e-Learning Modules of Tutorial Lessons for The Deaf Students : Development & Evaluation
"View Points of Experts in Consideration"

Dr.Karim Q Hussein

Assist Professor

Computer Science Dept. Faculty of Information Technology & Sciences Al-Isra private University– Amman Jordan

Dr.Ayman Al-Nisour

Associate Professor

The dean Academic Faculty of Information Technology & Sciences Al-Isra private University– Amman Jordan

Summary

The scope of our paper is quite interesting , it is our vision to develop an effective technology to support Deaf Students so as to learn various topics via computer. The major core of the mentioned technology could be represented by two branches : The first is to offer an empty templates to the first user " The teacher who seeks introducing e-learning modules (eLMs) for his own interest topics for the Deaf candidates". Our system will reconstruct the entry material by the teacher so that to be an e-learning modules of tutorial lesson according to the submitted material". The second task of our system is to translate all the submitted material as well as the output material from the normal text into its corresponding lips of sign language and finger spelling . To evaluate the experimental modules of tutorial e-lessons . The topic of General Science for primary school has been applied to introduce the desired modules. Some selected experts have tried the concerned modules. View points of the mentioned experts have been considered to form the major conclusions. Many fields have been covered in evaluation process , mostly deal with the Software development technique and multimedia objects besides other standard criteria of special needs requirements.

Key words:
e-Learning, Module, Tutorial Lesson

1. Why tutorial e-lessons for the Deaf Students?

We can summarize the problem of our research in few lines which represent the answer of the above question , as shown below:

1. To develop an eLM of 15 minutes for any topic to the traditional students needs a 75 work hours by developers. For Deaf Students , defiantly takes more time because developers must translate all the instructional material into languages of Deaf students like sign language , finger spelling and lip movements.
2. It is hard to find teachers of special needs . Also little work has been done to develop eLMs for Deaf Students. Deaf students need specific care

and interest to motivate them so that they can realize meaningful and effective learning.

3. eLMs of tutorial lessons represent the major core of the teaching/learning process in the e-learning technology. Tutorial e-lessons aim at presenting the instructional material as well as generating some exercises with their proper feedback.
4. As general aspect , e-learning technology provides a lot of advantages to the candidates, for Hearing Impaired students ,like individualization of teaching which strongly enhances self confidences for them while they carry out learning because student takes the central/major role in teaching/learning process via e-learning . Besides solving the problem of individual differences.

As per the previous items the authors exposed their motivation to develop eLMs for Deaf students to support them in achieving the instructional material via tutorial e-lessons to realize meaningful and effective learning. Our vision to develop the desired e-lessons systematically.

2. Objectives:

This paper aims at :

1- Developing e-learning modules for tutorial lessons of General Science Topic in Primary standard school level. The core of the mentioned e-lessons is the multimedia technique which is used to translate all the instructional material form normal text into the corresponding sign language clips for each word. Our principles of developing the needful eLMs are :- eLMs must be based on systematic model as well as confidence theory/theories of e-learning for Deaf Students.

2- Evaluating the effectiveness of the above modules according to standard criteria , using interview tool with experts to expose their responses and feedback.

3. Comparison between the current eLMs in this research and other e-lessons for Deaf Students

After surveying many eLMs for Deaf students . We can summarize the items of comparison via the following table:

No. of Item	Comparison item	The current/previous e-lessons for Deaf students in other works	Tutorial e-lessons in our research work
1	The systematic approach of developing the tutorial e-lessons.	1. e-lessons mostly depend on certain skills in programming and multimedia technique.	1. our e-lessons based on systematic integrated model , this model itself depends upon mostly specific learning theory besides other important factors like special needs requirements and S/W engineering criteria.
2	Facilities of our e-lessons	Instructional systems in the considered papers deal with specific subjects like languages and S/W skills also these systems are oriented to traditional students.	Authors developed their e-lessons so that to allow teachers to develop any e-eLM of any topic for Deaf persons, among others.
3	Modes of communications with Deaf students	Mostly are limited in one mode of communication. Like sign language	Our e-lessons were developed to present the instructional material in four modes of communication (finger spelling, sign language ,lip movement and normal text). It is possible to display the instructional material in all modes of communication at the same time.

The above table of comparison reflects somewhat of the originality of our work because according to our survey we did not find an eLM based on specific theory of technical model besides little work has been done on this topic , these factors motivated the authors to try developing these modules which based on a confidante theory and systematic technical model.

4. Theory of Teaching/Learning Process for Hearing Impaired Persons via e-Learning (Applied Theory)

We shall present the summary of the theory   , (for complete manuscript of the theory , kindly go to Ref.7)
 HI student receives the new information via multimedia presentation of sign language with lip movement and continuous interaction between HI student and presentation of screen. Such mechanism of teaching / learning process would stimulate HI student's mind to link the new information with current / past knowledge Then HI student's mind can reconstruct the frame structure of

the information. This reconstruction leads to positive change of HI student behavior. The instructional material needs to enhance the mind frame of HI person. Therefore it should be prepared systematically so as to trigger mental activities and cause positive behavioral change.

5. Instructional Computer Model for Designing e-Learning Modules for Hearing Impaired Persons (Technical Approach)

We shall present the summary of the model which would be used for designing eLMs for Deaf students.

The model represents a mental picture or computational framework based on a specific theory to stimulate behavior . It serves as an ideal guide to accomplish the desired production.

Therefore this model represents a guide to develop the systematic and meaningful eLMs for Deaf students. This model represents an interaction and integrate among many systems "stages" , the output of each system leads to the input of next system. Each system has its own elements as well as mechanism , this would explained in the next section. The following diagram represent the general aspect of the system.
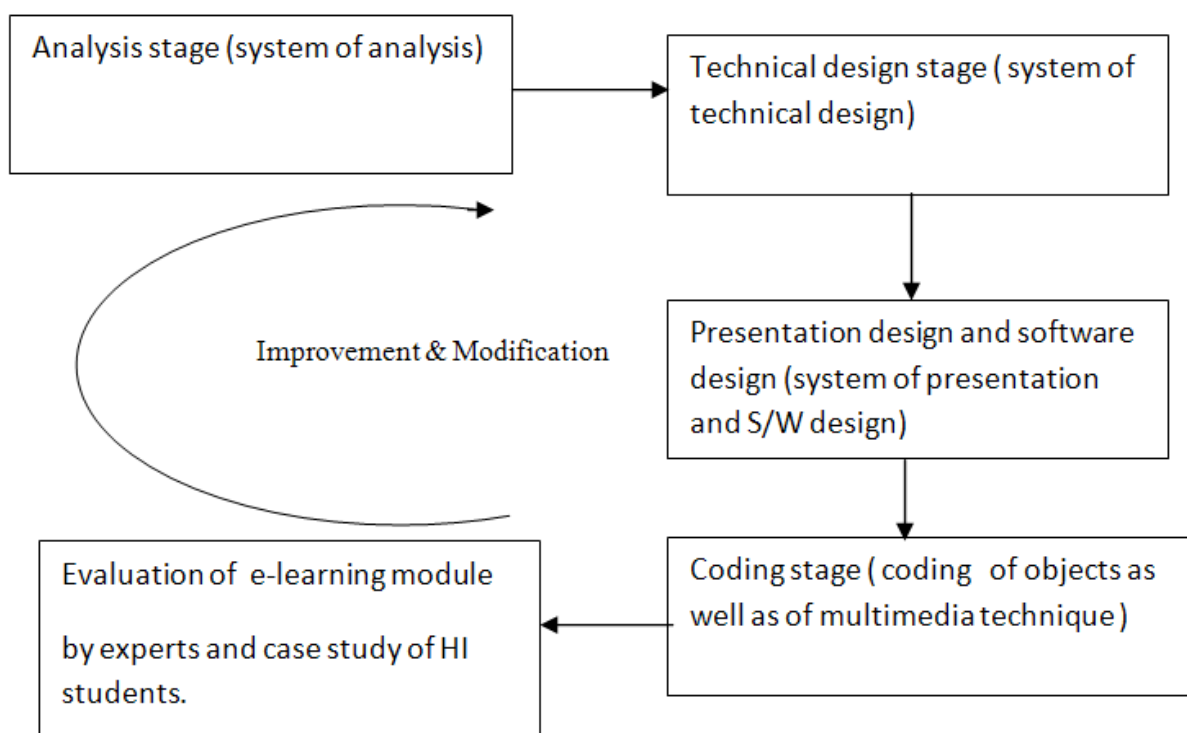

Figure 1: Stages of the Model

(For more details kindly read the manuscript of the research work in Ref.8) , the authors depended on the above model in designing their eLMs.

The analytical stage represents the preparations of the instructional material which would be submitted includes the questions and proper feedback as well as reinforcement for correct answer. These questions and feedback are a part of the tutorial e-lessons.

The technical design represents the decisions of the designer to select the suitable e-learning method , e-learning strategy , modes of communications to be covered via the eLM like finger spelling or sign language , rewriting the output of the analytical stage so that to prepare the instructional material which would be displayed to the Deaf student , the fundamentals of the S/W engineering particularly the hierarchy.

The presentation design is stage in which the designer may translate the output of technical design into real visual programming forms , model recommends to use Visual Basic or Delphi as typical visual programming language.

Coding stage writing the source of the instructional computer system , for sizable eLMs , it is recommended to use OOP approach. Multimedia represents the core of

the eLMs for Deaf students because they   can communicate and interact with clips of sign language , finger spelling and lip movements clips. Therefore the authors have linked around 3000 video cuts of English words and letters. If the word is present in the vocabulary ,its corresponding video cut, otherwise the word would be displayed by video cuts of finger spelling for each letter. The following table represents the technical stage of developing our eLMs using similar steps in the original model.
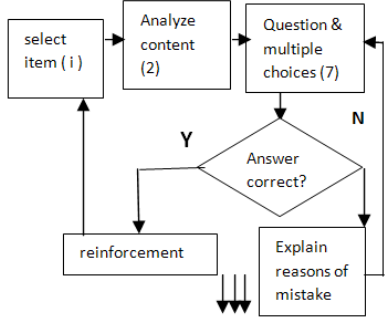
1. Instructional objective item in technical design	2. The Analysis of content of the instructional objective	3. Selection and design of e – Learning Method	4. Select e – Learning strategy	5. Mode of communication between computer and HI student	6. Select & Design computer based system model (S/W engineering)	7. Design of question / answer for the item
Item (i)(objective i in the analytical stage)

After finishing of technical design of item (i), we repeat all details to design item (i + 1) | Rewrite Activities and Conditions with renewed aspect, so that the new content represents the instructional material which would be displayed on the screen of computer for HI student.

However all the output on screen must be translated into languages suitable for HI student (finger spelling, sign language, , lip movements, tc). | Select the e–Learning method (tutorial, drill & practice, testing) that supports the objective of ELM of that lesson by HI student.
There must be a specific block diagram which describes the mechanism of the e–lesson and flow of information via the e–lesson for tutorial method is depicted below as an example.

Output of this diagram forms the input of presentation design and S/w design of the e-learning module. | Select the strategy which is suitable with the selected method like Pressy or Crawder | Three main modes of communication would be recommended by the model : sign language, finger spelling and lip movement besides normal text/picture presentation and sound. | Computer based systems hierarchy strategy would be recommended for the needful eLMs to HI person and system modeling and system simulation | If there is any needful question with multiple choices to the item they should be written here . |

Figure 2: Technical design stage in developing eLMs in the current work.

The output of technical design stage leads to the input of presentation design of our eLMs , the Block Diagram in filed 3 of the previous table represents the core of technical design stage which would be convert into Visual Basic forms as shown :

In the next few pages the authors would display a real run-out forms of an eLM , topic of general science for primary schools , Indian Schools , however the authors showed/tried the samples of the e-lessons to 20 experts in India and Jordan so as to receive from them the evaluation comments via their feedback and responses.
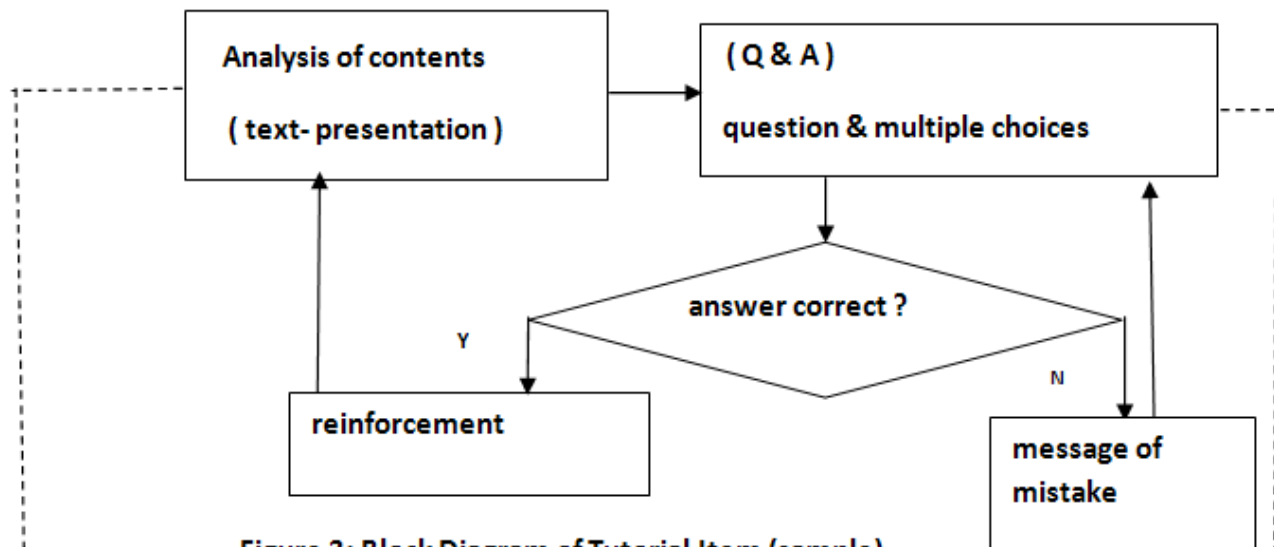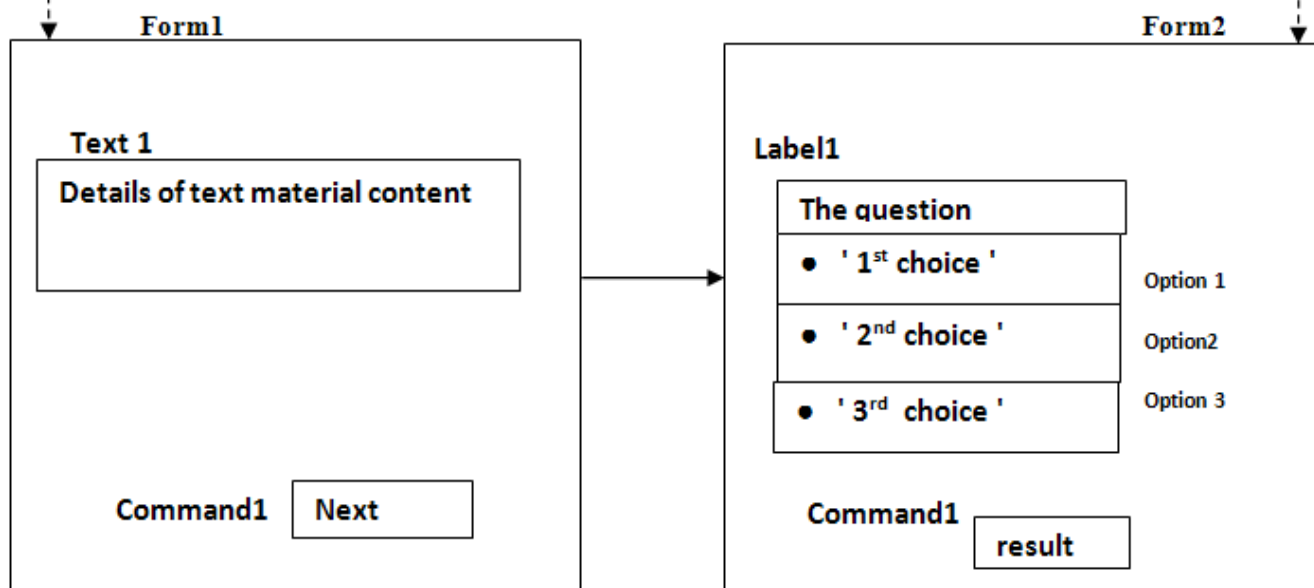
Figure 3: Block Diagram of Tutorial Item (sample)

Figure 4: Samples of Forms of Tutorial Item , converting the technical design stage into forms of Visual Basic forms.

6. Presentation of real Run-Out forms of an eLM of General Science Topic for Deaf Students:
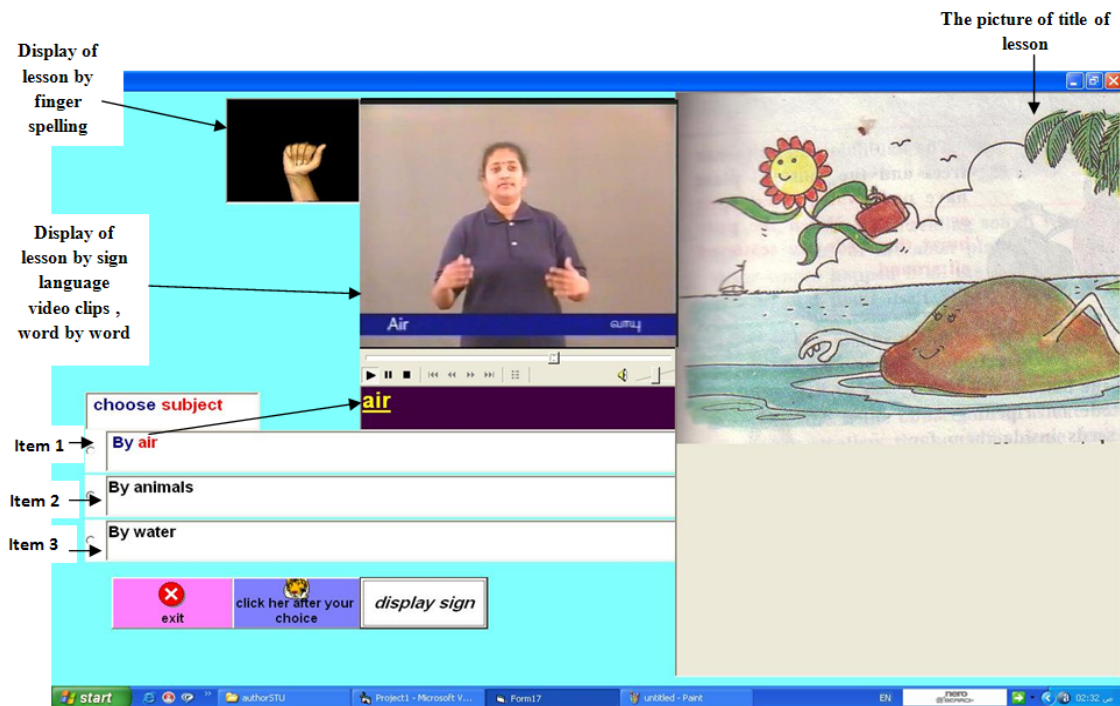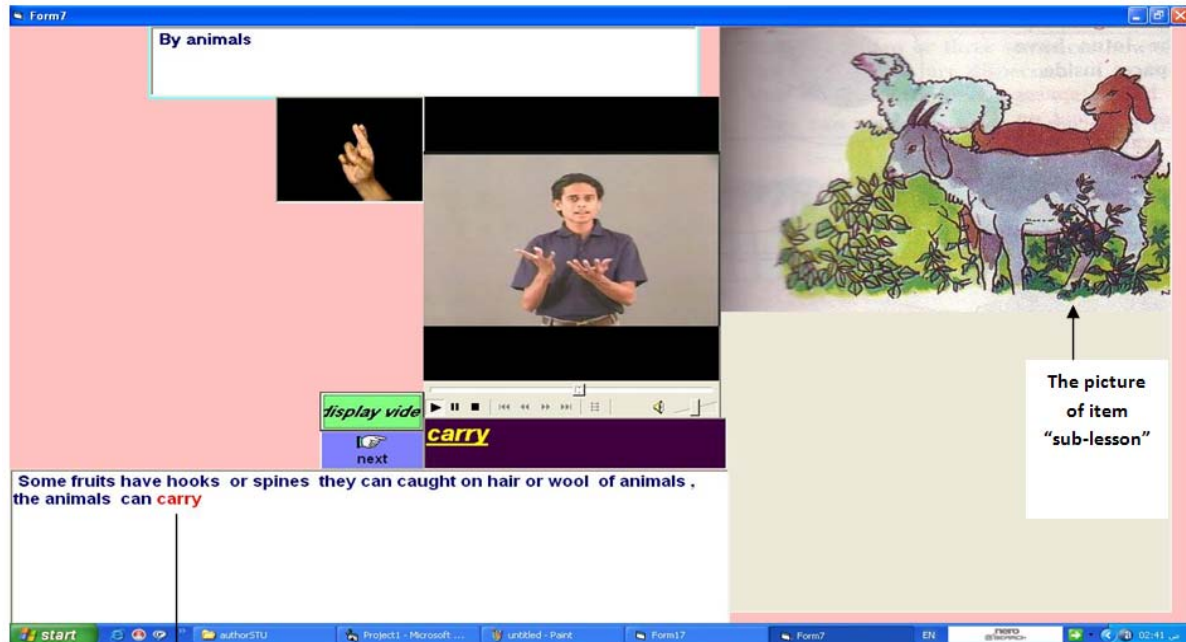

Fig.5 : Form1 of the lesson "title and sub-titles"

Displaying of manuscript of the lesson , word by word. Deaf can trace the lesson because when the word *carry* is completely translated into sign language, the next word should appear to be translated and so on.

Fig.6: Form2 of the lesson "The Deaf student selected item2 , contents of material and picture are displayed with full translation word by word and letter by letter"

Fig.7 : Form 3 of the lesson , question and multiple choices , the question deals with the previous form "manuscript of the lesson". Also all the texts are translated into sign language clips and finger spelling pictures , similar technique in the previous forms. Suppose deaf students selects choice 2 , what is the proper feedback in the next form?
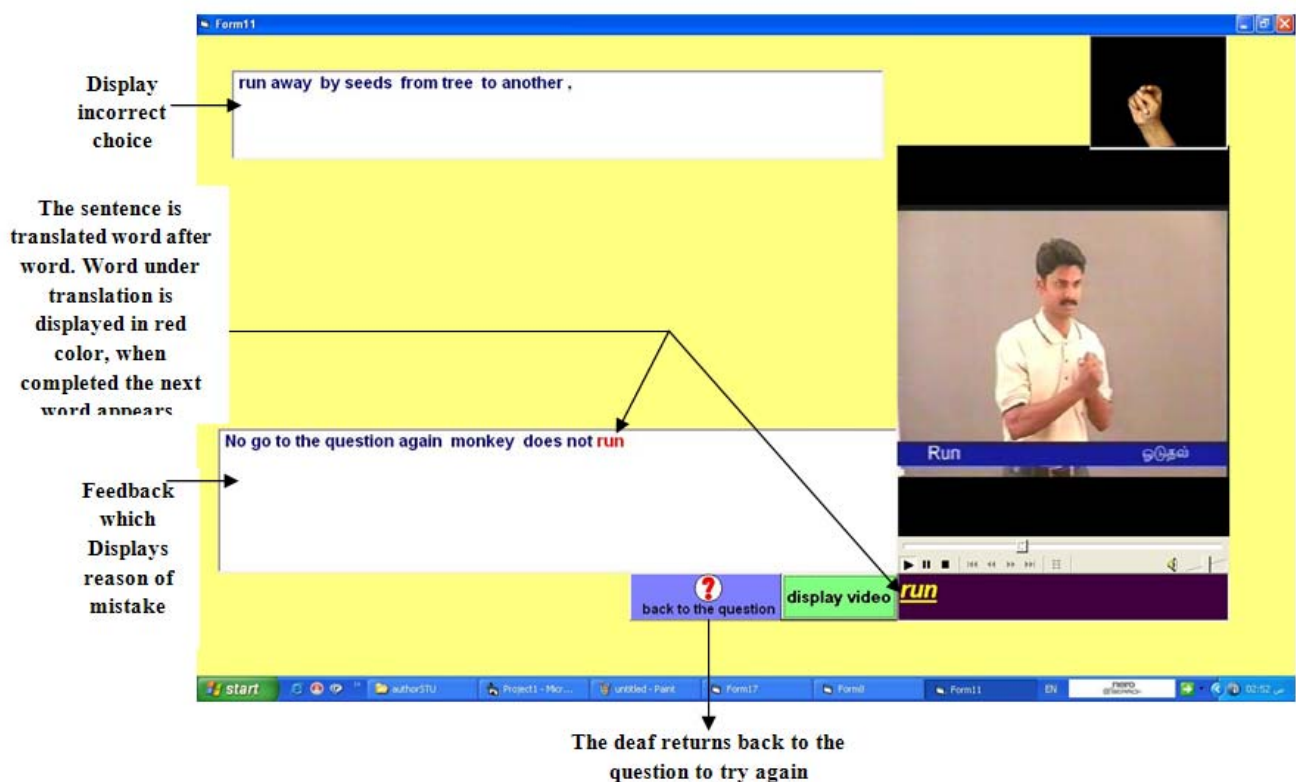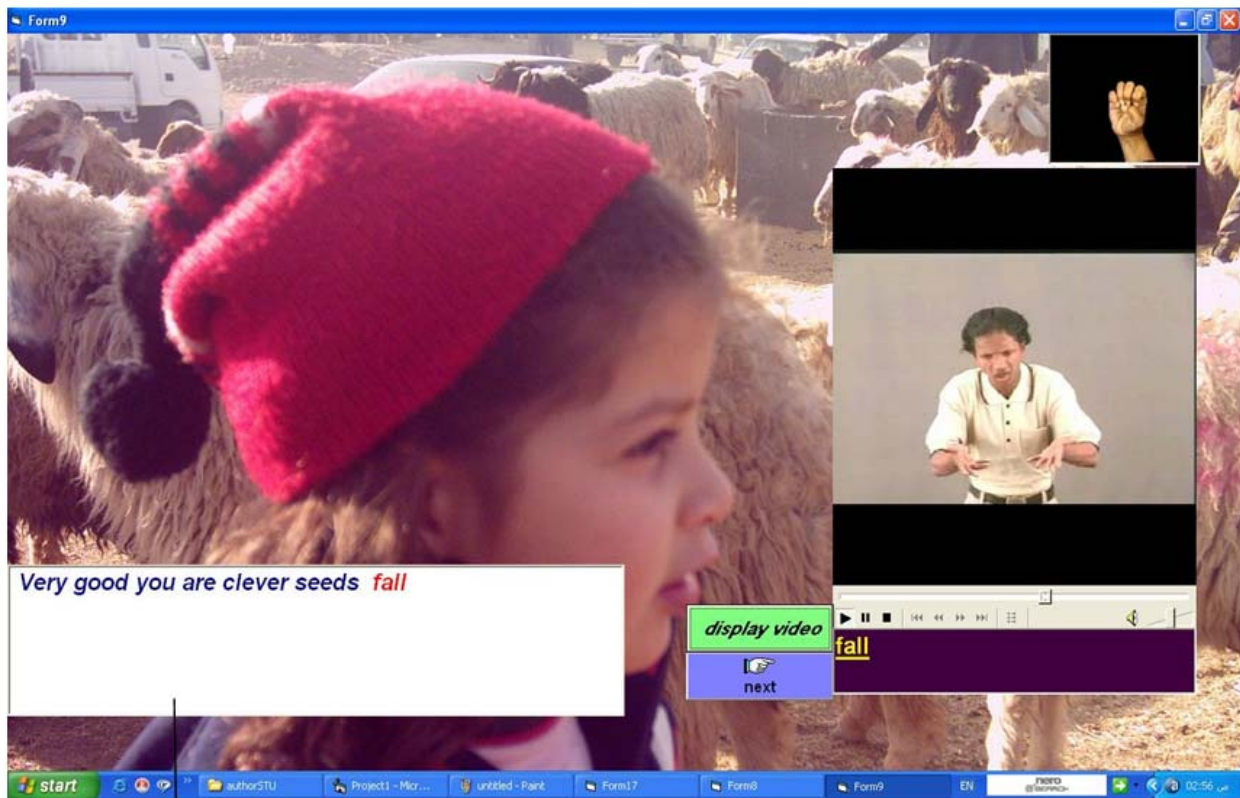

Figure.8:   form of 1st incorrect answer and corresponding feedback

Display of reinforcement for the correct choice

Fig.9:   form of reinforcement for correct answer .

7.   What is the technique used in translation texts " word after word" ?

Visual Basic as main source linked with shockwave multimedia modules. The authors developed their own database searching engine using data files. The sourcing coding is wide but the authors will display some of the multimedia shockwave module
(for more details look for the major reference of the multimedia technique, Ref.No 4)

```
Global fsc, mark As Double
Global nmb, t, i   As Integer
Private Declare Function SetFocusAPI Lib "user32" Alias
"SetFocus" (ByVal hwnd As Integer) As Integer
Private Declare Function GetFocus Lib "user32" () As
Integer
Declare Function PlaySound Lib "winmm.dll" Alias
"PlaySoundA" (ByVal lpszName As String, ByVal
hModule As Long, ByVal dwFlags As Long) As Long
Global pat$, r, totmks1, totmks2, totmks3, totmks4,
totmks5, totmks6
```

```
Global s2cor1, s2cor2, s2cor3, s2cor4, s2cor5, anim1,
anim2, anim3
Public Sub Mcallright()
pat$ = Left$(CurDir, 2)
Screen.ActiveForm.shk2.ZOrder 0
Screen.ActiveForm.shk2.Visible = False
Screen.ActiveForm.shk2.Stop
Screen.ActiveForm.shk2.Movie = ""
Randomize
anim1 = Int(Rnd * 5)
If anim1 = 0 Then
Screen.ActiveForm.shk2.Movie        =      pat$      +
"\chaitanya\standard1_M\Maths\animation\sahi.swf"
ElseIf anim1 = 1 Then
Screen.ActiveForm.shk2.Movie        =      pat$      +
"\chaitanya\standard1_M\Maths\animation\correct1.swf"
ElseIf anim1 = 2 Then
Screen.ActiveForm.shk2.Movie        =      pat$      +
"\chaitanya\standard1_M\Maths\animation\barobar.swf"
ElseIf anim1 = 3 Then
Screen.ActiveForm.shk2.Movie        =      pat$      +
"\chaitanya\standard1_M\Maths\animation\balloonright.s
wf"
ElseIf anim1 = 4 Then
```

```
Screen.ActiveForm.shk2.Movie        =        pat$        +
"\chaitanya\standard1_M\Maths\animation\correct2.swf"
End If
Screen.ActiveForm.shk2.Rewind
Screen.ActiveForm.shk2.Visible = True
Screen.ActiveForm.shk2.Play
Screen.ActiveForm.shk2.Width = 223
Screen.ActiveForm.shk2.Height = 195
Screen.ActiveForm.shk2.Left = 287
Screen.ActiveForm.shk2.Top = 193
Rght.Show
Rght.Visible = False
End Sub
Public Sub congrats()
pat$ = Left$(CurDir, 2)
Screen.ActiveForm.shk4.ZOrder 0
Screen.ActiveForm.shk4.Visible = False
Screen.ActiveForm.shk4.Stop
Screen.ActiveForm.shk4.Movie = ""
Randomize
anim3 = Int(Rnd * 3)
If anim3 = 0 Then
Screen.ActiveForm.shk4.Movie        =        pat$        +
"\chaitanya\standard1_M\Maths\animation\abhi.swf"
ElseIf anim3 = 1 Then
Screen.ActiveForm.shk4.Movie        =        pat$        +
"\chaitanya\standard1_M\Maths\animation\abhi1.swf"
ElseIf anim3 = 2 Then
Screen.ActiveForm.shk4.Movie        =        pat$        +
"\chaitanya\standard1_M\Maths\animation\abhi2.swf"
End If
Screen.ActiveForm.shk4.Rewind
Screen.ActiveForm.shk4.Visible = True
Screen.ActiveForm.shk4.Play
Screen.ActiveForm.shk4.Width = 330
Screen.ActiveForm.shk4.Height = 350
Screen.ActiveForm.shk4.Left = 220
Screen.ActiveForm.shk4.Top = 185
cogt.Show
cogt.Visible = False
End Sub
```

The above coding source represents a part of the module of the multimedia technique. About the major Visual Basic coding source , it is quite wide , the major core concern with translation each word into its corresponding video clip , if the word is not present in the vocabulary , then the world would be translated letter by letter as finger spelling clips.

8. Evaluation comments exposed by the expers :

After introducing the experiment eLMs , some selected experts in many fields have seen and tried the e-lessons so as to expose their evaluating feedback regarding effectiveness of the developed eLMs.

The Authors summarized the evaluating comments as shown:

Questions of interview are classified in 4 fields, around 9 experts have been asked to evaluate the e-lessons. Those experts are from various specializations, in computer science, special needs education, e-learning and instructional technology. The questions are about quality of translations, the model and theory which are used , the multimedia technique, efficiency of output on screen (human engineering), etc.

The comments are :

1. Real voice of characters in the video clip may be added. The real voice of characters in the clips of the original Indian-Sign language dictionary is absence. The authors confirm this weakness, they recommended to add real voice for the sign language in the concern cut. Because real voice with the action of sign language can support Deaf student to understand effectively particularly Deaf students who understands lip-movement reading. Also some Deaf students are partial hearing impaired, they can get use of the remaining hearing sense.

2. Colors of forms, backgrounds, color of text fonts, pictures linked with backgrounds and flashing of colors all need to be redesigned as follows :

Remove all pictures in background of forms, colors should be very clear, colors of text should be opposite to color of background to get good contrast. Screen which would be displayed for Deaf student should be very clear , simple , smooth without any visual noise. Because Deaf student must concentrate his mind and attention on the sign clips and pictures of finger spelling so that to trace his e-lesson.

3. Feedback of Deaf student's answer should appear on the screen of the question itself. The authors almost solved this comment , because , in the new screen , the full text of the students answer" his selected choice" is displayed besides its corresponding feedback.

4. Some Arab experts and Indian experts suggested that the Authoring System would be more effective if it processes the desired language of the teacher like Arabic or Marathi. The authors suggested this rich comment as avenue research work. But according to our experience , to develop an authoring system which generates tutorial e-lessons matches with multiple language requires a very complex work.

Besides the previous comments there are some positive comments.

1.   The system is useful for both teachers and Deaf students.

2. Tutorial e-lessons   Include fun & enjoyments and continuous interaction between Deaf student and computer. Such interaction is highly recommended in e-learning modern approach particularly for disabled students.

3. Teacher can introduce e-lessons for Deaf students even without experiences in sign language or finger spelling or without having   skills in   VB programming and its multimedia technique and e-learning. Also Deaf students can use those e-lessons with basic simple skills in using computer.

4. Deaf student takes the control/central role of learning /instruction process which strongly recommended by instructional technology literature.

5. The technique of multimedia translation   used of display the word in its corresponding video clip if the word is present in the vocabulary and display the word letter by letter in sequence if it is not present in the vocabulary, such this technique is successful and enjoyable for Deaf   students. And the word under translation action is appeared in the same time its video clip appears in the same time finger spelling appears , also that word appears in colored and underlining in another text-object, this process helps Deaf students to trace successfully translation and learning their topics

6- The system is easy to be used by Deaf students.

7- The experts were interesting while they were practicing e-lessons. As a result we can expect such system to be friendly learning tool to the Deaf student.

8- The system offers multiple modes of translation method. Therefore it is expected to cover all categories of Deaf students.

9- Some experts asked if we can link lip movement video clips . Actually the authors tried their best to obtain such software dictionary but according to their survey there is no available free lip movement software to be considered.

9. Conclusion:

As per the previous comments and their discussions besides the systematic approach in development the excremental e-lessons , the authors summarized their conclusion as following :

1- Developing e-lessons for Deaf students should be based on systematic instructional computer model as well as a confidence learning theory. These couple of factors offer to the designer the environment to introduce typical e-lessons which may realize effective learning , meaningful learning and maximization of instructional outcomes of learning besides provide fun & enjoyment for Deaf students.

2- e-lessons were developed successfully to realize continuous interaction between Deaf and computer ,

including fun & enjoyment. The Deaf takes the active/central role in the teaching/learning process. These factors provide important advantages to the Deaf like enhancing self confidence and solving problem of individual differences. Also the mentioned e-lessons could be considered as a friendly learning tools.

3- According to Hearing Impairment teaching strategies, use common, easy, clear,short and simple words as well as sentences. Those conditions have been applied successfully in our e-lessons.

4- Give Deaf student enough time to read, trace translation of words and answer the questions. This factor is successfully performed in our e-lessons as shown:

 Procedure of displaying multimedia in translation is successfully developed, if the word is present in the vocabulary it should be displayed as sign language video clip and if it is not present it should be displayed as alphabets finger spelling cuts. Also, simultaneously displaying word under translation in different color helps Deaf students in tracing his lesson.

5- As general aspect , view points and responses of expert were positive and recommended to carry out avenue work in this systematic filed particularly translating the system into local languages of Deaf students like Arabic language also trying another modes of communication like lip movements reading. Some effective suggestions are concerning with extend the e-sign language vocabulary "4000 clips are not surfactant to cover English language". Some experts suggested to try e-lessons of Drill & Practice and problem solving methods.

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