

Design of a strategic model with Neurodidactics in Higher Technological

Diseño de un modelo estratégico con Neurodidáctica en la Educación Superior Tecnológica

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Abstract

This research obeys the need of this 21st century, the era of knowledge, where education must reconsider its vision for the potentialization of student learning in technological higher education. Neurodidactics is a tool whose objective is to optimize the teaching-learning evaluation process, based on brain development, favoring learning with all the brain's potential. The objective is the design of a model based on neurodidactics in technological higher education, considering important elements for its application, and obtaining significant learning with critical thinking. Showing the elements according to the investigation in a case of use in the IT of Zitácuaro, for its creation of the model. The phenomenology provides the elements for the pertinent analysis to the design of the model. The design of a model based on neurodidactics gives teachers the opportunity to redesign themselves and identify the missing events to achieve their objectives in the learning of higher education students.

Resumen

Esta investigación obedece a la necesidad de este siglo XXI, la era del conocimiento, donde la educación debe replantearse su visión para la potencialización del aprendizaje de los estudiantes en la educación superior tecnológica. La neurodidáctica es una herramienta la cual su objetivo es optimizar el proceso enseñanza aprendizaje evaluación, basado en el desarrollo del cerebro, favoreciendo el aprendizaje con todo el potencial cerebral. El objetivo es el diseño de un modelo basado en neurodidáctica en la educación superior tecnológica, considerando elementos importantes para su aplicación, y obtener el aprendizaje significativo con un pensamiento crítico. Mostrando los elementos de acuerdo con la investigación en un caso de uso en el IT de Zitácuaro, para su creación del modelo. La fenomenología, proporciona los elementos para el análisis pertinente al diseño del modelo. El diseño de un modelo basado en neurodidáctica da la oportunidad a los docentes de rediseñarse e identificar los eventos faltantes para el logro de sus objetivos en el aprendizaje de los estudiantes de educación superior.

Neurodidactics, Meaningful learning, Strategy

Neurodidáctica, Aprendizaje significativo, Estrategia

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Introduction

Neuroscience, in its definition, refers to several areas of knowledge that address the current levels of knowledge about the nervous system, involving sciences such as: neuroanatomy, physiology, molecular biology, chemistry, neuroimmunology, genetics, neuronal imaging, neuropsychology, mathematics, computational sciences, artificial intelligence, among others. Therefore, neuroscience is in charge of revealing the secrets of the brain and all the other components of the nervous system. An essential element is the functioning of the brain, it is the essential organ for our intellectual, emotional and psychomotor development. It is the one that allows us to perform those activities that define us as human beings (reading, writing, speaking, appreciating, composing music, performing calculations, learning a number of skills, as well as expressing our emotions).

The main purpose of neuroscience is to understand how the brain produces the marked individuality of human action. It is to provide explanations of behavior in terms of the activities of the brain, to explain how millions of individual nerve cells in the brain act to produce behavior and how, in turn, these cells are influenced by the environment, including the behavior of other individuals [VII, VIII].

Currently there is knowledge and appreciation of how researchers in the field of education, teaching staff and managers of educational institutions, are motivated in the innovation of the neuro concept with respect to offering companies contemporary elements that allow them to improve their marketing processes of their products, generation of products and services, thus contributing to the promotion of economies, contributing significantly to the progress of this concept of neuro (FALCONI and ALAJO, 2017). Demonstrating that great range of ramification for neuro terminology, providing within education, the real entities that give focus to the educational area, the understanding of the student, the importance of generating attraction of the student body to a center of studies, their active participation and identification with the institution and control their respective permanence in it; a traditional action of an educational institution is only to focus on how to capture students, but not to analyze what happens to them in the course, during the whole process in which they study and how they study.

Today, the great importance and relevance is the reconceptualization of education in the digital era, in which the great challenges that higher education institutions in Mexico, for example, assume in general, must be dimensioned, and which are framed in the accelerated informational development, which has an impact on the social, technical and economic aspects and has direct repercussions in education, in the so-called educational informatics, enhancing the practical meaning of computer media and their application to the specific educational context [I].

With the reconceptualization of education together with the field of neuroscience and neurodidactics, it is proposed to start this paper, the use of some neurodidactics strategies essential to improve the teaching-learning-evaluation process in the educational system, so that the student appropriates the knowledge effectively and can put it into practice to understand their environment and contribute to it significantly [VI].

Generating a model as a tool in the application of support for meaningful learning and critical thinking of students in technological higher education.

Neuroscience applied to education tells us that motivation and challenges are able to activate certain areas of the brain that help in the learning process, that we learn more and better in interaction with other people than individually and collectively, as it encourages free and natural experimentation of their abilities and skills. From this knowledge, plus that provided by education and psychology, emerges neurodidactics, a bridge discipline between neurology and educational sciences in which educational psychology also plays a fundamental role.

Neurodidactics

It brings together epistemology, neurology, cognitive sciences, psychology of learning and pedagogy to understand and identify the best way to learn, which in turn allows us to organize the best way to teach. [4].

Origin of Neurodidactics: It is a relatively new discipline, no more than 20 years old. It was in 1988 when Professor Gerhard Preiss, a specialist in the field of mathematics didactics at the University of Freiburg began to write about pedagogy based on neurology, proposing to introduce a subject based on brain research and pedagogy, resulting in neurodidactics. The objective of neurodidactics is to design a teaching-learning evaluation process that enables or facilitates the creation of synapses to increase and enrich the number of neuronal connections, improve the quality and capacity to function as a human being for life.

Significant learning

Significant learning is, according to the American theorist David Ausubel, a type of learning in which a student associates new information with that which he already possesses; readjusting and reconstructing both pieces of information in this process. In other words, meaningful learning is not forgotten and is maintained in the student's capabilities throughout his or her life. The process takes place when new knowledge or information is related to the cognitive structure of the learner in a non-arbitrary and substantive way. Therefore, the teacher must not only provide the necessary materials to study, but also techniques and methods that make learning effective and meaningful.

Neurodidactics is a new discipline that studies the optimization of the teaching - learning - evaluation process, based on the development of the brain, or in other words: it is the discipline that favors learning with all our brain potential and achieving an impact on our environment.

Methodology

The objective of this particular research is the design of a model under the neurodidactic approach in students of the ITZ systems engineering career from 2021 to 2022. The general research work is much broader, in this article, only the design of the model under the neurodidactic approach will be included.

Case study

Instituto Tecnológico de Zitácuaro, Computer Systems Engineering, 7th semester project management course, from 2021 to 2022, 45 students participating in the study.

Instrument

ITZitácuaro has a questionnaire of 120 questions related to teaching performance, learning, quality of the materials provided and facilities, from which valuable information was obtained that is not far from the assumptions of neuroscience, neurodidactics. The questionnaire was previously validated by a group of experts from the central body of the Tecnológico Nacional de México.

Methodology

In order to achieve the stated objective, the design of the methodology used for the collection of information was framed in a non-experimental research design, with a type of documentary research and an analytical level, based on a phenomenological approach to the educational fact in the given subject, seeking a perspective for the understanding of the various intervening variables.

It is important to note that in the application of neurodidactics many key elements must be considered, which in this study were classified in three phases.

Phase 1 Moment of identification

* Curriculum

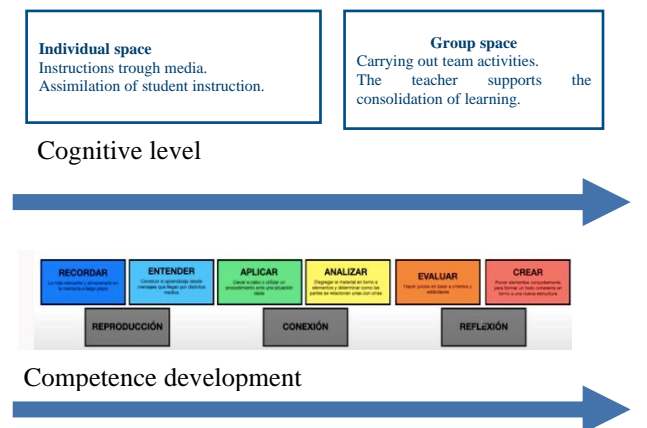


Figure 1 Computer systems engineering degree curriculum

* Contents

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* Indicators



Figure 2 Competencies of the project management course of the computer systems engineering degree program

Software project management	
Competence	Applies methodologies and tools to guarantee the adequate management of a software project.
General objective	Manages software projects applying the elements, techniques and tools, in accordance with cost, time and scope commitments

Figure 3 Content of the subject of project management

* Focused competencies

- Development of skills: communication, cooperation, creativity and critical thinking.
- Key elements: awakening and sustaining learning motivation.

Active and contextualized methodologies

Responding to complex demands and carrying out diverse tasks appropriately. Competence involves a combination of practical skills, knowledge, motivation, ethical values, attitudes, emotions and other social components and behavior that are mobilized together to achieve effective action.

Name of subject, lecture, course: Software Project Management	
	Unit, Block, Theme
Content block	Basic concepts for project management. Phases of project management. Project planning. Proposal. Personnel Selection and Evaluation. Project Supervision and Review. Reports. Project Management Fundamentals Institute.

Assessable learning standards	<ol style="list-style-type: none"> 1. Specify 2. Use 3. Discriminate 4. Contrast 5. Categorise 6. Analyse 7. Identify and describe
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Figure 4 Definition of learning objectives based on Bloom's taxonomy

Phase 2 Flexible timing, motivation

- Contents
- Autonomy
- Context
- Teamwork

Tools to carry out phase 2:

Problem-based

Problem-based learning first presents the problem, then the learning needs are identified, the necessary information is sought, and finally the problem is returned; with this dynamic, critical thinking and problem-solving skills are fostered while actively learning the theoretical basis of the subject in parentheses.

The Flow

Flow or Optimal Experience is a state in which the person is completely absorbed in an activity for his own pleasure and enjoyment, during which time passes unnoticed and actions, thoughts and movements follow one another without pause. Mihaly Csikszentmihalyi formulated the theory of flow or theory of optimal experience in 1975 which he published in an article in the "Journal of Humanistic Psychology".

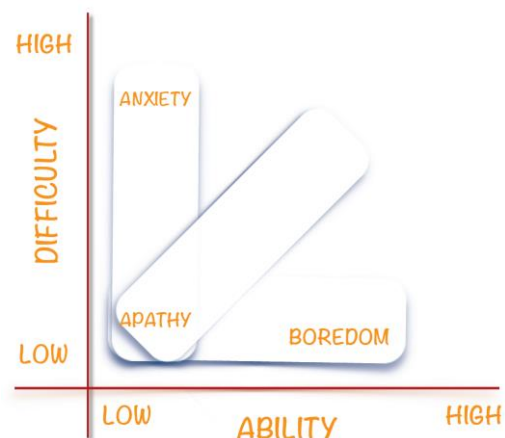


Figure 5 Diagrama del Flow. Mihaly Csikszentmihalyi GONZÁLEZ-RAMÍREZ, Claudia Teresa & VEYTIA-BUCHELI, María Guadalupe. Design of a strategic model with Neurodidactics in Higher Technological. ECORFAN Journal-Republic of El Salvador. 2022

- Narrative.
- Unit /thematic.
- Final reflection.
- Marker.

Criteria:		Skills to be developed:	
Objectives / Content:		Individual objectives:	
Activities	Indications	Comments	Delivery time

Table 1 Follow-up of tools

Phase 3. Evaluation momento

- Active learning.
- Challenges- Rewards- Feedback.
- Teamwork.

Elements of Formative Evaluation

Diagnosis

- Identify the gap between the student's current state of learning and some desired educational goals.
- A gap that is too large causes the student to feel a sense of failure and demotivation.
- A gap that is too small makes the student feel that he or she does not deserve any effort at all.
- The correct gap corresponds to the proximal development zone, the area of opportunity.

Feedback

- On basic levels of student understanding and next steps to take.
- Effective teacher feedback provides clear, descriptive, and criteria-based information.
- The teacher must take the necessary steps to close the gap by modifying instruction and repeating the assessment if necessary.

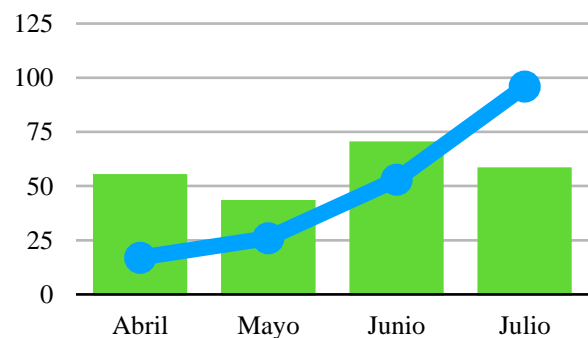
- Feedback enables students to improve their learning, enhances their motivation and sense of self-efficacy.

Student participation.

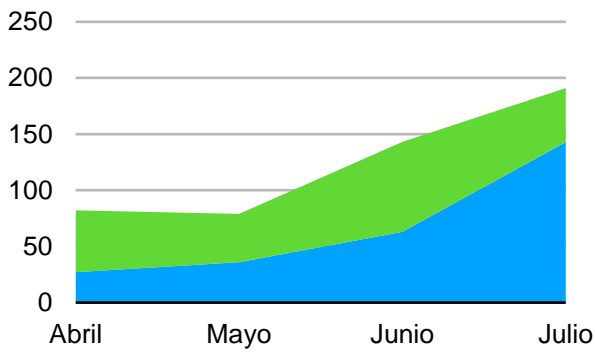
- Develop self-assessment skills
- Reflect on your learning and better understand the current state you are in.
- Develop self-regulation strategies, capable of adopting their strategies.
- Collaborates with the teacher to define success criteria for learning progress.

Learning progress.

- Progress should be structured on the basis of sub-themes that form the path to the final goal.
- Develop progress through the learning standards.
- Facilitates the teacher to locate the student's current state of learning on an ongoing basis
- The learner establishes the framework that allows him/her to interpret the learning evidences.
- It is vital to keep track of student activities and graph these quantitative partial results.
- Students' progress should be recognized with meaningful actions.



Graphic 1 Follow-up of student activities



Graphic 2 Tracking of significant student activities

Cognitive skills development		
Emotional	Self-confidence, frustration management.	Self-assessment, learning to win, learning to lose.
Cognitive	Attention, memory, language.	Logical reasoning, executive functions.
Social	Respecting rules, teamwork, conflict resolution.	Active listening, cooperation, collaboration.

Table 2 Students' cognitive skills

Results

According to the actions taken in each of the phases, and the actions identified in the students, in an analytical way, the following Model is proposed.

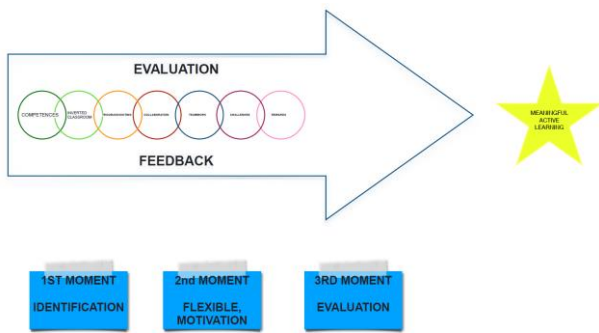


Figure 6 Proposed Strategic Model with Neurodidactics

In Figure 6 we can identify that it is a horizontal process, with valuable tools that a teacher can apply without difficulty, having the knowledge of the tool, determine the moments of its application or development, but throughout the model, feedback, also known as feedback, and constant evaluation must be carried out.

Acknowledgment

To the Instituto Tecnológico de Zitácuaro, in its systems and computing area, which is in charge of the computer systems engineering career, for allowing the application of this model. For showing enthusiasm in wanting to apply the model in the different subjects of the career and others that are in the institute.

Conclusions

Obtaining the Strategic Model with neurodidactics, applied in the career of computer systems, has allowed us to be disruptive in education, to visualize the importance of meaningful learning in students, since it is not only to train professionals, it is the integral formation of a human being who must impact his context in a positive way and ad hoc to the times we live in this XXI century. It is possible to work collaboratively, an element of impact on students and teachers, it is to innovate and grow by not seeing the student as a client, but as an entity that according to their emotions, their context, the tools that are provided for their learning is significant.

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