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The Open University (OU) is a pioneering institution in higher education, renowned for its commitment to accessibility and innovation. Founded in 1969, the Open University is the UK's largest university by student population and has seen more than 2 million students achieve their educational goals through its courses since its inception. A public research university, the University of Oklahoma primarily serves undergraduate students and offers flexible learning opportunities outside the classroom. Our university is a truly international university, offering undergraduate and postgraduate education to students from all over the world. The university is headquartered in Walton Hall in Milton Keynes, Buckinghamshire, but has administrative offices throughout the UK and in many European countries. The Open University offers a unique opportunity to personalise students' learning by bringing together modules from different disciplines, thereby increasing its appeal to a wider audience.

In recent years, the OU has embraced the potential of digital technologies to enhance the learning experience for its students. The university's Virtual Learning Environment (VLE) serves as a cornerstone of its educational delivery, enabling students to access course materials, participate in forum discussions, submit assessments, and track their academic progress. The VLE generates vast amounts of data, capturing student interactions and engagement patterns, which can be leveraged to improve educational outcomes. This has led to the development of the Open University Learning Analytics Dataset (OULAD), a comprehensive resource that provides insights into student behavior and performance across seven selected courses. The dataset, which includes data from both February and October course presentations (denoted by "B" and "J," respectively), offers a unique opportunity to explore the role of VLEs in supporting student success.

The application of data mining techniques in educational settings has gained significant traction in recent years, driven by the need to address challenges such as low completion rates and varying student profiles. Educational Data Mining (EDM) and Learning Analytics (LA) have emerged as key fields of research, focusing on the analysis of data from educational systems to uncover patterns and optimize learning environments. By examining interactions within VLEs, researchers can identify factors that influence student performance and develop strategies to enhance educational outcomes. This study leverages the OULAD to investigate the relationship between VLE usage and student success, with a particular focus on the following research questions:

1. RQ1: Is the use of the VLE associated with student approval?
2. RQ2: Which features from the VLE, census, and academic systems are most important for the early prediction of student performance?
3. RQ3: Which learning patterns can educational data mining help to unveil in the studied courses?

Through a series of data mining experiments, this work aims to uncover educational patterns and knowledge that can inform future institutional policies and practices. By analyzing data from the VLE, surveys, and academic systems, the study seeks to better understand the role of digital learning environments in supporting student achievement. The findings are expected to contribute to the broader discourse on the use of data-driven approaches in higher education, offering valuable insights for educators, administrators, and policymakers alike.

The remainder of this work is structured as follows: Section 2 provides an overview of related research in the fields of EDM and LA. Section 3 outlines the methodology employed in this study, including data collection,

model generation, and evaluation. Section 4 presents the results of the analysis, while Section 5 discusses the implications of these findings in relation to the research questions. Section 6 explores potential institutional policies based on the evidence, and Section 7 concludes with a summary of the study's contributions, limitations, and directions for future research.

Data Description

The dataset provided is part of the Open University Learning Analytics Dataset (OULAD), which captures detailed information about student activities, assessments, demographics, and interactions with the Virtual Learning Environment (VLE). Below is a comprehensive description of the datasets and their respective columns:

1. courses.csv
This file contains information about the available modules and their presentations.
- code_module: Code name of the module, serving as the identifier.
- code_presentation: Code name of the presentation, consisting of the year and a letter ("B" for February start, "J" for October start).
- module_presentation: Length of the module-presentation in days.
2. assessments.csv
This file provides details about assessments for each module-presentation.
- code_module: Code name of the module, serving as the identifier.
- code_presentation: Code name of the presentation.
- id_assessment: Identification number of the assessment.
- assessment_type: Type of assessment: Tutor Marked Assessment (TMA), Computer Marked Assessment (CMA), or Final Exam.
- date: Submission date of the assessment, measured as the number of days since the start of the module-presentation.
- weight: Weight of the assessment in percentage. Exams typically have 100%; the sum of all other assessments is 100%.

3. studentAssessment.csv
This file contains the results of students' assessments.
- id_assessment: Identification number of the assessment.
- id_student: Unique identification number for the student.
- date_submitted: Date of student submission, measured as the number of days since the start of the module-presentation.
- is_banked: Status flag indicating that the assessment result has been transferred from a previous presentation.
- score: Student's score in this assessment (0-100, with scores below 40 considered Fail).

4. studentInfo.csv
This file includes demographic information and results for students.
- code_module: Code name of the module, serving as the identifier.
- code_presentation: Code name of the presentation.
- id_student: Unique identification number for the student.
- gender: Gender of the student.
- region: Geographic region where the student lived while taking the module-presentation.
- highest_education: Highest student education level on entry to the module presentation.
- imd_band: Index of Multiple Deprivation band of the place where the student lived during the module-presentation.
- age_band: Band of the student's age.
- num_of_prev_attempts: Number of times the student has attempted this module.
- studied_credits: Total number of credits for the modules the student is currently studying.
- disability: Indicates whether the student has declared a disability.
- final_result: Student's final result in the module-presentation.

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This file contains information about assessments in module-presentations. Usually, every presentation has a number of assessments followed by the final exam.

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