IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

Proposal for the Development of Educational Software for Elementary School Students in Eastern Yucatan, Mexico

Victor M. Chi Pech[1], Erika R. Llanes Castro[2], Carlos A. Miranda Palma[3], Maximiliano Canché Euán[4]

Faculty of Mathematics, Autonomous University of Yucatán, Mérida, Yucatán, México[1-4]

Abstract: Nowadays, technology is of great importance in our daily activities and several of the technological systems that are implemented help us reducing, among others, the time to perform our activities, as it happens with the time invested to acquire knowledge. Taking advantage of the use of technological devices arises the idea of developing educational software for public elementary schools in the east of the State of Yucatan, to help the teaching-learning process and thus reduce the educational backwardness in them. This paper describes the development under the event-driven programming paradigm of some educational software, that will be of great help to teachers of public elementary schools by facilitating the learning of their students in some subjects such as mathematics, geography and Mayan culture.

Keywords: Software, educational software, event-oriented programming, event-driven programming, Mayan culture.

I. INTRODUCTION

Schools must bring students closer to the culture of today, and for this reason it is important the presence in class of technological devices, such as computers, as instruments that are used for various purposes: recreational, informative, communicative, instructive, among others. Information and communication technology is presented as a firm proposal that guides institutions to the academic vanguard in terms of the quality of their educational services [1].

Software Engineering is an undergraduate degree offered by the Faculty of Mathematics of the Autonomous University of Yucatan (UADY) in the Tizimin Multidisciplinary Unit, located in Tizimin, Yucatan, Mexico. This degree has among its curriculum the mandatory subject called Theory of Programming Languages, taught in the fourth semester, and its competence is "Develops software using various programming paradigms, based on the efficiency and relevance of the language" [2].

The study of this course is important for the formation of Software Engineering students since it allows them to adequately select the programming language in which to implement the solution of a problem.

For the scope of the competence of this course, the unit "Programming paradigms" is taught in which the student develops representative applications of each programming paradigm, according to their frameworks of reference. Within the programming paradigms reviewed, the event-oriented programming paradigm, also termed event-driven programming paradigm, is analyzed.

Regarding the development of representative applications and with the purpose that the student of the degree puts into practice in real learning scenarios the knowledge acquired in the course, the professors who teach this course in the Tizimin Multidisciplinary Unit request the students to develop educational software to be used in elementary, middle and high schools in the east of the State of Yucatan, so that they contribute to the teaching-learning process of the students of these schools, and in this way the university contributes to providing services to society.

In addition to developing new software, students review previous developments in order to provide feedback, improve them, and check their functionality.

The purpose of this paper is to present the development of some computer programs performed in the subject Theory of Programming Languages, with the purpose of being used as facilitators of the teaching process and, consequently, of learning in some topics that are taught in public elementary schools located in the eastern part of Yucatan.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

II. EDUCATIONAL SOFTWARE

The reason why it was decided to develop educational software is due to the need to incorporate new teaching strategies in the classroom in order to streamline and facilitate the teaching-leaning process in the classroom, and because of the great importance that educational software has taken in this process, considering them as tools that provide to both the teacher and the student dynamic learning spaces, since according to [3], an educational software is a computer program created to facilitate the teaching-learning processes.

Likewise, by having an educational software, teachers are making use of information and communication technologies and the application of these motivates students and captures their attention, which makes them one of the engines of learning since it encourages activity and thinking [1].

The term educational software has been addressed by several authors, so there are different definitions for this term, however, something that is present in most of them is a set of characteristics that a software must have to be considered educational, such as its didactic purpose, pedagogical intentionality, curricular support, pedagogical material, and the didactic medium [4].

According to [5], an educational software is a computer program created to facilitate the teaching-learning processes that aims to imitate the tutorial work performed by teachers and that presents models of knowledge representation in line with the cognitive processes developed by students.

For [5], educational software has the following characteristics: they are materials elaborated with a didactic purpose; they use the computer as a support on which the students perform the activities that they themselves propose; they are interactive as they immediately answer the actions of the students and allow a dialogue and an exchange of information between the computer and the students; they individualize the work of the students, since they adapt to the pace of work of each one and can adapt their activities according to the performance of the students; they are easy to use, the computer knowledge necessary to use most of these software is minimal, although each software has some operating rules that it is necessary to know.

III. EVENT-ORIENTED PROGRAMMING PARADIGM

The educational software presented in this paper were developed under the event-oriented programming paradigm, also termed event-driven programming paradigm. In this programming paradigm, both the structure and the execution of the programs are determined by events that occur in the system, defined by the user, or caused by them.

In event-oriented programming, the flow of the execution of the program is not determined in advance, we do not know which lines of code will be executed in each case. It is the user or the system that determines the execution of functions in response to events triggered by them [6].

Event-oriented programming is characterized by spending most of its time waiting for user actions (known as events) and responding to them. It is called user-dependent actions because the user is the one who gives the action or event for the execution of the program. Therefore, the user manipulates the events that concern them, events associated to methods and attributes, which are the procedures and features to execute in applications on different actions.

An event is an action that is recognized by an object and is usually triggered by the user interacting with the program interface. Many objects have a predefined set of events that they can recognize, if one of them occurs, an event handler is executed in response, therefore, an application for the operating system actually executes functions to handle the different events that occur [6].

Event-oriented programming uses visual elements in order to create a pleasant work environment and an interactivity with the program, allowing contact with the use of previously defined objectives and events. In visual languages, programming in this paradigm becomes simple and enjoyable.

One of the most widely used programming languages for this paradigm and used for the development of the educational software described in this paper is Visual Basic of Microsoft.

Visual Basic is a visual programming language, also called fourth generation language, which means that a large number of tasks are performed without writing code, simply by performing graphical operations with the mouse on the screen.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

This is also an object-based programming language, although not object-oriented like C++ or Java. The difference is that Visual Basic uses objects with properties and methods but lacks the inheritance and polymorphism mechanisms of true object-oriented languages such as Java and C++.

The Visual Basic application, that is, the tool of the development environment of Microsoft for its Visual Basic language, can work in two different modes: in design mode and in run mode.

In design mode the user interactively builds the application by placing controls on the form, defining their properties, and developing functions to handle events. On the other hand, the application is tested in run mode, in which the user acts on the program (introduces events) and tests how the program responds.

There are some properties of the controls that need to be set in design mode, but many others can be changed at run time from the written program.

IV. DESCRIPTION OF THE DEVELOPED SOFTWARE

Guessing Game

The purpose of this educational software is to provide the tools to generate in the user a meaningful learning about the Yucatec Maya language, one of the Mayan languages. It is an intuitive software that provides information for those who have the passion to learn the Maya language spoken in Yucatan in an easy and fun way, keeping the brain active, capturing the attention, and motivating the player to win in order to increase the knowledge and enrich the Maya vocabulary that he or she possesses.

This software was created with the purpose of encouraging the preservation of the Maya language, which is important for the culture of Yucatecans. Currently the number of people who speak this language is decreasing, so rescuing and making this language known to children from Yucatan and even to people who are not part of the State, would generate an enormous impact on the history and culture of Yucatan.

The software has both a beginner and an advanced level. The beginner level consists of the user having to guess the Maya word for some fruits and colors, through a clue that will be provided to the user, and eight attempts are allowed to achieve it. On the other hand, the advanced level consists of the user having to guess the Maya word for some animal names, body parts, objects in a house, and objects in a school, and similarly, a clue will be provided, and eight attempts will be allowed.

For this, the user is presented with an image of the object to guess, which is chosen randomly. If the player considers that the word is "difficult" and that he or she will not be able to guess it, he or she has the option of requesting a new object to guess. Otherwise, the game can start.

At the start of the game, the player will try to guess the name of the object which is entered through a keyboard presented on the screen. If the name of the object contains the letter entered on the keyboard, it is displayed in its place within the name so that the user can have a better idea of what the name of the object would be.

In addition to this, the interface displays a tree containing eight apples. Each time the user enters a letter that is not part of the name of the object, an apple falls from the tree, meaning that the user has a maximum of eight failures in his or her attempts to guess the name in Maya of the object.

When the player fails to guess the word, the tree without apples changes its appearance and the player is presented with the name in Maya of the object that he or she failed to guess.

Fig. 1 shows when the correct word in Maya language is "WOOB", and the user entered a total of ten letters to guess the name, of which seven were incorrect, so the tree was left with one apple. In this case, the user guessed the word.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

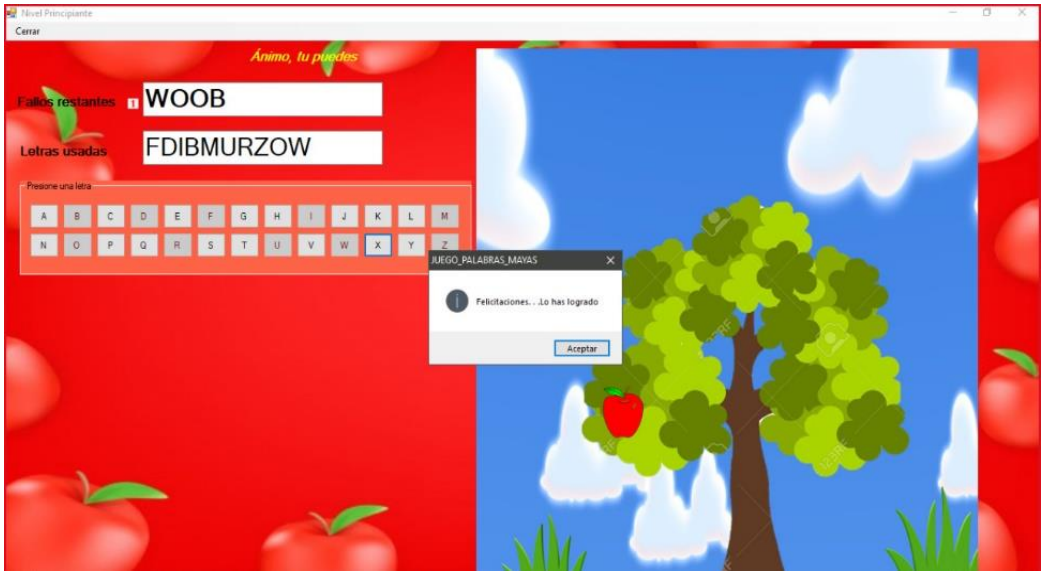

Fig. 1 Guessing game at the beginner level.

Although this software was developed to be used in elementary schools, it can also be used by anyone who wants to learn some of the Maya vocabulary at a basic level. Therefore, this educational software has the purpose of publicizing the Maya vocabulary, stimulating the interest of society in our culture, as well as stimulating the memory capacity of users.

Knowing the State of Yucatan

The purpose of this software is for elementary school students to learn about the municipalities of the State of Yucatan by obtaining information about each one of them such as: Name of the municipality, Meaning of the name, Number of inhabitants, Territorial area (Km2), adjective related, and a representative image of the municipality.

Fig. 2 shows the image of the software in which the user will select one of the 106 municipalities of the State of Yucatan of his or her interest to be provided with the information of the selected municipality. While browsing the different municipalities, the user can, if desired, by clicking on the speaker icon, listen to music from Yucatan added to the software.

Fig. 2 Interface to select a municipality in the State of Yucatán

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

Fig. 3 shows the result obtained when the user, by clicking with the mouse, selects the municipality Tizimin.

Fig. 3 Information of the municipality Tizimin.

Playing with Multiplication Tables

The purpose of this software is that elementary level students can learn multiplication tables and practice them whenever they want without the need for adult help, thus encouraging self-learning, in addition to providing the appropriate material for children to learn in an interactive and fun way.

For the development of this software focused on elementary level students, several rules were considered, such as designing the interface to be simple and creative in order to attract the attention of the user, as well as avoiding repeating the exercises when practicing the tables, so that the program does not turn monotonous and boring.

This software is developed in two sections, the first one is for the user to learn the multiplication tables (from 1 to 10), and the second one in which the acquired knowledge will be put into practice, which is done by selecting a specific multiplication table to practice, or by selecting the option to practice any multiplication table.

Once the practice of the corresponding table has been completed, the user can know the number of correct answers obtained in order to measure his or her learning in that subject.

Fig. 4 shows the images corresponding to the qualification obtained by a specific user when practicing the table of seven.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

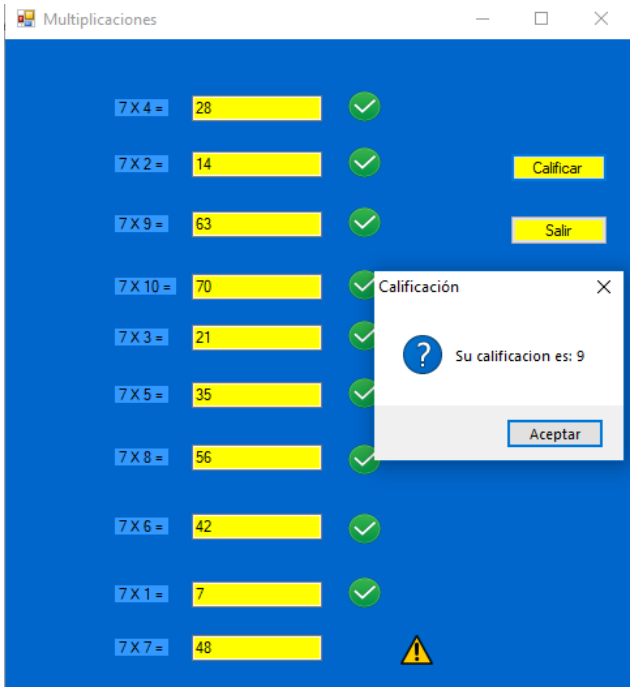

Fig. 4 Results of a test on the multiplication table of the number seven.

Learning Fractions

The purpose of this software is to help elementary level students in the study of fractions. It has a section to review some concepts related to the topic and another to put this learning into practice.

When the user wants to put his or her knowledge into practice, one of the activities presented are images with colored parts to identify what would be the numerator and denominator corresponding to the colored parts of that image, such as the one presented in Fig. 5. Finally, the user has the option to review his or her answers and receive feedback on the results.

Fig. 5 Practice space for the topic of fractions.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.12 ⁜ Vol. 9, Issue 12, December 2022

DOI: 10.17148/IARJSET.2022.91201

V. CONCLUSIONS

The educational software developed in the subject Theory of Programming Languages facilitates the teaching and learning process, since through the development of these software, the students put into practice the advantages of the event-oriented programming paradigm, which allows them to exercise the contents of the course. On the other hand, for the users of these software, they will serve as support for the learning of topics in the areas of mathematics, Mayan culture, and geography, determined by their elementary school teachers. The educational software presented here were developed considering that their interfaces must be simple and easy to understand, even for people who commonly have problems with technology.

These software were presented to the students of the corresponding semester of the degree to receive feedback regarding the design and development to make improvements and at the same time verify their functionality.

As future work is considered to perform the corresponding usability tests with elementary school students in some of the previously selected schools in the eastern part of the State of Yucatan, Mexico.

ACKNOWLEDGEMENTS

We thank the students of the fourth semester of the Bachelor of Software Engineering of the Multidisciplinary Unit Tizimín who took the Theory of Programming Languages course for designing the images presented here.

REFERENCES

[1] Luévanos Rojas Ramón, Ruiz Cisneros Guadalupe, Cortés Martínez Facundo, Diosdado Salaza Juan Antonio, Luévanos Vázquez Julio Ernesto. Plataforma virtual educativa en posgrado. En Cruz Chávez Marco Antonio, Peralta Abarca Jesús del Carmen, Martínez Rangel Martín Gerardo, Cruz Rosales Martin Heriberto (Eds.), *El desarrollo de software como herramienta en distintos campos de la ingeniería*. México (pp. 200). Primera edición, 2014.

[2] Curi Quintal, L.; Chi Pech, V.; Narváez Díaz, L.; Pasos Ruiz, A. Planeación didáctica de la asignatura Teoría de lenguajes de programación. UADY, 2018.

[3] Pérez, O.; Pérez, R. Software educativo: un instrumento para su desarrollo y evaluación. Editorial académica española. 2011.

[4] Fallas Monge, J.; Chavarría Molina, J. Validación de software educativo. VII Festival Internacional de Matemática. Instituto Tecnológico de Costa Rica. 2010.

[5] Pere Marques. El software educativo. Universidad Autónoma de Barcelona. 1996. Disponible en https://recursos.salonesvirtuales.com/assets/bloques/educativo_de_pere_MARQUES.pdf

[6] Rioja del río C. Docencia de la programación orientada a eventos. Universidad de Cádiz. Novena Jornadas de enseñanza universitaria de la informática. Disponible en http://bioinfo.uib.es/~joemiro/aenui/procJenui/Jen2003/riodoce.pdf