Learning analytics technology

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Learning Analytics focuses on using electronic learning data supported by artificial intelligence systems to benefit from learning outcomes. Using tools such as predictive analytics and others, to help teachers identify different learners' needs and individual differences between teachers. In this article, we review what learning Analytics are, their importance, components, and some of their systems.

Keywords: Learning Analytics.

Before the advent of e-learning and modern communication tools, it was difficult to identify individual differences between learners and to know the needs of each student, as well as to predict students 'academic failure rates.

Technological advances in recent decades have allowed people to learn in different ways. Universities now have more educational models to choose, such as e-learning. Modern online learning environments generate large amounts of data related to learning/ teaching processes, which makes it possible to extract valuable information that can be used to improve student achievement and this is called learning analytics technology [1]. Analytics involves the collection, analysis, use and dissemination of data from reliable sources in order to provide reports, generate forecasts and design other data structuring options [2].

Now, with the advent of learning analytics technology and its integration with artificial intelligence technology, it has become very easy to follow learners and to provide educational content that matches each student's needs, knowledge level, and learning style. It also helps in providing activities, tests, support methods and guidance, as well as providing appropriate teaching strategies.

Khamis M.A. defines learning analytics as an analysis of communication records, learning resources, learning management system records, learning design and activities that occur outside the learning management system, to improve the creation of predictive models, recommendations and reflections, and uses algorithms, equations and methods to convert data into meaningful information [3].

Learning analytics can be defined also as measuring, collecting and analyzing data from the learner's interaction with the adaptive learning environment using equations, algorithms and programs, to define each learner's learning style, providing the appropriate content, activities and strategies for the learning method, as well as identifying the learner's cognitive status, then providing adaptive feedback to the learner, recommending the aspects he or she should work on to improve his performance, and providing detailed reports on his or her performance, as well as comparative reports, to achieve adaptive learning goals [4].

However, learning analytics does differ from more traditional education analyses in a number of ways. Firstly, due to its strong quantitative focus, the size of data sets tends to be significantly larger allowing for a greater level of confidence in the generalizability of the findings. Secondly, as data is mostly collected from technical systems, there is a very fine level of granularity of available variables that cannot be captured through observational studies, interviews or self-reports. Lastly, the data tends to be longitudinal. That is, the manner of data collected and the processes used for collecting provide for a strong temporal dimensionality to be included in the research studies [5] [6].

There are many factors that have strengthened institutions 'interest in learning analytics, which has become one of the most optimal solutions to education problems and improved performance, due to its ability to provide teachers with the opportunity to quickly identify patterns of user behavior and identify the nature of students' development stages, in addition to their ability to provide data. And collect data in real time; Measuring and analyzing learners' data and their contexts in order to understand

the learning process and the environments in which the learning occurs. Learning analytics is a smart use of data, and one of the most important recent trends for improving accountability at all levels of training. Learning analysis software provides a variety of methods for monitoring learners' performance in addition to providing tools that encourage continuous improvement. The primary focus of Learning Analytics is developing structures that help fine-tune content, levels of educational support, and other customized services by capturing, processing, reporting and acting on data [7].

According to Rajab W.M., Khalifa Z.H., Fakhri A.M. the importance of learning analyzes in adaptive learning environments is represented in the following points:

– Student tracking: the navigation of all students is analyzed, which gives a set of indicators related to the performance of activities and patterns of student behavior.

– Management of the information reports: strategic planning of the learning process is based on the needs of learners.

– Predicting enrollment: Reports to the administrative authorities of the programs that are expected to join in the future according to the interest of the students.

– Management of Dropout Students: It defines how students at risk of dropping out behave; the system provides support at the institutional level and sets out a set of indicators to monitor that academic activity for students.

– Learning management: It uses the data to report on teaching and learning.

– Use it in participatory and adaptive learning to identify appropriate sharing strategies.

– In adaptive learning systems; to provide automated feedback and improvement.

– Learning Analytics helps integrate learners into the learning process; Where it focuses on the learners and the learning processes and learning outcomes, so that the learners are the focus of the learning activity.

– Effectively provide adaptive and immediate feedback; To improve the learning process [4] [8] [9].

Learning analyzes consist of a prediction model, an adaptation engine, an intervention engine, and a dashboard. Figure (1) illustrates the structure and components of learning analyzes as follows:

– A content management, maintenance, and delivery component interacts with students to deliver individualized subject content and assessments to support student learning.

– A student learning database (or other big data repository) stores time-stamped student input and behaviors captured as students work within the system.

– A predictive model combines demographic data (from an external student information system) and learning/behavior data from the student learning database to track a student's progress and make predictions about his or her future behaviors or performance, such as future course outcomes and dropouts.

– A reporting server uses the output of the predictive model to produce dashboards that provide visible feedback for various users.

– An adaption engine regulates the content delivery component based on the output of the predictive model to deliver material according to a student's performance level and interests, thus ensuring continuous learning improvement.

– An intervention engine allows teachers, administrators, or system developers to intervene and override the automated system to better serve a student's learning [10].

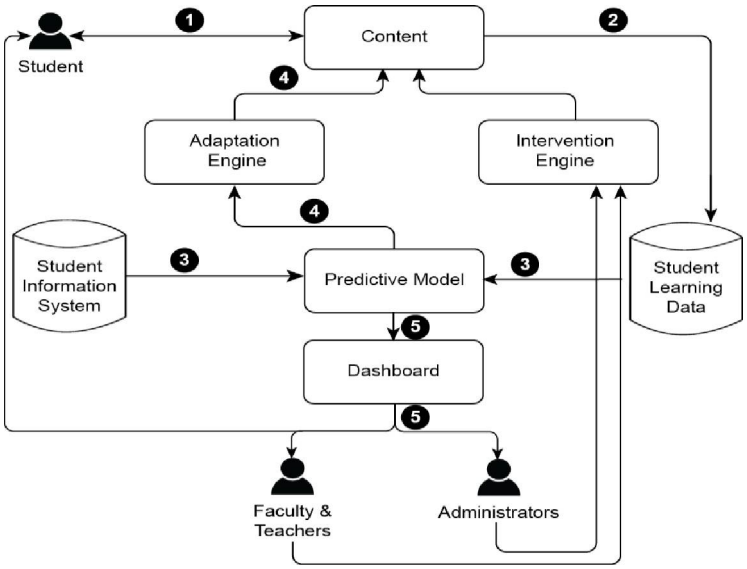

Figure (1): Structure of Learning Analytics [10]

There are many systems and programs for learning analytics in adaptive environments, one of these tools will be display as follows:

Signals Course

Course Signals (CS) is a student success system that allows faculty to provide meaningful feedback to student based on predictive models. The premise behind CS is fairly simple: utilize the wealth of data found at an educational institution, including the data collected by instructional tools, to determine in real time which students might be at risk, partially indicated by their effort within a course. Through analytics, large data sets are mined and statistical techniques are applied to predict which students might be falling behind. The goal is to produce —actionable intelligence —in this case, guiding students to appropriate help resources and explaining how to use them.

With Course Signals, students are not placed at risk due to one single factor; risk is determined by a contextualized landscape that varies from student to student . Since a course-specific risk indicator is created for each student based on performance, peer-based behavior, and educational preparation data, instructors can intervene early and give students a realistic opportunity to adapt their behavior to be more specific in a given course.

Figure (2): Course Signals [4]

Among the most important features of the Course Signals system are the following:

– The speed of identifying the names of learners who are at risk of failure in the course, or learners who have scored poor performance.

– Alert the learners about their status, and whether they are threatened with failure (red flag), poor performance (yellow flag), or good performance (green light).

– Providing teachers with the necessary tools; to correct the path of learners.

– Achieving communication between teachers and learners; to provide better support.

This tool is used in the adaptive learning environment in determining the cognitive state of the trainee, and if the learner's performance is weak (red flag), average (yellow signal), or strong (green signal), as well as comparing his performance with his colleagues, as the tool analyzes the learner's responses to the questions (Number of correct answers, number of wrong answers, time for solving questions, reading time, number of attempts to answer the question [11].

Analytics and recommendation system:

It is a tool that can be used by the teacher and the learner alike, and this tool allows visualizing learners' contributions in all e-course activities, and it also provides recommendations to learners about activities that can help them, and uses tables and charts; In order to present information in an easier and more effective manner.

Figure (3): Analytics and recommendation system [4]

This tool is used in the adaptive learning environment to track learners' contributions and interactions during their interaction in the adaptive learning environment, such as: the number of content visits, the time spent on visiting the content, the number of video and image visits, the number of text and audio visits, the number of summary visits, the number of visits to examples, The number of calendar visits, the time spent on visiting the calendar, the number of activities visits, skip sailing, the number of visits to the introduction, then determine the style of learning, and make recommendations and proposals to learners with content and resources that are compatible with his learning style [4] [12].

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