge bases of Arabic; be it of Arabic language system (grammar and structure, ESA) or literature, history, or math content (cultural themes), or of Arabic linguistic- or functional-based (communicative aspects) instruction.

The obstacle of splitting into feminine and masculine could also be explained by the difficulties in grammatical features, such as tense and aspect, in addition to agency. Yet, given the simplicity of the dialogue in the prototype (consisting mainly of naming self or another person or

object) the prior-patterns factor seems a more likely explanation. The obstacle might also be attributed to learners' inability to deploy the variation between masculine and feminine due to the phonetic ambiguity between MSA and the Levantine dialect. This is exemplified in the distinctive variation between   feminine (   ) and masculine (   ) "you" in MSA vis-à-vis the "hard-to-distinguish" variation in the Levantine dialect (see Figure 5).

In this figure, we explain the interaction between previous knowledge and learning patterns with learners strategies in learning Arabic. The same explanation is being extended to understand learners' attempt to relate what they hear in the dialogue (an educated form of Levantine, combining a Palestinian, Lebanese and Syrian dialects) and what they know of AMS pronoun properties.

Evaluative data are still being analyzed and validated. Preliminary findings suggest negative effect of prior language patterns on the AFL learners' awareness of their own learning, and on learning within the Arabic environment. The pedagogical implications of such findings is to make learners, through working-out the two lessons/stories in the prototype, more aware of the power of consciously using language learning strategies to make learning quicker, easier, more effective, and more fun" (Oxford, 1992/93:21).

One of the goals of the empirical research and curricular development processes is to understand these aspects of learners' strategy systems to assist learners in explicitly expressing these strategies and in drawing relationships to their own prior language patterns. Such relationships also make learners aware of the power of consciously using language learning strategies.   This awareness is assumed to facilitate learners' integration of procedural and
declarative knowledge of Arabic with problem-solving skills and underlying Arabic linguistic principles that guide their application to diverse contexts.

Two basic components are presently under construction for furthering the expansion of this project into full curricular development activity. One is modifying the AFL prototype according to the evaluative study results . The other component is the development of two other modules for native adults and children. The development of the latter two modules will further test the theoretical and the curricular framework. The research findings will provide further pedagogical implications for the framework and for the learners.

ENDNOTES

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2. Marwan Al-Bawab, Muhammad Mrayati, Yahya Meer Alam, and Muhammad Hassan Tayyan. "A Computerized Morpho-Syntactic System of Arabic." The Arabian Journal for Science and Engineering, 19, 3, 1994: 461-480; and M. Mrayati. "Statistical Studies in Arabic linguistics." in MacKay, ed. Computers and the Arabic Language. (1990), 190-200.

3. The empirical research and curriculum development part of the project is being carried-on at Cornell University in Ithaca, New York. The ESA development and the native, non-specialist module part is being carried-on at HIAST. Other members at HIAST are attempting to contribute to the ESA, see for example, M.Y. Al-Hafez, et al, 1992. "Design of an Arabic Language Knowledge-Base as a Lexicon for NLP" in the   3rd ICEMCO Proceedings: 2. 4.1-17.

4. Details of theories--using principles of Arabic language development, Arabic linguistics, language learning and acquisition in general, computing, and computers in education--, methodologies and findings of the research will reported elsewhere (Barazangi et al., in preparation).

5. See Anderson's definitions of the two types of knowledge and implications for computer simulations, and the distinction between the two types of knowledge with the implications for instruction as quoted in O'Malley and Chamot, 1990: 20-25 and 27-28.

6. This figure is a modification of two figures used by Rick Altman. The Video Connection: Integrating Video into language Teaching (Boston, MA: Haughton Mifflin Company, 1989), 2-5.

7. See for example, Rouchdy, Aleya, ed. The Arabic language in America (Detroit: Wayne State University Press, 1992); and Eid, Mushira. "Arabic Linguistics: The Current Scene" in Mushira Eid, ed. Perspective on Arabic Linguistics I: Papers from the First Annual Symposium on Arabic

Linguistics. Amsterdam Studies in Theory and History of Linguistic Science, V 63 (Amsterdam/Philadelphia, John Benjamin's Publishing Company, 1990), 3-37.

8. Mohammed Jiyad,"Non-Conventional Material for Conventional Classroom: Teaching Cultural Awareness Through High Technology" in 1992, 3rd ICEMCO: 10.5.1-8) suggests teaching cultural awareness through high technology.

9. David Nunan (Collaborative Language Learning and Teaching. Cambridge: Cambridge University Press, 1992:10) emphasizes the redefinition of the role relationships of learners, teachers and researchers in such a collaboration.

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