

First Steps in Physics for the Deaf

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Abstract. This article presents the educational computer program “First steps in physics for the deaf”. It serves to introduce concepts from the field of physics to students with impaired hearing, as well as to hearing personnel of Bulgarian special and mainstream schools. The program provides a choice of vocabulary divided in categories (alphabets, digits and numbers, pronouns, energy and motion) which students use to form a sentence. The programme then translates the sentence into sign language. This mechanism not only develops the pupils’ vocabulary skills but helps reinforce correct grammar in Bulgarian.

Introduction

The pupils with disabilities in Bulgaria and particularly those with impaired hearing are educated in special schools. The recent years have noted a positive tendency towards mainstreaming children with hearing loss. As a result, a number of the legal documents [1, 3, 4] have been created to ease this process. However, they fail to lead to the cultivation of effective educational processes. This is why such measures have become inadequate and the everyday integration of children with disabilities has left entirely to the initiative and good will of the individual teachers.

In particular, the education of the deaf students in physics in the mainstream, as well as in the special schools has always accompanied by certain difficulties – the lack of appropriate facilities, the lack of a sign language expertise on part of the teachers, the lack of information technology equipment and many more. These obstacles do not allow educators to present information correctly and yet accessibly. If that were possible, it would have provided for effective physics classes and would have subsequently provoked a long-term interest in the pupils.

More developed countries boast a number of methods, such as software products, to use in the education of the deaf. One of these is the animation of a three-dimensional boy (Andy) who possesses natural facial expressions, which assist in the translation of words and phrases into sign language. Andy translates English into sign, helping the deaf and hard of hearing students build language and reading skills. The software product has developed by a team of teachers of the deaf and computer engineers. The technology in use is the same one as the 3D of the computer games. This software has used for educational purposes [2].

Another system, which improves hearing and pronunciation skills of children with hearing disabilities (ages from 6 to 12) is Baldy – an oval-faced boy with computer-generated face. His articulation, lips and facial expressions add to and complete the meaning of the words and sentences he says [2].

To generalize, the computer plays a motivational role for the majority of pupils. As a result, using it they put a greater effort than when they put into written tasks. When the educational content is on the screen, as a game, and in sign and written language at the same time, the children memorize and analyze is more. This is valid especially for the deaf children who use two languages with distinctly different grammatical structures.

Description of the Programming Language Used

First steps in the physics for the deaf is an educational programme with a goal to introduce physics concepts in sign language both to a deaf and hearing audience.

The management of this system has performed through Action Script 2.0, which is an object-oriented language. The graphic part of the project has developed with the Macromedia Flash 8. The programme exists in two versions: one is an .exe file and runs on Windows while the other one is a .swf and can use via an Internet browser (Mozilla, Internet Explorer). This provides a multi-platform environment of the product.

The programme allows the upload of new videos as well as various new informational materials that allows for the expansion of the sentence variety and word combinations. *First steps in the physics for the deaf* consists of 219 videos that are pre-coded in an .flv format – Flash video - in order to has streamed so the users can download and watch at the same time. In a module structure, all buttons are identical and the parameters have specified in the object – the words and sentences to be loaded in the required field - while the option for a specific word has defined for each button.

The minimum system requirements for running the program are a 233 MHz processor or higher; 200 MB of RAM or more; Windows 98/ME/2000/XP.

Features of the educational program *First steps in physics for deaf*

The presentation features have articulation and sign but no sound.



Fig. 1 Sign for the word “conductor”

Users can choose a word from a list of categories (titled step 1, step 2 and so on) from menu on the left hand side of the window. The categories are: alphabets, digits and numbers, pronouns, energy and motion. Once selected, the word can to drag the first open line on the right. For example, the word conductor has taken from the step 4 list and placed in the first available line. By clicking, see word button, the user can see the sign language translation (Fig. 1).

However, the program has intended not only to offer a simple review of vocabulary, but also to allow correct construction of any term in the physics, composed by a number of words, which have listed randomly in the categories. This mechanism requires certain resourcefulness on a part of the pupil. If the words have placed in a correct order, the button “see sentence” will activates. These way deaf pupils have the opportunity not only to study physics in sign language, but also to practice correct word order in Bulgarian. This is necessary because a Bulgarian sign language differs from Bulgarian in many aspects. Prepositions and conjugation as well as gender, number and other parts of speech lack in Bulgarian sign language. Often one sign serves as a noun, an adjective and a verb (for example, the same sign has used for Sun, shines, and bright).



Fig. 2 Presentation in sign language of the term “good heat conductor”

The words for which more than one sign exists have presented in all options. The words in the categories can make a different number of sentences.

Often the diversity of spoken language (the combination of words and punctuation) has not reflected in sign language. While in Bulgarian words can have a different meaning depending on the phrase, the possible combinations in sign have reduced to a minimum.

In the see word section, the word and the sign have presented simultaneously (in combination). Its articulation has accompanied by the sign. This is possible because when one linguistic unit is used the word order and the sign order match.

In the see phrase section, the sentences have presented only in sign language, because the simultaneous usage of the sign and verbal language is impossible – the word order and the sign order do not match.

In case the sign language mimics the verbal language, it’s a form of sign language called sign exact Bulgarian which however is not the subject of this article.

Description of the Steps in the Program

Step 1. Alphabets

In this step, users can see the three types of alphabets used in Bulgarian sign (Fig. 3). Bulgarian single-hand alphabet

This alphabet has imported from Russia and most of its configurations of the fingers and wrists are symbolic of some letters (for example *A*, *B*, *Ж*, etc.). If not symbolic, the letters have shaped with the fingers (for example *Г*, *М*, *Л*, etc).

Bulgarian two-hand alphabet

Unlike the one-hand alphabet, this alphabet evolved in the language of the Bulgarian deaf people. This can be seen in the logic used in the formation of each letter (the authentic Bulgarian word is presented first followed by its translation in English): *Б* – *БУЗА* [cheek]; *В* – *ВЪЖЕ* [rope]; *Д* – *ДЛАН* [palm]; *З* – *ЗЪБ* [tooth]; *К* – *КУКА* [hook]; *У* – *УХО* [ear]; *Ч* – *ЧЕЛЮ* [forehead]; *Я* – *ЯД* [anger] and so on.

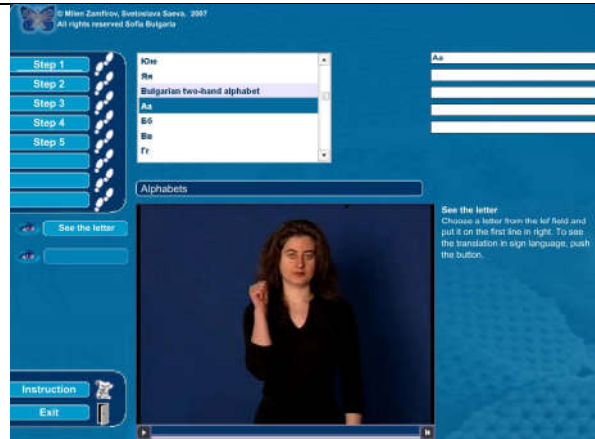


Fig. 3 A letter from the Bulgarian two-hand alphabet.

International dactyl alphabet: The international dactyl alphabet (International finger spelling) is the alphabet recognized by the World federation of the deaf. It has used in International sign communication. The alphabet and international sign have developed based on the American Sign Language. Nowadays knowledge of International sign is necessary and important to deaf people. This language has used in international meetings, workshops, forums, symposiums, congresses, and conferences, in trainings, exchange and other events attended by deaf people. Knowing this language is as important as knowing English is to hearing people in modern societies.

Step 2. Numbers and digits



Fig. 4 The number eight in Sign language

This step presents the numbers and digits of Bulgarian sign language. The logic of hearing people would not allow for differences in the visualization of numbers and digits. However, in reality we see that national sign languages do not match. For example, *eight* in Bulgarian sign would mean *three* in American Sign Language (Fig. 2). The numbers and digits have expressed with fingers, wrists and the whole hands.

Step 3. Pronouns

In the step all the words have visually presented – there are no symbolical gestures.

This section contains information about all words and terms included in Step 4 Energy and Step 5 Motion. These materials as well as the user manual have attached as an external file so that additional instructions can be added. They have been converted into a pdf file and can be opened directly in the browser (Fig. 8).

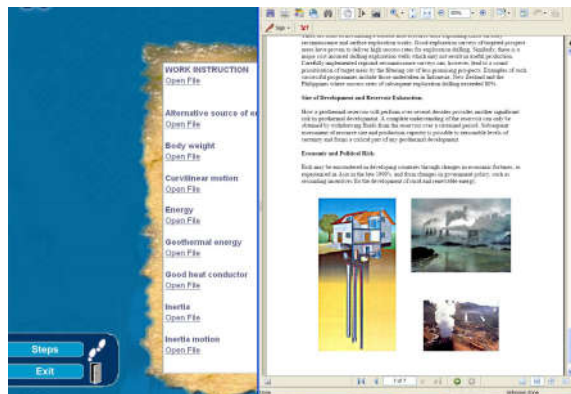


Fig. 8 Additional material for the term “geothermal energy”

Conclusion

The educational program “First steps in physics for the deaf” is an introduction to the world of physics in sign language, targeted primarily but not exclusively at deaf pupils. The program has developed so that its vocabulary can be expanded which would allow for more and more important definitions and descriptions pertinent to physics and astronomy to be included in the education of deaf children.

In addition, the program allows deaf students to practice their written Bulgarian in which, due to the specifics of their sensory disability, they make many grammar mistakes. This is valid in great extent for their non-disabled peers as well. The additional materials make teaching easier. Instructors can use the program to conduct interesting classes in the form of educational games.

References

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