

Alternativas de desarrollo de software para caracterizar estilos de aprendizaje en los estudiantes

Software development alternatives to characterize learning styles in students

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Resumen: Los estilos de aprendizaje constituyen características internas predominantes que influyen en la forma en que las personas perciben, recuerdan y piensan. La utilización de la informática en el proceso enseñanza aprendizaje puede contribuir a realizar un buen diseño de las estrategias y su adecuada utilización, y aumentar el éxito en la formación. El objetivo del artículo es realizar un análisis de las principales alternativas del desarrollo de software para el diagnóstico de los estilos de aprendizaje de los estudiantes haciendo uso o no de la minería de datos. Lo que produce un resultando beneficioso al utilizar herramientas informáticas en el diagnóstico de las características de los estudiantes, al precisarse el proceso de enseñanza conveniente.

Palabras clave: Estilos de aprendizaje; Aplicación web; Perfil de aprendizaje; Minería de datos

Abstract: Learning styles are predominant internal characteristics that influence the way people perceive, remember and think. The use of computers in the teaching-learning process can contribute to a good design of the strategies and their proper use, and increase the success in the training. The aim of the article is to analyze the main alternatives of software development for the diagnosis of the learning styles of students making use or not of data mining. What produces a beneficial result when using computer tools in the diagnosis of the characteristics of the students, when the appropriate teaching process is specified.

Keywords: Learning styles, Web application, Learning profile, Data mining

Introduction

Among the multiple dimensions in the personality singularity of each student that influence the quality of learning, and the level of success achieved in their respective learning process can be mentioned the characteristics of their respective learning styles. From this point of view, Vélez, Baldiris, Nassiff, and Fabregat (2008) specify the individual character of the learning styles and express:

Learning is a very complex process that involves multiple variables and that because it is a unique human act, it is carried out differently in each individual. From this point of view, Information Technologies and ICT Communications are called to be not only promoters of new learning environments, but also generators of teaching processes - more effective and efficient learning. (p. 50)

In universities, the diagnosis of learning styles constitutes an opportunity for the training process. The knowledge, at least with an approximate character, that reaches the teacher of the main learning styles that each of the students deploys in their unique learning process, allows them to establish teaching strategies with higher levels of effectiveness.

The diagnosis of learning styles allows the teacher to maintain communication with each student to make them aware of their main learning mechanisms, and offer alternative strategies to develop other learning styles in order to ensure an optimal domain of the content under study.

The teaching-learning process in universities has been constantly developing. This is influenced by technological innovations that support the training process. Computer technologies provide tools that can be used to identify the ways in which students learn. In this way it is possible to customize the resources and evaluation activities by identifying the learning styles of each individual.

There are different models of learning style, each with its corresponding instrument to identify the main styles used by each student. Some authors of these models have been Felder and Silverman (1988), Kolb (1984).

The aim of the article is to analyze the main alternatives of software development for the diagnosis of the learning styles of students using or not data mining.

Development

Software development to characterize student learning styles

Education has not been alien to the great technological development present in recent years. The application of information and communication technologies (ICT) in educational

practice, is giving rise to technologies that are part of everyday life, academic and work, and hence the growing importance of good training in the classroom in the use of ICT.

ICT in education is a pedagogical support tool as they strengthen teaching-learning activities. For this reason, it is possible to talk about the transition to a teaching-learning model in which computer science is occupying an increasingly preponderant place. The entrance of ICT in the university world has caused transcendental changes and generated challenges in the current university perspective, which gradually transforms under this influence.

Among the main alternatives that the development of information technology has had in the university training process in Cuba can be mentioned: the accessibility of information through networks, the forms of semi-classroom and distance learning have begun to reach more space in front of the classroom, the teacher goes from being the main source of information to being a counselor for the students.

The identified impacts can be observed in the fundamental functions of ICTs in education. (Marqués, 2013)

1. Information source (hypermedial).
2. Channel of interpersonal communication, for collaborative work and for the exchange of information and ideas (emails, telematic forums).
3. Means of expression and creation (word and graphic processors, editors of web pages and multimedia presentations, video camera).
4. Cognitive instrument and to process information: spreadsheets, database managers.
5. Instrument for the management, since they automate diverse works of the management of the centers: secretariat, action tutorial, attendances, libraries.
6. Interactive resource for learning. The multimedia didactic materials inform, train, simulate, guide learnings, motivate.

Therefore, ICTs provide technological conditions for the transformation of traditional education into a more personalized, participative educational process, focused on

meaningful learning, and aimed at achieving a human dimension and developer of the personality of all participants.

Being one of the edges of the use of new computer technologies for the development of the educational process in Cuba its implementation in the diagnosis of the main characteristics of the learning process of each of the students, and in correspondence with it provide criteria for the selection of the main teaching methods that could be used.

Each student has their preferred environments, special methods, own motivations and objectives, techniques to remember, all of which define a personal way of learning, that is, a learning style. Thus, the study of these individual characteristics can only be carried out from an interdisciplinary perspective in which psychological, pedagogical, and social theories are transcendent and essential, among others.

Currently there are different models and theories about learning styles, which, from different perspectives, offer a conceptual and explanatory framework of the behavior of the person who learns and the type of didactic action that can be more effective at a learning given moment in time.

Starting in 2000, various tools emerge to describe and predict the learning styles of students. The analysis of diverse sources allowed us to verify the existence of different software that contribute to identify the learning styles of the students:

- System to identify learning styles, through a virtual computer environment. It has been developed by students of the National Polytechnic Institute of Spain. It is a web page through which it can be evaluated learning styles through multimedia animations and questions that reflect real situations. The model used was Peter Honey and Alan Mumford's test. (Martínez, 2011)
- Learning Styles Detection System at Austral University of Chile, is the most recent, of 2014. It consists of a web tool to detect the learning styles of a student or a group of students (course, cohort, career, etc.). It admits the use of several questionnaires, statistics of the courses and suggests teaching methodologies to teachers. (De la Maza, Álvarez, Campos, and Vásquez, 2014)

- Tool for the Detection of Learning Styles in Students using the Moodle Platform. This project allowed the development of a software component that is compatible with the Moodle platform. The criteria that evaluate the test of Richard Felder and Linda Silverman in the Manual of Learning Styles (2004) are identified by presenting an administrative tool that supports teachers of virtual subjects, seeking a greater appropriation of the concepts adapting them to the learning styles of each student. (Puello, Fernández, and Cabarcas, 2013)
- Author tool for the identification of learning styles using self-organized maps on mobile devices. In this paper it is analyzed a methodological proposal whose main objective is to work with the Kolb and Felder-Silverman models to identify learning styles. It uses a method of Self-Organized Maps implemented to work on mobile devices mainly. These can work in real time and without direct interaction of the student, which implies the absence of prior information. The results generated are a tool for adaptive courses in Web 2.0 environments. (Zatarian and Barron, 2010)
- These and other computer tools, besides being an object of study in the training process of professionals, are used to boost the processing of diagnostic tools for learning styles. Thus, these computer tools can contribute to a quantitative analysis that benefits the essential qualitative analysis of the diagnostic instruments.

It is the contribution of useful information to define the corresponding perspective of a methodology in correspondence with the selected learning style model. The results obtained in the characterization carried out are used in the definition of the pedagogical treatment of the teaching process. It can be said that computer science provides tools in a process of diagnosing the characteristics of students when the appropriate teaching process is specified.

These tools developed to identify learning styles do not use data mining techniques to identify students' learning styles and organize them according to the results obtained.

However, the investigations exposed below, showed that the use of some data mining and treatment techniques applied to the results obtained from the tests to identify the learning

styles, made it possible to determine with greater precision the degree of homogeneity in the style of learning. student learning.

- Data mining in mathematics education relationship between learning styles and academic performance. (Martínez, 2011)
- Learning content management systems and data mining techniques for teaching computer science. A case study in the north of Coahuila. (Olague, Torres, Morales, Valdez, and Ávila, 2010)
- Data mining to discover learning styles. (Durán and Costaguta, 2007)
- Diagnosis of the predominant learning style based on data mining and the Felder model: applications to e-learnig 3.0 (Ramírez and Ortega, 2012)
- Identification of Learning Styles in Computer University Students of the Huasteca Hidalguense using Data Mining Techniques. (Núñez, Hernández and Redondo, 2013)
- The use of data mining techniques allows a better characterization of individual learning mechanisms, has the ability to record accurate data, discover new and useful information on different types of students, predict learning behaviors, which allows redirecting strategies to develop better teaching strategies adapted to the needs identified. This is especially related to the planning alternatives of the teaching process activities, since it increases the effectiveness of the same.

All these tools, described above, can be developed in several ways:

- a software component that is compatible with the Moodle platform,
- a Web page through which learning styles can be evaluated,
- a Web tool to detect the learning styles of a student or a group, allows the teacher to manage this information,
- a program in the Delphi 7 programming environment that allows teachers to manage data derived from diagnosis for decision-making in favor of directing the teaching-learning process; until,

- a method of self-organized maps implemented to work on mobile devices mainly.

As evidenced, in none of the cases were software developed to identify the learning styles using data mining techniques for the analysis of the final data. Therefore, only the learning styles of the students are recognized taking into account the results obtained with the application of the questionnaires.

However, the use of data mining techniques facilitates an efficient discovery of knowledge, obtaining homogeneous subgroups, patterns of learning styles in general, and the tendency towards other learning styles. This allows an optimal grouping and a better classification.

In the investigations that make use of data mining techniques, the methodology followed in order to discover the knowledge implicit in the responses of the questionnaires of learning styles followed the process of knowledge discovery in databases.

The process of knowledge discovery in databases (KnowledgeDiscovery in Databases, KDD), (Jiawei, Micheline and Jian, 2012), follows three stages: pre-processing, data mining, and post-processing. The information gathered in the questionnaire is loaded in an excel spreadsheet, then converted to a word document for later conversion to an .arff file (Attribute-Relation File Format), required as input to the WEKA software (Locualo, 2007), which is used to obtain the pattern of student learning styles. Cluster analysis is then applied to identify homogeneous subgroups within the sample of students. For the processing of information, different statistical packages can be used, such as StatisticalPackageforthe Social Sciences (SPSS). (Pardo and Ruiz, 2002)

The use of computer tools to detect the predominant learning style in a group of students, with or without the application of data mining, is useful to determine the characteristics of the learning profile of each one, and accordingly adapt the teaching strategies.

Conclusions

The combination of computer technologies and ICT communications, and the diagnosis of students' learning styles, allows to achieve greater potential in teaching-learning processes through the tools developed for the processing of questionnaires of styles of learning. This

leads to a new paradigm of teaching that is much more personalized and focused on the student, which, without forgetting the other contents, ensures students the ICT skills that today's society demands.

It can be concluded that the previous diagnosis of the learning styles of the students significantly guides the design process of the teaching-learning plan, whether this is done in a computer application, or that the result obtained from the learning style surveys they have been subjected to data mining.

Bibliographic references

B. Durán, E., y N. Costaguta, R. (2007). Minería de datos para descubrir estilos de aprendizaje. *Revista Iberoamericana de Educación*, 42(2), 1-10.

De la Maza, M. E., Álvarez, L., Campos, A., y Vásquez, C. (2014). Sistema Detector de Estilos de Aprendizaje en la Universidad Austral de Chile (Vol. 10, pp. 487-492). Presentado en XIX Conferência Internacional sobre Informática na Educação (TISE 2014). Recuperado a partir de www.tise.cl/volumen10/TISE2014/tise2014_submission_47.pdf

Jiawei, H., Micheline, K., y Jian, P. (2012). *Data Mining: Concepts and Techniques* (3.^a ed.). USA: Morgan Kaufmann. Recuperado de <https://works.bepress.com/madraky/11/>

Martínez Valdés, J. A. (2011). *La minería de datos en educación matemática relación entre estilos de aprendizaje y desempeño académico*. (Maestría en enseñanza de las ciencias exactas y naturales). Universidad Nacional de Colombia, Sede Palmira. Recuperado de <http://bdigital.unal.edu.co/6590/>

Núñez Cardenas, F. de J., Hernández Palacios, R., Mariano, V. T., y Felipe Redondo, A. M. (2013). Identificación de estilos de aprendizaje en alumnos universitarios de computación de la Huasteca Hidalguense mediante técnicas de minería de datos. *Ciencia Huasteca Boletín Científico de la Escuela Superior de Huejutla*, 1(2). [https://doi.org/https://doi.org/10.29057/esh.v1i2.1018](https://doi.org/10.29057/esh.v1i2.1018)

Olague Sánchez, J. R., Torres Ovalle, S., Morales Rodríguez, F., Valdez Menchaca, A. G., y Silvia Ávila, A. E. (2010). Sistemas de gestión de contenidos de aprendizaje y técnicas de minería de datos para la enseñanza de ciencias computacionales. Un caso de estudio en el norte de Coahuila. *Revista Mexicana de Investigación Educativa*, 15(45), 391-421.

- Pardo Merino, A., y Ruiz Díaz, M. Á. (2002). *SPSS 11. Guía para el análisis de datos* (1.^a ed.). España: McGraw-Hill Interamericana de España S.L. Recuperado de <https://www.casadellibro.com/libro-spss-11-guia-para-el-analisis-de-datos/.../861405>
- Puello, P., Fernández, D., y Cabarcas, A. (2013). Herramienta para la Detección de Estilos de Aprendizaje en Estudiantes utilizando la Plataforma Moodle. *Formación universitaria*, 7(4), 15-24. <https://doi.org/10.4067/S0718-50062014000400003>
- Ramírez León, Y. del V., y Ortega Carrillo, J. A. (2012). *Diagnóstico del estilo de aprendizaje predominante basado en minería de datos y el modelo de Felder aplicaciones al Elearnig 3.0. Presentado en Estilos de aprendizaje: investigaciones y experiencias: V Congreso Mundial de Estilos de Aprendizaje, Santander. Recuperado de <https://dialnet.unirioja.es/servlet/articulo?codigo=4651452>*
- Zatarain Cabada, R., y Barron Estrada, M. (2010, 1 de diciembre). Herramienta de autor para la identificación de estilos de aprendizaje utilizando mapas auto-organizados en dispositivos móviles. *Revista Electrónica de Investigación Educativa*, 13(1), 43-55.