

# Interface Design Theories of Foreign Language Multimedia Software: A Hyper Model of Cognitive and Software-engineering Approach.

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**Abstract**—With the advancement in communication technologies and computing, more tasks are accomplished effectively and efficiently using interactive foreign language software as a tool. This paper is concerned with criteria for the interface design theories of foreign language multimedia software. A dual approach is proposed that combines cognitive and technologist approach. Based on this contextualised mode, a formative evaluation method was developed to augment the interface design support the cognitive process (linguistic, pragmatic and SLA competencies). The focus will be concentrated on referencing and analyzing the principles implemented when creating the learning material and on presenting the design and SLA theories which oriented the construction part. For the sake of future work, students-users were observed and their feedback was collected to achieve draw prospective of a post-production procedures, both for improvement and extension of it. Although recent popularity and potential of hyper media authoring shells are generating high profile developments of hypermedia courseware in higher education, however very little help in the form of design and technical support is being made available to individual authors with little or no design expertise. It is hoped that this research will act as a catalyst to fill this gap.

**Index Terms**—CALL authoring software, design process, and technology-fit hypermedia application.

## I. APPROACHES AND MODELS OF INTERFACE DESIGN

Recent advances in Information Communication Technologies ICT made it possible for moderately equipped educators to produces their own computer-assisted language learning CALL materials [10]. Usefully, these advances help educators design better language materials that pinpoint and meet their learners need. On this premise, it is clear that there is a need for educators to understand and recognize the important theoretical and pedagogical influences of their language learning materials production. Defined in very general term, the interface design is the part of the application that is in charge of communication with the user, it "conveys the functionality of the computer application to the user and translates the user's input into machine specific-format" [13]. Plass distinguishes between four different types of approaches to Interface design:

Craft approach

Enhanced software engineering approach

Technologist approach

Cognitive approach

Craft approach is the design which is based on the experience of the human expert to suite the particular

circumstances [1]. The enhanced software engineering approach "incorporates human factors, such as user characteristics and task analysis, into traditional structured software engineering models [13]. The technologist approach focuses on providing software tools for interface design, aimed at automating and quantifying the design process [13]. The cognitive approach applies psychological knowledge, such as theories of information processing and problem solving to interface design [15]. As cognitive approach is the most theoretical approach to interface design because it is both user and learning task-oriented approach, it seems to be the most appropriate approach for the development of second language acquisition SLA applications. For this reason, it has been implemented in this study coupled with software-engineering approach. In the next section, I will therefore shed lights on the specific considerations of the users of this application.

## II. INITIAL ASSESSMENT; IDENTIFYING NEEDS OF STUDENTS

According to [15] there are 7 factors for successful implementation of technology for learning. These are: 1) Providing effective development for teachers in the integration of technology, 2) Aligning local or state curriculum standards with appropriate use of technology, 3) Incorporating technology into the weekly learning schedule, 4) The ability for teachers to tailor lessons to individual student needs, 5) Incorporating technology use into a collaborative teaching environment, 6) Focusing instructional technology utilization into specific project-based learning, and 7) Providing leadership, modelling. The significant point to this study is meeting students' needs to the project, factor (5).

Many researchers contribute to the belief that learners' needs are crucial to the design of educational material [15] [6] [2]. In 1998, Jolly and Bolitho [7] made "identification of learners' needs" the first step of their seven step-model for material production. As for interactive multimedia production, Watts [1] says that there are two approaches: technology-driven approach and learner-based. This application was designed to achieve greater integration with the pedagogical theories at MCT and provide students with more freedom by employing non-linear navigation and many types of activity.

Given this brief outline of the importance of learners' needs in educational software, let us now look at their needs at MCT. As previously stated, I used Jolly & Bolitho's seven step-model and began the first step (Identifying learners' needs) by identifying the targeted learners' needs. The next paragraph lists and further explores these needs in

an attempt to achieve the second step, "Exploration of needs". This discussion about learners' needs will show how they have been met in the design of this programme. Below are some of the salient features of students at MCT, taken from the proceedings of the first Saudi TEFL conference in MCT. 1) poor linguistic competence, 2) negative attitudes toward L2, 3) shyness and inhibition, and 4) English learning is kept to the classrooms. This software was designed to address these deficiencies. Learners need to consolidate their previous knowledge of basic English with the computer-related skills and terminology necessary for studying their major and functioning in their future career as well as to prepare for an adequate performance in their future professional workplace [16]. As we have identified learners' needs, we can now state the expected aims behind the production of this software. The designer hopes that students will be able to: a) Grasp, acquire and use a reasonable number of basic technical terms, b) Comprehend simple IT text, and c) understand acronyms. In terms of language content, this software focuses on meaning-based learning tasks [12] by providing key points of computer-related vocabulary and key functions; grammatical points were not covered. This was achieved by introducing a range of 70 computing and IT terms, in seven units, which are important for decoding texts in the students' specialism. To tackle previously mentioned student defect (1) about poor linguistic competence, the content is graded from simple to difficult with short sentences and easy language [12] [6]. In addition, the programme aims to offer a remedy for student shyness (defect (3)) through a friendly interface and easy-to-use navigation which should motivate and encourage them to use the application. Kelm [8] claimed that CALL is a "great equalizer" among students especially because it caters for passive or quiet learners. This was supported by Hubbard [6] who believed that the individualisation facility that computers offer is its "greatest strength" while "dehumanisation" is one of the most significant limitations.

To overcome students' negative attitudes toward L2 (defect (2)), the home page, which is accessible from all other pages, was designed to be motivating, and attractive [5]. I hope students' understanding about language learning will change as they find this software new, easy and fun to use [3]. To promote successful language learning, the application utilises many "instructional media" (visuals, sound and videos) to satisfy different learners' preferences and learning styles [12] as well as to provide them with extra visual and audio help traits that could enhance their competence and acquisition of the targeted vocabulary. Most importantly this seeks to convey to students that the software was specifically designed for them, the learner at MCT. It differs from other commercial software because it incorporates the Saudi flag, an MCT animation and logo, and a man with Saudi costumes who provides support and guidance in their native language. By so doing, I have applied the third stage of Jolly & Bolitho's model which concerns "Contextualisation realisation of material". According to Hubbard [6], material designers should develop cultural awareness of their learners, otherwise learners experience negative feelings in their learning because they think that their entity is "put at risk"; it "distorts their situational and linguistic reality". With regard

to student defect (4), about learning being limited by time and space, learners will be able to use this software at home because mobility is actually a great advantage of CALL software [9].

Having the learners' needs and level of language in mind, most units start with tuning-in and warm-up sections, which prompt students' thought, pool their knowledge and thus encourage them to start working co-operatively [16]. These are often based around a revealing visual or an authentic diagram [7]. They introduce new contents succinctly and are the basis for the next page which has the main input for the lesson. This section is more detailed and has more data than the previous one. As far as possible, these units rely on a straightforward presentation involving examples in the context of computing. To maintain principles such as user-task match and user-task feasibility [5], every third page is a follow-up activity where students perform simple interactive activities with easy instructions, and instant feedback to reinforce positive learning [12] without the need for teacher guidance. Here, feedback is a software response which indicates whether an answer is true or false, whereas interactivity refers to two-way communication with the computer whereby it accepts user input and delivers appropriate output. Tasks are designed as pair or individual group activities, ending with a teacher playing the role of facilitator. Activities may use Interactive White Boards (IWB) so that the whole class participates in the same task. This does not, however, mean that the teacher can dominate the tasks or learners are marginalized, because the constructivist model is still not affected. The constructivist CALL model is a humanistic model where the learner has "greater control and responsibilities over what he or she learns ..." [1].

To summarise, in order to meet students' needs this project has adapted a pure learner control approach [6] to maintain autonomy and authenticity for the learners. Hopefully this design gives the learner complete control over "pacing and the sequencing of the content presentation", easy navigation, and quick reversal options [15]. If learners' needs and current pedagogic theories are interrelated, then this is an interesting area to investigate.

### III. TECHNOLOGY AND PEDAGOGY IN PRACTICE

As information technologies become increasingly common in foreign language classrooms, SLA theories are always pertinent and present. Although recent popularity and potential of hyper media authoring shells are generating high profile developments of hypermedia courseware in higher education, however very little help in the form of design and technical support is being made available to individual authors with little or no design expertise. In order to maximize learners' memorization and help them remember more technical vocabulary, clear and simple visuals were used simultaneously with their names "text" using a hide and show facility [16]. These two media reinforce each other and help learners access the two different types of memory: verbal (such as words stored either auditory or visually) and non-verbal (images and visuals). This project makes use of the dual-coding theory [11] which proposes that abstract and concrete words are

stored in the verbal mode with only concrete words represented in the visual mode. Technical terms are concrete words and therefore have more chance of being recalled.

Other aspects of learning theory in MCT include implicit (inductive), or passive learning, where students are exposed to information and expected to acquire knowledge of that information through that exposure [3]. Such exposure, achieved by combining visuals and texts together in this application, leads the learner to develop a kind of consciousness. Later on, the learner will start 'noticing' this particular vocabulary and this is crucial for the development of implicit knowledge [3]. Hémarid [5] states that high student-control design would fit better with software driven by implicit learning theories where learners are encouraged by "memorization process [which is] based on exploratory mode". The learners' needs (promotion of L2 lexis through provision of meaning and comprehension-based activities) determine the type of design of the interface model; learner-based [13].

Hubbard [6] suggests that the language teaching approach is determined by two elements that a designer needs to understand prior to software design: linguistic and learning assumptions. Linguistic assumptions are principles adopted by the designer based on his understanding of the L2 nature and the importance of "structural, cultural and social aspects". Learning assumptions are principles adopted by the designer based on his understanding of the nature of the L2 learning process and the whereabouts of the context of this software. I have been teaching at MCT for ten years and have attempted to combine these two elements both in class and throughout the design of this software. I hope that the previous two sections have whetted your appetite and you will take a look at the design process described below. In essence, IWB at MCT generates learners' engagement, supports their preferred learning styles and caters for social interaction because it is innovative and new.

#### IV. SOFTWARE ARCHITECTURE

Recent advances in ICT allow moderately equipped educators to produce their own media-aided language learning CALL materials [6]. Usefully, these advances help educators design better language materials that pinpoint and meet their learners' needs. On this premise, I will start with a discussion of the term "user-interface" and then move on to discuss the design principles of the software interface. In any human-computer relationship, we firstly need to define the model of interaction, known as the user interface. Plass [13] defines the user interface as:

"The part of application in charge of communication with the learner ... [it] conveys the functionality of a computer application to the user and translates the user's input into a machine specific format".

I now focus on some of these "internal representations" starting with the screen background. I have chosen a background that is dark-red with Islamic ornamentation to make it more user-friendly [5]. Hopefully this colour is appealing and attentive to young Saudi learners. In order to reduce the cognitive load on the user (ibid) and to maintain

continuity and consistency of screen design [12] this background has been used on all pages.

In 1999, Soo [15] maintained that when designing high learner control interfaces, learner-computer interaction should be easy and that this could be attained by providing simple navigation with organized button and menu locations. Thus, buttons were explained in the audio help, self-explanatory and consistent [12]. In addition, this project follows both a tree (hierarchy) and linear model to guarantee that the learner is free to initiate and take the actions he wishes. Exiting is possible from all places by returning to the home page and is indicated by a door icon. Because users sometimes exit an application when they do not actually want to, pop-up text is displayed before exiting, asking the user whether he really wants to quit. I have also tried to avoid add-ons which distract learners' attention [2].

The same font is used throughout with different sizes to indicate titles and subtitles [12]. I selected "Arial" because it is a sans-serif font which optimizes text readability [5]. I used a permanent font because it has a significant invisible effect on the reader in that every font has three basic attributes: first, size, measured in points; second, weight, which is a "relative measurement of the thickness of the strokes that make it up"; and third, style, which is Roman, Bold or Italic [4]. Changing font means changing these three attributes, with a potential effect on the reader and impact on text readability, continuity, and consistency of screen design. Elsom-Cook [4] claims that Serif fonts are best for body texts and Sans-serif for headings, but my learners seem to favour sans-serif; therefore I have used the latter throughout the project. However, I agree with Elsom-Cook that left-justified texts are easier and quicker to read. Therefore all my texts are left-justified. Important linguistic features are highlighted with a different colour that causes no colour contrast (light golden texts over the dark red background which is framed with saturated purple) to draw learners' attention [12]. Green was used for positive feedback because it indicates happiness in Arabic culture while dark blue, connected with sorrowfulness in the learners' L1, was used for negative feedback. To maintain the standardization of the display [5], only a few specific screen information elements, such as fonts, colours, shapes, and menus, were used.

Most of the images were self-captured with digital camera and then digitised with Adobe Photoshop elements 3.0 or Snag it 7 Software. The most difficult task was combining separate parts of pictures into single images. I faced difficulties in the image layers' transferability by changing the file extension of the images e.g. from GIF to JPEG in order to ensure less image size. Images were not generally used for decorative purposes but to convey meaning, explain complex relationships and attract attention with visual clarity [13].

I have used two self-made videos to explain things which either are difficult to convey using text or demand motion. These videos were meant to be short, clear and easily understood; the language used was Arabic, the learners' native tongue, because the targeted learners have low level English ability. Moreover, I maintained the synchronization of video with audio as this seemed more important than the quality of the display [15]. Videos were used to add to the

learning experience and learners' integration. To maximize learner interaction, students can stop, rewind, forward and start the videos at any time so that they can freely discuss the content. To digitise the videos, I used Adobe Premiere elements 6.0 and found it to be problematic, time-consuming, demanding of extensive preparation, and the most expensive form of digitisation. Photos that look like icons of video tapes were used to signal that video is available.

Sound was given less significance in this project than video and images simply because the software does not target students' pronunciation skills. Perhaps one reason for students' good pronunciation skills is that most computer vocabulary does not have a counterpart in the students' L1, so they are called by their English names in shops and at home, e.g. "laptop". Students need, therefore, to understand what a "motherboard" is, not how to pronounce it. However, when audio was used (in the feedback and instructions) good-fidelity was taken into consideration as long as it provided a "customized and recognizable display" [8].

I will now move on to discuss other principles guiding design of the display starting with the screen layout. Though many researchers accentuate the importance of permanent screen information [5], it was impossible to adopt one specific layout, or what Hubbard [6] terms a "Presentational scheme", because different technical terms are represented with different pictures that need different spaces.

"The presentational scheme as the core of the procedure section strongly influences the remaining elements: screen layout, control options ... and help options" (Hubbard, 1996:28).

Moreover, the content of the cognitive load of each unit requires different types of comprehension-check activities. However, it is hoped that optimization of the screen [5] was maintained, in that all views are uncluttered and the information displayed can be quickly understood. Bearing in mind the users targeted, and other factors like the simplicity of the project, I felt it unnecessary to include facilities such as On-line help, Error-recovery [15], or a search-engine [12]. However, the last section "What is this word?" was supposed to offer lexical help for the uncommon words e.g. "peripheral" but unfortunately Mediator 7 pro does not seem to support Arabic text. Let us finish this section by acknowledging the importance of metaphor [15]. Although metaphor is highly beneficial in interactive software, I was unable to use it due to the nature of the software and the learners' English ability.

To summarise; despite the plethora of design principles scattered throughout the literature of CALL software, I have mentioned only the important ones in this paper and adhered to only a few of them in my material. The next section will discuss one of the most pivotal stages of software production; evaluation.

#### V. EVALUATION OF THE STRONG AND WEAK ASPECTS OF THIS MATERIAL

The primary means of university teaching and software evaluation is the student survey. However, the researcher felt that conducting a semi-structured focus-group interview

post session was a better alternative. The researcher administered it in order to collect data about students' opinions of the software. Bell [2] claims that the focus group interview is rich in data because of the interaction factor which makes it more interviewee-centred. Having said this, I am more concerned with software interface evaluation and will apply formative evaluation [14] that aims to improve the quality of the product. I managed to convince three MCT students to try this software and provide me with feedback. Their views were quite astonishing in that they perceived more advantages than disadvantages. I will begin with the strong points. These were that the project was easy to navigate, the background was engaging, there were high quality images, it was Saudi content-related, and it benefited from use of videos and careful selection of colours. Most importantly, they liked the different types of activities (true and false, fill in the gaps, multiple choice, and drag and drop) and the implantation of a show-and-hide facility which is a "positive feature" [12]. They did, however, spot some glitches. The font size and display window were too small, the screen sometimes appeared cluttered with text (e.g. unit 6), some images have garish colours (e.g. unit 4). They would also have favoured a different way of viewing large images such as the scroll bared motherboard image in unit 5. They would have preferred the "hotspot" facility where the cursor changes into a hand when moved to a specific area, and clicking it shows that location in detail. I have optimized the prototype to the best of my ability, but intermittent weaknesses will appear for many reasons. Chief among these are time constraints, lack of practical knowledge as a novice programmer, and economic limitations. Thus, I would have been able to provide a better multimedia (visuals, sound and video) quality only if I had been able to afford the required hardware and software. These disadvantages could, however, be avoided in the post-production development process which the next section suggests.

#### VI. FUTURE WORK

This section was designed to increase the usefulness of this software. A great advantage of multimedia technology is that there is room for further development, even post production. A number of improvements to this software have been suggested in previous sections but I will now specify the ones I have been working towards. With autonomous learning in mind, I thought it is useful to include a print facility so that learners could obtain print-outs of specific pages. Blogs could also be attached to reinforce the memorisation process. Moreover, students in classes other than English could also benefit from this software if the Arabic version, which I have marked on the home page, was available. Furthermore, the display of L1 and L2 could trigger comparisons between the two languages that yield deeper understanding of both languages in terms of similarities and differences.

Another option might be to include videos in English to allow learners to choose their preferred language, giving more exposure to L2 and increasing authenticity [3]. Still on

the topic of media and having in mind Paivio's dual coding theory [11], sound could be added to provide aural examples so that multimedia caters for increased memorisation. Kozma [9] supports this view, claiming that recall is more likely to occur given a combination of sound and visuals, rather than either one in isolation. Furthermore, more activities could be created to enhance other language skills, (listening and reading) by providing actual recorded interviews or authentic simple texts. Also, the integration of games could highly motivate and maximise learning experience. As a believer in the lexical importance of ESP courses, I feel that anchoring dictionary access, be it bilingual or ESP monolingual, will yield fruitful results for students. At a later stage, provision of internet chat or online help websites would help students of a similar level to exploit this facility and interact with peers with shared interests. It is hoped that this research study will contribute to the literature of CALL authoring software research as the researcher is unaware, to date, of any previous local ( Saudi ) studies that have set out to investigate self-made materials ascribed effect as a foreign language learning aid. It should be seen as inductive rather than definitive. Further research of greater depth and from different perspectives is direly required.

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