Planning an EDM Model for Continuing Teacher Education.

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Abstract. The constant advances in scientific research in the area of Artificial Intelligence have proposed new and innovative adaptive learning processes, tutors and intelligent systems, data mining, among others, which impact educational practices and research. All these factors encourage an exponential increase in the volume of educational data that can support decision-making in various aspects of educational institutions and public policies, especially in the continuing education of basic education teachers, which is one of the main demands of education. current. This study sought to identify the elements that could compose a proposal for planning an EDM model to help decision-making in the organization of personalized continuing education e-learning courses for basic education teachers in the Brazilian context. The problem of the study questioned which elements make up a proposal for an EDM model to support decision-making in the planning of e-learning courses for the continuing education of basic education teachers in the Brazilian context? From bibliographical research, the results indicate that research on EDM aimed at the continuing education of teachers in basic education in Brazil is incipient, so that there are several gaps in the study area and the need for further discussions on this theme in the scenario of scientific research. Existing research focuses on identifying the prediction of the profile of students who drop out of e-learning or face-to-face courses, however, several authors have been identified who indicate an EDM application taxonomy that can be used for the organization of e-learning courses for continuing education for basic education.

Keywords. EDM, artificial Intelligence, model, continuing education, teachers.

1. Introduction

The area of Artificial Intelligence (AI) seeks to understand how man thinks, as well as invests efforts in research and studies to build intelligent entities [1]. According to [2], in the mid-1950s man established one of his most ambitious and complex purposes "to recreate human intelligence in a machine" [2, p. 08] or as a reference [3] to develop a "non-biological intelligence", using different techniques (algorithms and methods) to solve tasks in different areas of knowledge.

In contemporary times, practical applications of AI approaches are centered on human behavior and rationality almost everywhere, in self-driving cars, chatbots, hospitals, the Internet and the Internet of Things, robots and satellites sent into space, satellite navigation systems, Hollywood animations, virtual games, Google search engines, systems for predicting the financial movement of the stock market, unfortunately, military drones, but, fortunately, also minesweeping robots [4], in educational data mining.

It is essential to adopt resources from AI that carry out an Educational Data Mining (EDM) to contribute to the analysis of a large volume of educational data related to the skills of basic education teachers to be represented in the context of continuing education. According to the International Society for Educational Data Mining, EDM "is an emerging discipline concerned with developing methods for exploiting unique data [...] from educational contexts and using these methods to better understand students and settings in who learn" [5, s./p.].

The MDE is developed in 6 stages: a) Understanding the problem - formulating a problem and designing a solution; b) Understanding the data - understanding the limitations and potential of the database; c) Data preparation - converting data to different types; d) Modeling - applying MD algorithms and techniques; e) Evaluation - validly assess the MD results; f) Implantation - use MD data [6]. For MDE tasks and applications, there are groups of users and/or participants with different interests in the process, thus [7] propose a classification designated as "Taxonomy for the application of MDE" (Tab. 1) which indicates the main groups, the tasks and your goals with EDM. The authors warn that this

Taxonomy does not cover all the alternatives for using EDM in each group of applications, that is, its tasks and applications can be classified in more than one group, this will depend on its educational objective.

Tab. 1 - Taxonomy for Application of EDM.

GROUP	INTERESTS
Students	"Personalization of environments; Identification of learning strategies; Supporting resource recommendations; Suggestion of reinforcement tasks; Identification and treatment of learning gaps.". [7]
Instructors Teachers Tutors	"Obtaining objective feedback; Analysis of student learning and behavior; Identify students who require differentiated support; Grouping of apprentices; Characterization of successful teaching strategies". [7]
Describe student characteristics	"Evaluation of didactic material; Course evaluation; Improvement of student learning; Automatic construction of student and tutor models; Comparative study of mining techniques; Development of mining tools". [7]
Knowing relationships between students and concepts	"Course recommendation for groups of students; Improvement of the decision-making process in investments in Education; Support in the selection process of admission of students". [7]
Managers Directors Administrators	"Support for investment in educational resources; Efficient use of educational resources; Assessment of course offerings and needs for improvement; Evaluation of instructors and curricula; Support in the configuration of websites and services". [7]

This research asks which elements make up a proposal for an EDM model to support decision-making in the planning of e-learning courses for the continuing education of basic education teachers in the Brazilian context? The hypothesis of this study is that the elements of an EDM model for the continuing education of basic education teachers are incipient in studies of the current literature on EDM in Brazil.

The objective of this article is to identify which elements make up the planning of an MDE model to help decision-making in the organization of personalized continuing education e-learning courses for basic education teachers in the Brazilian context. The results of this study may open discussions on research proposals dealing with EDM aimed at basic education teachers and their professional training needs.

2. Research Methodology

The method used in this study was the bibliographical research with the survey of articles and literature on EDM. To this end, the first search was carried out on the [8] the search with the term and logical operators "educational data mining" obtaining 26 articles. In the second search with the terms and logical operators "educational data mining" OR "EDM", 9,386 articles were obtained. In the third search, the terms and logical operators "educational data mining" OR "EDM" AND "continuing education" were used, resulting in 26 articles. In the fourth search, the terms and logical operators ("mining educational data" OR "EDM" AND "continued education" AND "basic education" AND "Brazil") were applied, continuing with 26 articles, then the filter was applied peer-reviewed journals resulted in 9 articles.

Among the 9 articles, it was observed that there were no articles focused on the application of EDM in the continuing education of teachers, thus, we tried to select 3 articles based on the following inclusion criteria: a) research that investigated EDM in courses; b) articles with methodology consists; c) investigations carried out in the last 4 years. Soon after, the title, abstract and conclusions were read; and d) studies in Brazilian basic education with EDM.

3. Previous studies

In this study, some findings of Brazilian research dealing with EDM and demands of Brazilian education will be presented.

3.1 The EDM in Brazil

[9] through a systematic review of the literature on EDM in e-learning contexts, found that this area of research has several gaps, since the topic is recent in Brazilian research, as well as identifying that systems such as MOODLE are the best known, for these systems the MDE process for the management of e-learning is fundamental, as it will be able to provide data for the evaluation and improvement of online courses.

[10] use the systematic literature review that deals with the interaction analysis of the Virtual Learning Environment (VLE) for predicting dropout in distance education courses, they point out the relevance of mining students' semester data regular and evaded, which may predict information about the period that the student will drop out of the course.

[11] applied the EDM on the microdata collected in the Brazilian National Institute of Educational Studies and Research Anísio Teixeira (INEP) database, they indicate that 9th grade students suffer socioeconomic factors, such as family income, these factors impact in school activities, influencing school dropout and school failure.

Tab. 2 - Peer-reviewed journals on EDM.

Title	Authors	Method	Findings
Educational Data Mining to Improve E-Learning Management: A Systematic Literature Review.	Marques et al. (2020)	Systematic literature review.	The profile prone to evasion of the courses is the one who does not view the materials and tasks and barely interacts with the course materials.
Analysis of Interactions of the Virtual Learning Environment for Predicting Dropout in Distance Learning Courses (EAD).	Sonnenstrahl; Bernardi; Pertile (2020)	Systematic literature review.	- There are few studies published on the subject over the years, it was considered that the study is not consolidated, since it does not present authors who stand out in the area.
The relationship between socioeconomic status and mathematics proficiency of 9th grade students from Pernambuco through Educational. Data Mining	Brito Júnior et al. (2022)	EDM on microdata collected from a database.	State schools have a better math proficiency rate over the years than state network schools.

Based on the data collected (Tab. 2), it can be seen that Brazilian research on EDM is recent and in its infancy, with several gaps that could be investigated in a near future scenario. learning. Such information is fundamental for managing the planning of any proposal that aims to offer courses that seek to professionalize people in any area of knowledge, such as continuing education courses for basic education teachers.

3.2 EDM model proposed for continuing education

In the present study, the main elements of a proposal for planning an MDE model (Tab.3) will be presented to obtain explicit knowledge that can support decision-making in planning an e-learning course for personalized continuing education for teachers of basic education.

Tab. 3 - Proposed EDM model.

TITLE	Development of an EDM model to identify knowledge that supports decision-making in the development of an e-learning course of personalized continuing education for Brazilian basic education educators.
Question	Will the EDM be able to contribute to identifying the individual skills of basic education teachers and offer support for management in decision-making in the elaboration of e-learning courses of personalized continuing education for these teachers?
GOAL	Propor um modelo de EDM para auxiliar a tomada de decisão no planejamento de cursos e-learning de formação continuada personalizada para professores da educação básica com base em conhecimentos explícitos resultantes.
TAXONOMY FOR THE APPLICATION OF EDM	Propose an EDM model to help decision-making in the planning of personalized continuing education e-learning courses for basic education teachers based on resulting explicit knowledge.
PARTICIPANTS	Basic education teachers will directly participate in the EDM model, from Kindergarten to High School.
DATA MINING TECHNIQUES	Clustering and Classification.
DATA MINING TOOL	RapidMiner or Orange.
DATABASE	Sociodemographic profile of teachers; Teachers' social networks and lattes; Minutes requesting continued training; Moodle data from activities, interactions, student and teacher grades.
ETHICAL ISSUES	Request authorization for the use of teachers' personal and professional data and students' academic data, and ensure data protection for the subjects involved.

Based on the proposed EDM model, it is suggested that while possible results at the national level obtain explicit knowledge that may help in the reformulation and implementation of public policies for continuing education of basic education teachers, the results obtained may collaborate for the construction of a knowledgegraph of educators based on their skills, facilitating the selection of e-learning courses in a more structured way, as a way to better provide personalized continuing education.

In this research, it was difficult to find systematic and empirical review studies that deal with EDM in the continuing education of teachers. In this work, the main portal of repositories of Brazilian scientific articles was used, however, EDM studies in Brazil focus on data on school dropout in distance education or prediction of the profile of students who drop out of e-learning courses.

4. Conclusion

Current studies on EDM in Brazil focus on systematic literature review and empirical studies that predict the profile of students who drop out of e-learning courses and face-to-face basic education, in relation to research applied to EDM in training courses. continuing education of teachers are incipient or non-existent.

However, the scientific literature recognizes the importance of EDM, so that several authors propose a taxonomy for the application of EDM that can be used to identify elements to compose an EDM model that helps management in decision making at the time of planning of e-learning courses for the continuing education of teachers.

In this research, an EDM planning model is proposed based on the "Taxonomy for the application of EDM" [7] that can be used in the organization of e-learning courses for the continuing education of basic education teachers. In future studies, the application of this model based on EDM will be investigated.

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