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THE DESIGN OF A LEARNING ANALYTICS DASHBOARD: EDUOPEN MOOC PLATFORM REDEFINITION PROCEDURES

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The current EduOpen dashboard is not capable of monitoring performances and trends over the medium to long term both for the students as for the instructors; summarising and synthesising the adequate information; allowing implementation of any sort of predictive actions and functions (learning prediction). The article aims to expose the process of innovation and redefinition of a learning analytics dashboard in the EduOpen MOOC platform in order to define a model to design it accurately in terms of productivity for all users (teachers and students above all). From the literature analysis, main MOOC platform comparisons and the insights from the round tables a time spent variable is identified as at the basis of the entire user experience in online training paths. A concrete experimentation, through the design of a learning timeline and a constructive feedback system of an upcoming course in the EduOpen catalogue, is designed and explained relaying on the hypothesis of the existence of a correlation between the "time spent" (time value) and the final performance of the student.

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1 Introduction

This contribution connects three fields: the area of Learning Analytics, the area of Massive Open Online Courses and the area of Dashboards in digital learning environments. The discussion about these three areas is presented through the analysis of EduOpen case study.

Namely, learning analytics is the measurement, collection, analysis and reporting of data about students and the contexts they learn through. The aim of learning analytics is to understand, personalize and optimize learning and the environments in which it occurs. Learning analytics are mainly used in learning contexts mediated by the use of digital environments, since they can produce an amount of data about the traces each student or entire groups of learners leave online, successful activities, difficult experiences, and so on (Rienties & Rivers, 2014, in Dipace *et al.*, 2018).

Learning analytics and Massive Open Online Courses (MOOCs) are two of the most relevant emerging topics in the domain of Educational Technology that can be represented as an umbrella that includes a wide range of engaging online environments and fields. Speaking of Mooc means referring to a well-structured course and not a whole of OERs. As such, a MOOC presents a syllabus with explicit educational objectives and therefore provides a learning assessment system and one or more teachers and tutors responsible for the educational path (Sancassani *et al.*, 2019). Due to their openness, MOOCs attract many participants from all over the world and due to their massiveness, the huge datasets of MOOC platforms need advanced and innovative tools and methodologies for extra examination and analysis.

The extensive amount of data provided by MOOCs platforms concerning students' usage information is a gold mine for Learning Analytics field, but it is important to underline that it is quite difficult extracting meaning from raw data and metrics without being able to visualize it in the form of tables, graphs and other graphical representations (Sclater, 2017). Dashboards are suitable for this purpose as they are systems developed for helping researchers, learners and teachers being extremely useful as a visual overview of their activities and how they relate to those (Duval, 2011).

EduOpen[1] is a project funded and supported by the Ministry of Education, University and Research aimed at creating a digital platform for the provision of online courses defined as MOOC (Massive Open Online Courses) by a network of Italian universities and institutions and a set of selected partners of particular scientific and cultural importance. The EduOpen convention to initiate the project was signed in April 2015, and the kick-off is dated 21st April 2016.

In November 2018, the EduOpen portal was subjected to a major update

[1] learn.eduopen.org

since the launch of the platform where a large number of elements of the LMS have seen a profound update: new general interface, new course formats, adoption of the multilingual system, new parameters and search engine in the catalog, and much more.

The EduOpen innovation process has in a first place introduced a series of questions and definitions regarding the context (state of the art) of the EduOpen platform. In particular, focusing on the the EduOpen dashboard, evident, and in some cases, critical issues emerged from the confrontation with instructors, tutors, course developers (content editors[2]) and instructional/learning managers, highlighting some significant margins for improvement.

The use of dashboards to support sense-making from learning and teaching data, especially speaking about the online education, is not a new concept. The purpose of a dashboard, on the teaching side, is to offer tools for instructors at monitoring the course and student progress in real time, and for educational designers and content editors allowing the visual exploration of data to help understand better the way in which learners engage with particular elements of a course and provide some valuable information able to inform future course designs.

It is important to point out that EduOpen, as a MOOCs delivering portal, seeks in a dashboard a core tool able of guiding users through a whole online experience during the learning pathways, which should effectively synthesize the key data, information and notifications for both the students (learners), who often follow or are enrolled in high number of courses and courses (pathway) whose representation and synthesis becomes fundamental, and, at the same time, the instructors who frequently encounter a high number of enrolled learners, therefore needing synthetic and immediate synthesis and reporting tools.

One of the key aspects that led the process of innovation and redesign of the platform refers to the feedbacks provided by the users, both teachers and students, during the two years of moocs provisions under the 1.0 version of the platform. The so provided feedbacks ware generally pointing out the emerging needs for a move to a newer version of the platform able of taking into account the aspects and demands gradually emerged.

[2] The EduOpen platform has different "roles" that can be assigned to the users depending on which are their "offline/real world" profiles and objectives. The most common role, and the lowest in terms of function permissions, is a "student" which is often referred as "learner". The role assigned to teachers is known as "instructor" and as much as the "tutor" role this guarantees editing permissions on the course contents and some of the main course settings. "Content editors", which is the role assigned to the course developers have even some more editing and setting permissions compared with "instructors". Finally, the "instructional managers" have editing permissions in addition to a course setting and are able to control and edit some aspects related to the platform (outside the course) functionality such as: data extraction, their own institution's settings etc.

2 Background

Learner dashboard:

The current EduOpen architecture does not expose in real time (neither for the students or the instructors) any type of data regarding the learners trends or performance; if we exclude a graphical percentage representation of a course completion displayed in the dashboard list view (Fig. 1) no other indicators are available to summarise the progress and progress of the student within a course.

Fig.1 - EduOpen Dashboard Course representation (list view)

One of the main features, which is present since the launch day, refers to a possibility to distinguishes courses and pathways in three main categories: currently in progress; to be opened soon and completed courses.

Fig.2 - The main EduOpen course dashboard classification

Instructor-side dashboard:

Looking at the instructor dashboard side the learners trends and progress information are summarized through a set of "default" reporting tools provided from the Moodle LMS, which, notoriously, are considered not easily readable.

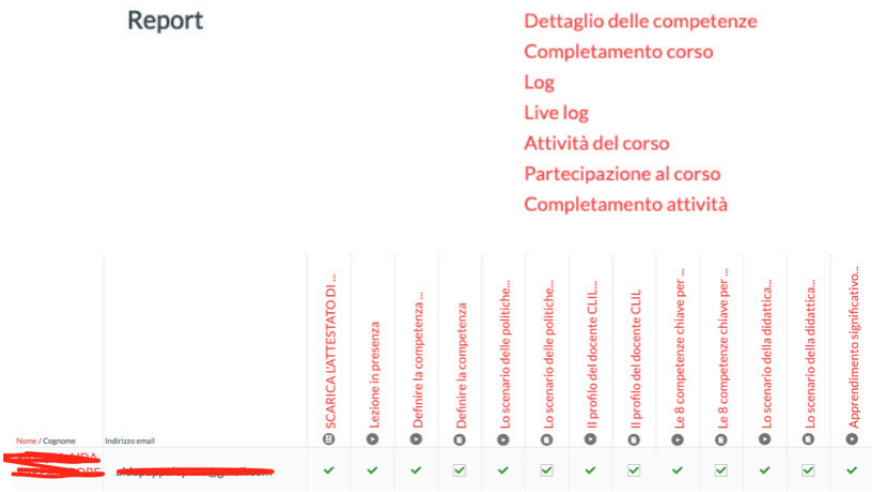

Fig. 3 - EduOpen course progress for a single users report

The need for a general "rethinking" and "redesign" of the platform user experience and the set of available tools, particularly the dashboard, gradually emerged through the first two years after the kick-off. Both the content editors as instructors reached out to the EduOpen staff quite often during that time interval, as the first version of the platform presented more than a few critical issues from a functional point of view. For example, the inability for the instructors to filter the enrolled students list by some basic parameters such as name, mail or id. On the other side, also the learning managers and course editors encountered problems both during the course design phase as during the monitoring one. These "spontaneous" feedbacks structured over time in suggestions and proposals delineating some more concrete objectives of the EduOpen innovation process.

3 Methodology

The innovation process has been structured in three main phases:

a. *Confrontation between instructors and learning managers*:
   The EduOpen team, aware of the critical issues that emerged in the early years of the project, assumed that the innovation process should have been extended to a wider audience right from the beginning of earliest development stages, including not only the developers and the staff members, but, most importantly, all the different types of the platform users such as *instructors*, *students* and *content creators*. The

underlying objective of the extension of the work group at this phase was mainly aimed at gathering as much information as possible on the critical aspects of the EduOpen user experience from multiple points of view based on which role the users ware fulfilling in the platform. A teacher (*instructor*) of a MOOC expresses different needs and goals compared to a *learner* with respect to some basic summary information, functions and filters on what should be more or less clearly visible in the dashboard.

Two different data collection methods have been hypothesised, in order to gather the needed information:

- a profiled questionnaire according to the user "role" in the platform containing questions regarding the most critical issues, proposals or desired features and levels of satisfaction of the adopted tools;
- the establishment of "round tables" with the EduOpen staff and developers.

The two approaches reveal significant differences in terms of information structuring and implementation times.

The final choice fell on the second option following the need to accelerate the innovation process and its implementation given the tight deadlines at that phase, moreover not only it was possible to save time that would have been required for an accurate design and implementation of the questionnaires, but it was also possible to gain time where the "meetings" with the professors and users were in most cases carried out directly "online" in virtual classrooms with evident organisational time and procedure savings. The "round tables" were held, and also recorded, with the Blackboard Collaborate video-conferencing platform focusing on the development of the new version of the platform with a monthly frequency over the 4 months developing period. The adopted procedure saw the developers and staff propose new solutions followed by feedbacks and considerations by the instructors, tutors and learners. The results of the periodic meetings were than structured in concrete *suggestions and indications list* aimed at improving the so proposed and developed tools, which consequently gave rise to the development of guidelines and indicators capable of representing and measuring the strengths and weaknesses according to the needs of different actors. The variety of ideas and proposals were classified into four main categories/ indicators:

- Key Performance Indicators (KPI);
- Data hierarchy;
- Dashboard Design;
- Filters;

The so constructed indicators were then applied in a second development phase focused on a direct comparison with the major/main MOOC platforms.

b. Literature analysis:

The monitoring of teaching and learning activities is a fundamental element of any training initiative in order to ensure the control and management of interventions, particularly in online learning environments. In fact, in these online platforms, a timely visualization of the students' activity status allows teachers to provide useful warnings and suggestions to facilitate the learning process.

Monitoring the student's behavior in online learning environments does not only mean collecting data, but it is also essential to take action to maximize the effectiveness of the learning pathway through monitoring. Studies and research on Learning Analytics go exactly in this direction as they focus on how to collect, analyze and present the data produced online to provide rapid feedback and allow the formulation of appropriate, personalized and timely interventions.

Learning Analytics, as claimed by Siemens & Baker (2012), provides new data reading techniques by bringing the focus of educational research closer to the science of data driven decision-making and by integrating the technical and socio-pedagogical dimensions of learning analytics. In this sense, learning analytics allows the analysis of educational processes at the level of assessment and at the level of quality of interactions. Thus, pedagogical research is not limited to the analysis of learning outcomes, but uses data that allow the ongoing monitoring of educational processes by using "current and contextual" data (de Waal, 2017).

Learning analytics focus is on the application of predictive models in education systems through the description of data and results using specific techniques, such as: statistics, SNA visualisation, sentiment analysis, influence analytics, discourse analysis, concept analysis, and sense-making models.

Predictive analytics derives from the use of such data mining practices aimed at using patterns for forecasting purposes. It is a consolidated process that allows to synthesize a large amount of data in powerful decision making capabilities (Baker, 2007).

In academic contexts, learning analytics are mainly used with the intent of encouraging the achievement of an increasing percentage of successes in terms of student learning. Through specific methods of presentation of the educational process, it is possible to stimulate the knowledge, evaluation and self-evaluation of the student. The dashboards of

an online learning environment aim exactly at the presentation and representation of learning data for both teachers and students in order to promote effective and targeted pathways. Therefore, in order to set up tools for the timely visualisation of the students' learning status, it is necessary to refer to learning analytics and dashboards.

The process of designing applications using Learning Analytics involves a number of different phases.

The first phase involves the essential selection of data to be used as predictors and indicators of students' progress in terms of educational success. This selection has an effect on the accuracy of the forecasts and also on the validity of the entire analysis.

Indicators can be distinguished in (Brown, 2012):

- *Predisposition* indicators (they refer to the student's background: age, gender, previous assessments, etc.);
- *Activity* and *Performance* indicators (they refer to the performed activities and the traces of those);
- Student's artifacts (refer to works/artifacts produced by the student)

Also in the next phase there is a process of selection, but in this case the most appropriate techniques of analysis are chosen in order to identify the significant patterns hidden within the data sets; in this case, it is possible to apply different techniques that refer to the field of statistics, visualisation, data mining and social network analysis (Chatti *et al.*, 2012).

Visualization techniques play a particularly important role in making information accessible to students and teachers (Brown, 2012). These techniques can produce different types of fully automated feedbacks, when they do not require additional interventions, or partially automated when the final choice is delegated to the teacher.

c. *MOOC platform analysis*:

One of the main objectives at realising the EduOpen dashboard redesign guidelines was to allow a subsequent comparison, as much as quantitative possible, regarding the lack or possession of data reporting functions and data summary elements in a comparison with some of the "best-known" MOOC platforms, in particular: Coursera, EdX and FutureLearn.

The dashboards functions and tools analysis of the "leading" platforms was performed according to scheme of indicator categories emerged from the "round tables" (phase a) and in line with the findings of the literature analysis (phase b). The main elements that have been considered are four:

1. What are the *Key Performance Indicators* (KPIs)? That is, what is the synthesis data able to express the achievement of the objectives according to the "role" of the user? A key performance indicator (KPI) is a quantifiable measure that is used to determine to what extent the set objectives are achieved. For example, for a teacher it could be the number of users that completes the course, or the achievement of a certain average of grades, or the number of users that exceed at least 70% of the course etc. For a student, for example, a key indicator could represent the overcoming of a certain threshold of votes, or the temporal progress in the course etc.
2. What is the correct *data hierarchy*? Intended both as structure(levels) of displayed data as access permissions (privileges): for example, speaking about permissions a *learning manager* may need to access to some data set able to explain the overall institution system performance, but a teacher/instructor does not necessarily have to get too much data (information overflow), while a student should be able to see only his/her personal data. Secondary, speaking about some levels of analysis, at analysing for example the progress of a specific student within a course, it would be more significant to highlight the totality of the activities and actions of his/her course progression, or is it more meaningful to synthesise as first the "mandatory" steps?
3. *Dashboard design*: what is the most appropriate way for an effective representation and consultation of the dashboard? Is it able to effectively respond to the increasingly emerging needs of "mobile" consultation and navigation? Is it able to remain synthetic and data effective even if the data expressed are numerous?
4. *Filters*: are they present, and if so are they clear, visible and effective? If present, what type? For example, an instructor frequently expresses the need to search for a specific student by his/her ID number, or in quizzes/assessments to highlight only those students who have not achieved sufficient marks or those who have actually been present on the platform for a certain period of time, etc.

The dashboard analysis of the three main platforms focused as a first at the comparison with the critical issues present in the EduOpen dashboard on the student side, as it was not always possible to get a full "instructor" access to a synthesis and reporting tools on the platforms mentioned above. Most of the

instructor side insights came from external studies and analysis: "Coursera Instructor data dashboard"[3]; "Toward the development of a dynamic dashboard for FutureLearn MOOCs" (Chitsaz *et al.*, 2016); "Building and Running an edX Course" guide (Edx, 2017).

The EduOpen dashboard was therefore compared according to the criteria identified with respect to the three reference platforms. The KPI column indicates what were considered to be the most significant summary indicators; the hierarchy column indicates the dataset setting from a hierarchical consultation point of view; the design column was divided into two additional factors that could explain and summarise two often conflicting dimensions:

- *readability*, how easy is to read and capture the needed information;
- *information*, what is the quantity of information provided.

Regarding the student-side dashboard:

Table 1
INSTRUCTOR AND STUDENT DASHBOARD ANALYSIS

Student/Learner Dashboard			
	KPI	**Hierarchy**	**Design**
Coursera	My courses (active, inactive, completed) Updates Course progress Messages	Overview Week Activities	Readability 10/10 Information 9/10
EdX	Courses/Programs (completed, in progress, remaining) Discussion Progress	Course Chapters Activities	Readability 6/10 Information 9/10
FutureLearn	Courses Wishlist Recommendations Achievements	Course Weeks Steps	Readability 9/10 Information 6/10
EduOpen	My courses (active, completed, archived)	NA	Readability 3/10 Information 5/10

[3] Natalie Kim, Instructor data dashboard, http://ny-kim.com/work/dashboard/dashboard.html

As for the instructor-side dashboard:

Instructor Dashboard				
	KPI	**Hierarchy**	**Design**	**Filters**
Coursera	Enrollments Completions Active Learners Student Engagement Payments	Course Overview Ratings Content	Readability 10/10 Information 8/10	10+ e.g.: learner's payments, demographic status, course comparison
EdX	Enrollments/Completions Grades Assignments	Course Learners Activities	Readability 6/10 Information 9/10	10+ e.g.: learner grades, retention
FutureLearn	Enrolments Step Activity Comments Sentiment Peer Review Assignment/ Reviews	NA	Readability NA Information NA	NA
EduOpen	NA	NA	Readability 3/10 Information 5/10	NA

Furthermore, during the analysis process it was found that the presence of a well-designed and accurately planned data and dashboard construction allows future development actions of considerable interest. Coursera, for example (Fig. 4), implements forms of "smart information nudging" when, given a precise monitoring of the viewing lessons time and frequency, "suggests" students to review a specific lesson indicating that 70% of the other learners have viewed it more than one time.

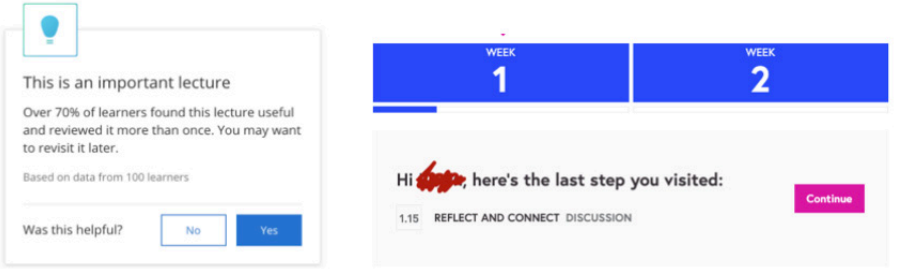

Fig. 4 - Coursera learning path "suggestions" and FutureLearn "resume feature"

In the FutureLearn platform the last visited lecture is shown giving the straight possibility to continue the learning path directly after the course access (Fig. 4).

4 Results

The analysis of the reference platforms and the consequent comparison with the EduOpen portal revealed a general lack of a series of elements which are considered "key" for tools such as dashboards. On the student side dashboard the only key factor that has emerged is the main course dashboard classification (Fig. 2). No clear hierarchy classification was found and the readability and information in the dashboard design scored respectively 3/10 and 5/10. On the other hand instructor side, has proven to be even worse with no clear KPIs, hierarchy and filters and with the same score in a design category.

Given the insights from the three main platform analysis one factor emerges above all: the dashboard tools are dynamic and real-time applications. Coursera provides a dashboard to educators and developers with a live view of their data (Chitsaz *et al.*, 2016). EdX, have analytical plug-in modules to achieve real-time monitoring (Cobos *et al.*, 2016; Fredericks *et al.*, 2016). New time-tracking approaches and technologies are available (Intelliboard, time tracking plugins, xAPI) which allow to collect, process and display this data in a much more effective way than in the past.

4.1 Time spent value

Time-spent value[4] is at the basis of the entire user experience in online training paths as it is a data that transversally affects the entire educational offer and all types of users. The information obtained from the measurement of the time-spent value can be useful both in the monitoring of users, students or teachers, as well as in the analysis of the course activities. Measuring a time-spent value allow the education managers to enhance the students' learning process and to apply an effective and adaptive learning model.

The results and insights of the innovation analysis process came together in a concrete testing proposal. From both literature analysis and the major platforms ones, the variable time-spent, intended as the point measurement of time actively spent on the platform, appears to be a transversal and common element, as well as being particularly useful in the practical process of redefining a dashboard tools.

The role of time in online education is the core of many researches. The Framework for Time Competencies in elearning (Fig. 5) shows both the micro and macro levels to be considered in the online learning and teaching processes, and the variables subordinate to time spent in the considered levels: learner, teaching, institution and technology (Romero & Barberà, 2015). The authors highlight the relationship between the importance of the time factor in online

[4] Indicates the time a user "spent" on a given activity, course or platform section.

education and the importance of developing skills related to its management in teaching and learning processes. In fact, specifically, they consider time competencies not as "individual and preexisting abilities that learners and teachers already have, but to think that the design and the implementation of online education can offer opportunities to increase and refine these competencies through the lifelong learning processes" (Romero & Barberà, 2015, p. 139).

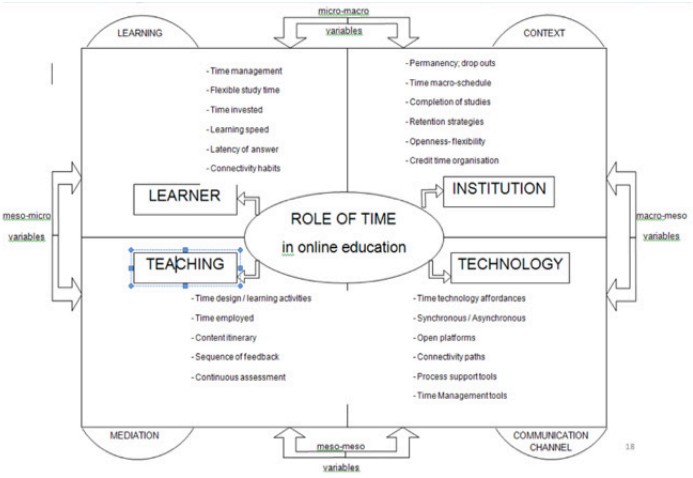

Fig. 5 - Framework for Time Competencies in e-learning, from Romero, M., & Barberà, E. 2015, p. 140.

The current EduOpen dashboard does not expose the time-spent value neither for the instructors or students at any stage or in any format. One of the main reasons why this variable could be effectively implemented is the fact that the core architecture of the system (Moodle LMS) allows us to collect and aggregate this data within a series of minor and additional developments. Secondary, a time-spent value is a traversal element of the learning paths which effects and it's available in all the courses and pathways. Platforms such as Coursera, as experiments available in the literature (Purdue University, Arnold, 2010; Arnold & Pistilli 2012) focus on the time-spent variable to evaluate and therefore also stimulate the student's effort during the learning pathways.

The well-known cited example is Course Signals[5] used at Purdue University

[5] The software product developed at the University, Course Signals is designed to increase student success by using analytics to alert faculties, students, and staff to potential problems. In particular, at the student level, this LA system gives them feedback on the progress of their learning process. At the same time, students do not run the risk of receiving a negative evaluation when it is too late, and accordingly they have enough time to ask for help. In this way, dispersion can be reduced and corrective actions can be promoted through scaffolding strategies and formative feedback that leads students to improve

in Indiana to prevent drop-out (Arnold & Pistilli, 2012). The system adopted consists of a traffic-light signal used for all students to indicate their possible risk of failure. This tool represents a device that acts as an ongoing assessment tool for students, but it also assesses the quality of the processes for the institution (Author et al., 2019 in press).

The time-spent variable allows to measure accurately the "progress" of the student within a specific learning path and therefore to relate this value to the educational objectives and goals. For example, by measuring the time spent by the students in a particular activity, if it turns out to be abandoned and viewed considerably less than the design approach, an indication could be that the resource/lecture is not particularly meaningful, weak or not inherent within the course thematics.

Given this consideration the concrete experimentation will be carried out within the course of Scientific Calculus in Python - Optimisation and differential equations for modelling (University of Padova, opening 16 September 2019).

4.2 Design of experimentation

Design of the EduOpen Learning Timeline:

Given the premises a precise indication of the temporal value of each single resource/activity of an EduOpen course is required. In particular, each section/week will be expressed in a given time "n", and the sum of all sections/weeks will indicate the "course length" value.

More in detail, this sum will represent an "EduOpen Learning Timeline" which reflects generically a "course length" value (student side), through segmentation of course training path into 4 basic elements:

1. time video resources (***t***v)
2. time reading resources (***t***r)
3. time training resources (***t***e)
4. time social interaction resources (***t***s)

These 4 timings constitute together a learning timeline, but will be stored in a separate tables which will be then updated following the student time progression during the course. Each mandatory activity/resource will have time value to be completed. Completing an activity subtracts that specific activity

their learning and their final grade. At the institutional level, the goal is to improve overall retention and the academic success rate and, consequently, the number of students who graduate (Sclater, 2017). This device represents a traffic-light signal, which depending on the light (whether red, yellow or green), indicates the level of risk run by each student is at a certain point in his or her course of study. The predictive algorithm takes into account four components (Sclater, 2017, p.38): Performance (based on the grades obtained during the course up to a certain point); Effort (the level of interaction with the LMS environment compared to other students); Academic background (including the students' average grades from high school and the standardized grades); Characteristics of the student (i.e. age).

time from the total amount of time. That means that a timeline table is updated after every user interaction and updating the data after the activity completion.

In a nutshell:

A total course time left will be divided into 4 time categories.

course ***time left****/course length* = $\boldsymbol{t}$v + $\boldsymbol{t}$r + $\boldsymbol{t}$e + $\boldsymbol{t}$s

At the $\boldsymbol{t}$0 the *time left* is ***max*** ($\boldsymbol{t}$v + $\boldsymbol{t}$r + $\boldsymbol{t}$e + $\boldsymbol{t}$s).

At the $\boldsymbol{t}$1 the *time left* is ($\boldsymbol{t}$v + $\boldsymbol{t}$r + $\boldsymbol{t}$e + $\boldsymbol{t}$s) - $\boldsymbol{t}$1*

and so on…

*1. Video lectures time (**tv**)*:

The time of video resources ($\boldsymbol{t}$v) is automatically calculated from the "video length" duration which is already stored for the video seek feature, and displayed in the course page as in figure:

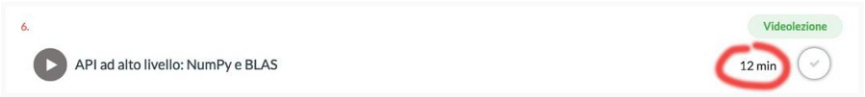

Fig. 6 - Video lecture time indication

*2. Time reading resources (**tr**)*:

"Reading resources" are all mandatory materials that must be read in order to complete the course. Not all files are mandatory, and not all files are "reading type files".

To distinguish between different type of files in the file resource settings (modedit.php?add=resource) a selector will be added for the instructors and content editors to select which type of file/material is being uploaded:

- *Other* (default selection, no time tracking)
- *Reading*
- *Training*

The time duration for the "reading resources" will have to be manually added by the course managers. In order to achieve so, a new field will be added ("type=time field") in the settings.

*3. Time training resources (**te**)*:

Will be developed same as the above reading time ($\boldsymbol{t}$r).

*4. Social interaction time (**ts**):*

This value refers to a user time spent during social or interactive resources. At the moment this time tracking is meant only for the forum activity and

virtual classroom (Blackboard collaborate meetings).

Section/Card/Week time left:

The section/week time will be separately stored and then specified as a time left value for each card/section/week.

card/section 1 = *card 1 time left*

card/section 2 = *card 2 time left*

card/section n = *card n time left*

This value will be displayed on every single card and will be updated according with the user progress.

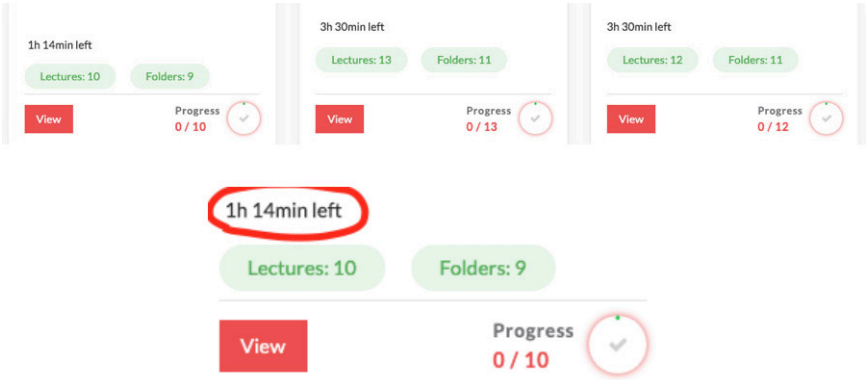

Fig. 7 - Week/section time indication

The time/progress tracking so obtained allow us to "place" a precise position of the student in what is considered a full or total timeline of the course/pathway, which will be displayed in a visual timeline for the student (Fig. 8).

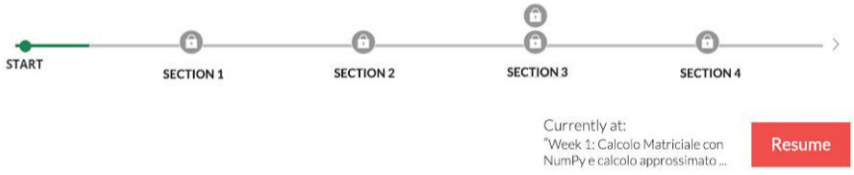

Fig. 8 - Visual timeline for the student

Finally, a "Resume" feature will be added in the section 0: The resume function links to a next single activity after the "last" completed (Fig. 8).

5 Study limitations and future implications

Future developments will be directed towards assessing the impact of using tools that allow monitoring of time-spent value in online learning. In particular, the following hypothesis will be investigated:

H[1]: Is there any correlation between the time-spent value and the student's final grade/performance?

For a more exhaustive study, we propose to start from the quantitative data obtained from the analysis of time spent value, combining it with a series of additional data as those obtained through the implementation of a feedback tool for the student. Each video lecture, at the end of the vision, will provide the opportunity to express an evaluation (from 1 to 5) in three distinct categories:

1. *Video* quality (technical)
2. *Communicative* quality
3. *Teaching* quality

Thus collected data will be cross-referenced with quantitative data obtained from learning analytics and will be subject to further analysis and study.

Conclusions

Both literature and analyses conducted highlight the importance of implementing activity monitoring processes that take place in online learning environments. By default, e-learning platforms are equipped with systems that are often not adequate to meet the needs of the various stakeholders involved in the training processes. The major challenge is frequently linked to the numerous difficulties encountered in trying to interpret these data. For such reasons, it is essential that e-learning platforms are equipped with dashboards that are properly designed and able to provide useful data for the definition of effective, user-centered training paths.

By definition, a dashboard is an interactive tool for collecting, monitoring and displaying data and information which, in the case of e-learning platforms, is a valuable contribution to providing both teachers and students with a complete picture of learning activities.

The literature and context analysis that has been developed and described in this paper has shown that time-spent value can be useful for teachers to identify students at risk and for students to compare their own efforts with those of their peers (Klerkx et al., 2017).

The correlation between the time-spent variable and the performance of the students can therefore be an important starting point in the design of the EduOpen dashboard.

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