



RELEVANT ASSESSMENT AND PEDAGOGIES FOR INCLUSIVE DIGITAL EDUCATION



IO3 LEARNING ANALYTICS FOR FLIPPED CLASSROOM AND WORK BASED LEARNING

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Abstract:	This document includes the overview of the work performed and the results achieved within the IO3 Learning analytics for flipped classroom and work based learning that was coordinated by FOI, with participation of all partners. All the planned activities were performed and the main conclusions and results are listed below.
Key words	learning analytics, tips and trich, ethical use of data

EXECUTIVE SUMMARY

This document includes the overview of the work performed and the results achieved within the IO3 Learning analytics for flipped classroom and work based learning that was coordinated by FOI, with participation of all partners. All the planned activities were performed and the main conclusions and results are listed below.

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<https://docs.google.com/document/d/1ZlncC3rikk-8nnedDYvSsPry4W6AogxG/edit>

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1. INTRODUCTION

This IO was developed with the aim to target both teachers and students, to design dashboard models for teachers and students that supports innovative and inclusive teaching approaches - FC and WBL. It shall provide recommendations of the supporting actions for both students and teachers to be more successful in meeting learning outcomes. Further, it will offer tips and tricks for teachers including the ethical use of data.

The development of this output was organized around the following questions:

Q1: How to design dashboards for teachers and students that enhance positive effects of FC approach for all students?

Q2: How to design dashboards for teachers, students and employers that support WBL and work integrated learning such as work on projects and skills development?

Within this IO the innovation is recognized in the designed and tested:

- Unique dashboard model that supports FC approach
- self- and peer- assessment meaningful feedback to students
- data that supports WBL through problem solving (criteria and rubrics), projects with employers and tracking skill development
- models how to identify students at risk or detect problems in the educational resources (technical or pedagogical)
- tips and tricks how to read the dashboard and how to find solutions for students
- concise ethical guidelines.

The expected impact within this output is:

- to provide innovative visualization model of dashboards supporting FC and WBL in an online environment to increase engagement, independent inquiry and self assessment and peer support
- to prepare teachers to use unique dashboard to track students progress and achievements
- to enable teachers to pedagogically interpret data and to give feedback to students and to therefore to open better communication with students
- to enable teachers to innovate their teaching
- to enable students to adjust their learning according to the provided feedback and peer/teacher communication
- to enable individualisation of teaching and support
- to provide HEI management with evidence how innovative teaching approaches can increase engagement, motivation and satisfaction.

2. LITERATURE ANALYSIS AND BEST PRACTICE EXAMPLES ON IMPLEMENTATION OF LEARNING ANALYTICS (LA) IN INNOVATIVE TEACHING APPROACHES (FC AND WBL)

As the basis for the following research, a literature review was conducted on the perceptions of LA and needs in terms of LA dashboards, taking into account two essential end-user groups: students and teachers. The research method used is Systematic Literature Review (SLR). The set of papers included the total of 63 papers identified in the Web of Science and Scopus databases (December 2021), using the following search string: "learning analytics" AND "dashboard" AND "higher education". The papers were analyzed considering the perspectives of the two LA user groups.

Literature review: Student perspectives

The literature review showed that students expect LA and dashboards to support the planning and organization of their learning. This includes features like reminders, to-do lists, agendas, learning recommendations, information on their peers' learning (Schumacher & Ifenthaler, 2018; Roberts et al., 2017). Dashboards can help them identify their knowledge gaps, reflect on their learning, and recommendations can help them act on knowledge and skills gaps (Bodily et al., 2018).

Students also need LA and dashboards to support them during their learning processes. They need personalized, fast and detailed feedback, and possibilities to assess their progress and time spent on learning (Roberts et al., 2017; Schumacher & Ifenthaler, 2018). They find learning recommendations, links to learning resources, and suggestions for learning partners to be useful (Roberts et al., 2017; Schumacher & Ifenthaler, 2018; Bodily et al. 2018; Rets et al., 2021).

Besides the possibilities, students are also aware of the challenges. Research shows students' generally positive attitudes and interest in using LA, but also concerns related to privacy, anonymity and surveillance (Roberts et al., 2017; Schumacher & Ifenthaler, 2018). Comparisons with peers' progress are found useful by some students (Roberts et al., 2017; Bodily et al., 2018), but not universally (Schumacher & Ifenthaler, 2018; Rets et al., 2021). Students perceive LA as an additional resource, and stress that learning taking place offline or in different systems also needs to be considered (Schumacher & Ifenthaler, 2018; Bodily et al., 2018).

Students like personalised LA and customization. For example, choosing the displayed features and the learning environment layout, without excess information (Roberts et al., 2017; Schumacher & Ifenthaler, 2018; Bodily et al., 2018). They expect comprehensive systems, combining various programs and functions (Schumacher & Ifenthaler, 2018).

The findings of the literature review were considered when conducting the survey on students' perspectives, presented in the following section.

Literature review: teacher perspectives

The literature review focused on what teachers consider important for students in terms of student dashboards and what they want to have on teacher dashboards. The 63 papers were analysed based on their relevance related to the following criteria: I) focus on higher education, II) clear / practical dashboard functionalities, III) teachers' perspective. From the 63 papers relevant to the dashboards only 7 met the defined criteria. The papers were further reduced based on the relevance of the presented information, according to the II) criterion.

The literature resulted in an overview of examples presented in a separate report (Learning Analytics Dashboard in Higher Education: Teachers' Perspective).

Best practice examples

At the LTT3 activity, partners presented their best practices related to the use of LA and dashboards. FOI presented the design of a students' dashboard covering all three stages in FC implementation (related to section 5 of this Report), and a concept and tool for peer-assessment, focusing on inter-rater reliability. The Open University presented OU Analyze, Management Information Tools, and the PowerBI app. Goethe University presented an LA dashboard for visualization of peer feedback, and the University of Rijeka talked about their experience with LA possibilities in Moodle.

3. RESEARCH ON STUDENT AND TEACHER PERSPECTIVE ON LEARNING ANALYTICS USE

Student perspective

Taking into account the literature review, in 2022, research of students' perspectives on LA and dashboards was conducted at FOI. The study was based on a student survey (2nd year undergraduate ICT students) focused on what LA features they consider to be the most important in terms of student dashboards. The research was conceptualized as a part of a longitudinal study, with the first iteration conducted in 2017. The 2022 version of the student survey was modified to accommodate for the changes in learning and teaching which have taken place following the COVID-19 pandemic, as well as for features relevant with respect to innovative pedagogies like flipped classroom.

The research was conducted with the aim to answer the following research questions (RQ):

RQ1: What are students' preferences regarding LA?

RQ2: How has the COVID-19 pandemic affected students' preferences regarding LA?

RQ3: What are the underlying factors related to students' preferences regarding LA?

Most importantly, it was found that dashboard features related to immediate planning of learning, e.g. schedules, calendars, notifications, assessment points, were the most appreciated by the students, while the features related to competition and comparison were less appreciated. The study also showed that the awareness of LA benefits has increased with the COVID-19 pandemic, with several significant differences. It also found that some features, not much appreciated before the pandemic, were ranked even lower during the pandemic, with significant differences regarding comparisons and

competitions. A factor analysis pointed to five underlying factors and a dashboard model proposed including: comparisons, planning, competitions, extracurricular and teachers.

Preliminary results of the research were presented and discussed at the LTT3 activity held in April 2022 in Frankfurt, as well as within the RAPIDE e-course (Module 3). The research has been reported on in more detail in an article submitted to the Learning Analytics and Knowledge conference 2023 (LAK23), organized by the Society for Learning Analytics Research, and is currently in the process of review.

Within the RAPIDE project, the survey was also conducted at the School of Medicine, in 2022 with students of the second, third and fourth year of study. Since the learning analytics have the potential to provide students with insight into different kind of learning information our study analysed attitude and opinion of students related to receiving different information via its learning dashboard. Survey questions created by FOI were used as a template for our research therefore we were able to compare our data with their findings. All data were statistically processed in order to establish whether there are differences between individual surveyed study years. Differences were found in only a few examples, while in the other questions, no statistically significant difference was found between the students' answers of individual study years. Our study has shown that almost all dashboard features related to learning of planning e.g. schedules, calendars, notifications, team work, teachers info, giving feedback on the teaching, creating a personal plan, are as important to our students as they are to FOI students. As well as, features related to competition and comparisons, e.g. among students, between grades, and awards, were not important to our students as they were not to FOI students. The main difference between SOM and FOI students is related to personal data protection. For SOM students this feature was very important, while for FOI students it was not important because of their strict policies about private data protection.

Teacher perspective

Within the LTT3 activity organized in April 2022 in Frankfurt, focus groups were held with teachers and instructional designers from the partner institutions, as well as student representatives.

The focus groups (three in total) were held face-to-face at the Goethe University, among which one of the groups was organized in a hybrid mode. Prior to the focus groups, the concept of an FC dashboard developed by FOI (section 5 of this Report) was presented to the participants.

The focus group discussion was focused on the following:

Student FC dashboards, with the following questions:

1. Do you find such a dashboard helpful in terms of enhancing students' learning in FC? If not, why?
2. Do you think any additional features are needed in a student FC dashboard? If so, which?
3. Do you think the design of the dashboard is user-friendly or would you suggest improvements? If so, which?

The participants indicated they generally found the dashboard useful for students and appreciated the design and the amount of information. It was stressed that dashboards are not equally used by all students. Some additional features were proposed as useful, e.g. topic students are not mastering yet, workload, time left to complete activities, personal planning, learning recommendations. It was pointed out that it is important to consider what students need.

Teacher FC dashboards, with the following questions:

4. Do you think a dashboard would be useful for teachers in managing FC?
5. What functionalities and visualizations do you find the most useful to support teachers? (e.g. how many students have completed pre-class activities such as reading, videos or formative assessment; students' in-class activity; overview of activity and progress of specific students; notifications on students at risk; predictive analytics, etc.)?

The participants found the teacher dashboard to be useful for the implementation of FC. In terms of most useful (potential) features, they proposed, e.g., student comparisons, tips & tricks for less experienced teachers, commenting and grading of learning materials, indicators of student activity, prediction of student success, sorting students, overview of less successfully mastered topics.

Dashboards for other teaching and learning approaches, with the following questions:

6. Would the functionalities of FC dashboards also be applicable to other T&L approaches?
7. In particular, what functionalities do you consider important for PBL?

Generally, the participants found the proposed functionalities to also be useful with respect to other teaching and learning approaches. In terms of PBL, they suggested adding features related to teamwork (including performance analyses, recommendations, suggestions for team members) and peer-assessment.

4. LEARNING ANALYTICS MODELS FOR TEACHERS AND STUDENTS INCLUDING DATA SETS AND METHODS FOR REPORTING AND PREDICTION

Within the RAPIDE e-course - Module 3 on learning analytics, participants (predominantly educators, but also learning designers, support and others) developed (and then peer-assessed) their proposals for learning analytics dashboard models for teachers and for students, for flipped-classroom or work-based/problem-based learning.

Working in teams, after investigating relevant reading and other materials, their task was to answer the following questions:

1. What features do you find essential for a student/teacher dashboard? What is the benefit of such features for students/teachers?

2. What are the potential challenges in providing such LA?
3. What data is needed to support such LA? Are such data available and where?
4. Are there any ethical concerns related to the proposed LA?
5. How do you think these features should be visually presented to students/teachers?

The teams prepared visual representations of their concepts - examples:

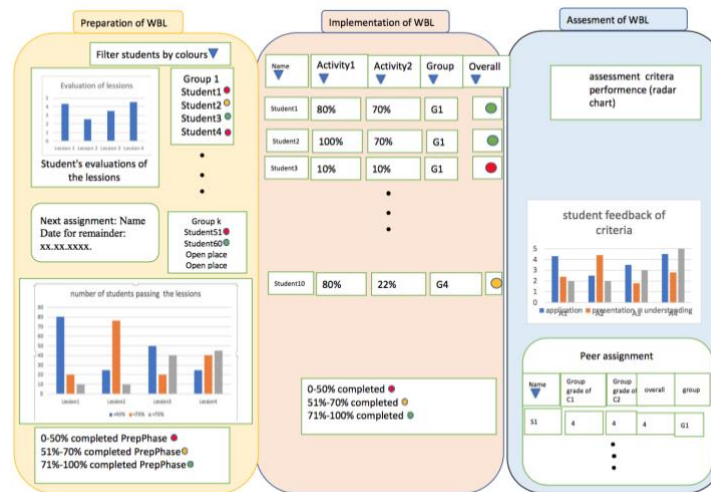


Figure 1. PBL/WBL dashboard for teachers

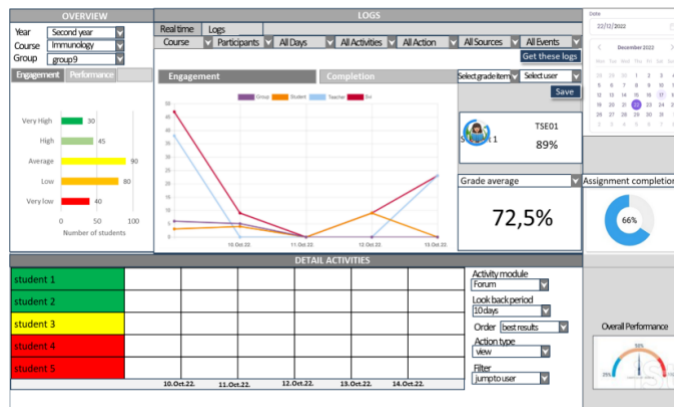


Figure 2. FC dashboards for teachers



Figure 3. FC dashboards for teachers



Figure 4. Student dashboard

5. FUNCTIONAL SPECIFICATIONS AND DEVELOPMENT OF THE DASHBOARDS FOR STUDENTS AND TEACHERS FOR AN OPEN SOURCE LMS

In order to support implementation of innovative pedagogies we prepared the showcase consisting of three parts:

- prototype of a “Engagement activity” plug-in to support implementation and usage of

innovative pedagogies (such as Flipped Classroom - FC[BD1] , Work Based Learning - WBL, etc.) in the Moodle LMS;

- student and teacher dashboard supporting implementation of flipped classroom;
- e-course prepared in line with FC principles to enable better insight in functionalities of student and teacher dashboard supporting implementation of flipped classroom.

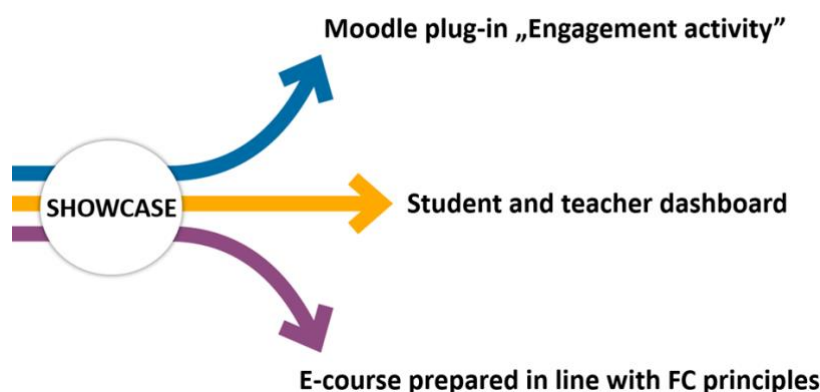


Figure 5: Showcase

E-course

For the purpose of testing and validating Moodle plugin prototype supporting implementation of innovative pedagogies, specifically Flipped Classroom approach, we have prepared e-course in line with FC principles: three phases (pre-class, class and post-class) and different types of activities (acquisition oriented activities, independent student activities, problem solving and discussion oriented activities, interaction with teacher and other students, investigation, independent learning and production oriented activities).

Dashboards

As defined by Schwendimann et al. 2016, learning analytics dashboards are “single displays that aggregate different indicators about learner(s), learning process(es) and/or learning context(s) into one or multiple visualizations”.

For the purpose of this showcase we designed dashboards supporting implementation of flipped classroom.

The design process of dashboards is in line with the Deming cycle Plan-Do-Check-Act (DCA) cycle (Innovative. Authentic. Deming., <https://deming.org/explore/pdsa/>) as presented in **Figure 6**.



Figure 6: Dashboards design in line with PDCA cycle

The aim of the dashboard is to:

- support implementation of FC approach
- enable more effective student and teacher engagement
- allow more advanced monitoring of students' progress.

Main functionalities of the dashboard are:

- messaging system
- alert system
- calendar
- easy to read graphs
- more detailed activity completion and progress report.

5.1 Student dashboard

The aim of the student dashboard is to:

- enable better monitoring of students learning path through FC activities
- raise students' awareness on their progress during FC activities
- motivate students to increase their engagement in FC activities
- provide students with clear overview of FC activities and of their and peer results.

Elements of student dashboard

Student dashboard consists of four blocks:

- Block 1: Welcoming block
- Block 2: Prepare! block
- Block 3: Engage! block
- Block 4: Extend! block

and detailed report on student' activities.

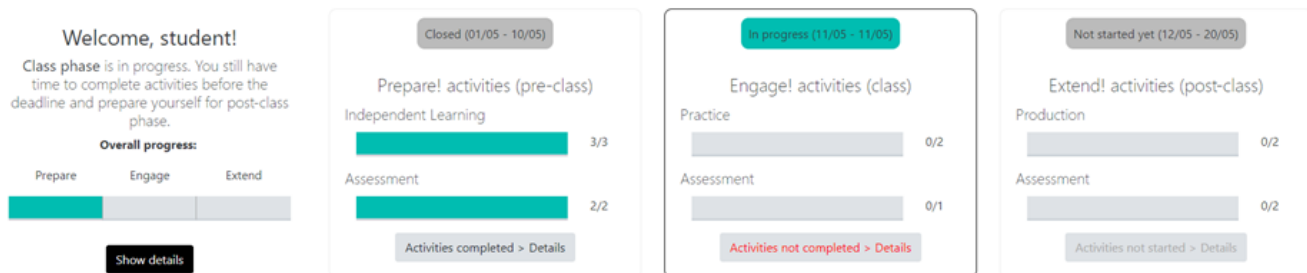


Figure 7: Student dashboards (Engage! Phase is in progress)

Detailed review of student' activities enable student insight into completion status on each activity, peers statistics on activities (accessed and completed) achieved student grade and achieved average grade of all students in the course per activity.

Resource / Activity	Completion status	Peer statistics - accessed	Peer statistics - completed	Grade	Average grade
Independent learning					
📅 07/05/2022					
📄 Learning material 1	☑	80%	70%	/	/
📄 Learning material 2	☑	90%	85%	/	/
📄 Learning material 3	☑	60%	55%	/	/
Assessment					
📅 10/05/2022					
📄 Quiz 1	☑	90%	85%	3.5	4.2
📄 Quiz 2	☑	60%	55%	14	12

Figure 8: Activities details

5.2 Teacher dashboard

The aim of the teacher dashboard is to:

- enable better monitoring of students progress through FC activities in three phases
- support adaptation of teaching strategies and individual support to students
- enable better post-analysis of FC activities

Elements of teacher dashboard

Teacher dashboard consists of four blocks:

- Block 1: Welcoming block
- Block 2: Prepare! activities (pre-class)
- Block 3: Engage! activities (class)
- Block 4: Extend! activities (post-class)

and detailed report on students' activities.

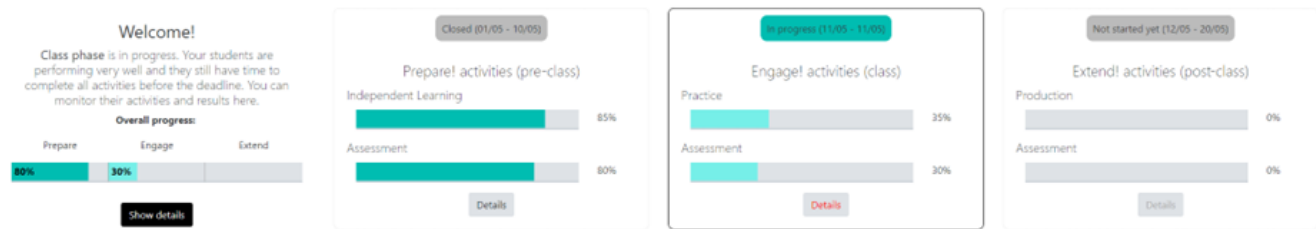


Figure 9: Teacher' dashboards (Engage! Phase in progress)

Student	Completion summary	Independent learning			Assessment	
		Learning material 1	Learning material 2	Learning material 3	Quiz 1	Quiz 2
Jessie Bell	5/5	👁️🟢	👁️🟢	👁️🟢	👁️🟢 (4)	👁️🟢 (13)
Austin Chambers	1/5	👁️🟡	👁️🟢	👁️🟡	👁️🟡	👁️🟡
Carolyn Stevenson	3/5	👁️🟢	👁️🟢	👁️🟢	👁️🟡	👁️🟡
Shari Meyer	3/5	👁️🟢	👁️🟢	👁️🟢	👁️🟡	👁️🟡
Terrance Schultz	3/5	👁️🟢	👁️🟢	👁️🟢	👁️🟡	👁️🟡
Marshall Webb	3/5	👁️🟢	👁️🟢	👁️🟢	👁️🟡	👁️🟡
Tabitha Beck	5/5	👁️🟢	👁️🟢	👁️🟢	👁️🟢 (4.4)	👁️🟢 (11)
Average grade					4.2	12

Figure 10: Students' activities details

Detailed review of students' activities provides teachers better insight into students' activities through completion summary of all activities per each student, status on each activity per each student (viewed/completed), achieved scores for assessment activities, and average grade per assessment activity.

Detailed technical specification is available as result "Functional specifications and development of the dashboards for students and teachers for an open source LMS" available on project web site.

6. TIPS AND TRICKS FOR TEACHERS ON DASHBOARD DATA INTERPRETATION

Tips and tricks on LA were prepared to support teachers, but also higher education institutions, in the successful use of LA. They provide some guidelines on how to (strategically) plan the implementation of LA, as well as how to use and interpret data delivered via LA dashboards, LMSs and learning design tools,

minding the ethical perspective (which is elaborated in more detail in a separate document).

Besides the basic terminology, the document includes the following:

1. For the higher education institution level, institutional actions are described, followed by the questions to be asked at an institution level, related to the implementation of LA.
2. For the university teacher level, general recommendations are given, followed by questions to be asked by teachers related to the implementation of LA. Importantly, this part includes several practical examples of data and LA use (prepared in co-creation of teachers and students), with suggestions for interpretation.

The full document is available in the RAPIDE e-course Module 3: <https://learn.rapide-project.eu> and has been used for teacher training purposes.

7. GUIDELINES ON ETHICAL USE OF DATA

The document was developed in order to provide project partners and the broad research community with the latest research and recognised principles on ethical use of (sensitive) data in LMS and LA systems.

Learning analytics collects, analyses and reports data about learners, in order to optimize learning (Tzimas & Demetriadis, 2021). The use of educational data for learning analytics is related to legal and ethical considerations (Ifenthaler & Tracey, 2016), with various ethical issues applying regardless of the size of educational data sets (Tzimas & Demetriadis, 2021). A number of ethical issues are not related specifically to learning analytics, but to other domains as well (Timmis et al., 2016).

While numerous benefits of learning analytics have been recognized, when discussing the ethical aspects, some of the drawbacks of learning analytics relate to issues like surveillance and stereotypes (Wintrup, 2017). It should also be noted that educators and students have different perspectives (Tzimas & Demetriadis, 2021), and that students have their concerns related to privacy (Ifenthaler & Schumacher, 2016). Furthermore, there are different perspectives on ethical issues related to geographical contexts (Tzimas & Demetriadis, 2021).

A systematic literature review (Tzimas & Demetriadis, 2021) has identified the following key ethical concerns related to learning analytics:

- Privacy: privacy and data protection refer to how various stakeholders collect and process personal data (Ifenthaler & Schumacher, 2016)
- Transparency: enabling an informed consent on collecting and processing data, giving students the possibility of self-control and self-observation (Tzimas & Demetriadis, 2021); including information about who has access to data, what data are collected and visualized, processing principles, how long data and outcomes are to be stored (Pardo & Siemens, 2014)
- Labeling: even though success has different dimensions, data-driven education can be related to stereotyping and mistreating of students (Scholes, 2016)
- Data ownership: while raw data traces belong to the learner, processed data – in practice – no longer belongs to the learner (Tzimas & Demetriadis, 2021)
- Algorithmic fairness: data analysis can be harmful to students if there are errors (Tzimas & Demetriadis, 2021), either related to data misinterpretation or misleading patterns (Flynn, 2016)

- Obligation to act: educational stakeholders should act when data points to the need for action (Prinsloo & Slade, 2017), and institutions should use data purposefully to support the progress of their students (Tzimas & Demetriadis, 2021).

The developed guidelines for the ethical use of learning analytics present a response to the identified key issues, proposing principles to be followed in order to avoid and minimize the risks related to unethical use of data. The guidelines take into account recent research, as well as relevant policy documents.

The full document is available in RAPIDE eCOURSE Module3: <https://learn.rapide-project.eu>

8. E-COURSE CHAPTER ON LEARNING ANALYTICS

8.1 E-COURSE ‘LET’S GET FLIPPED’

The course was designed by the team from the Faculty of Organization and Informatics with support of other RAPIDE project partners to host the following chapters to be developed within RAPIDE project:

1. Let’s innovate teaching
2. Let’s innovate assessment
3. Dashboard model that supports inclusive flipped classroom and work based learning and WBL
4. Impact analysis of innovative pedagogies.

The e-course is available at: learn.rapide-project.eu

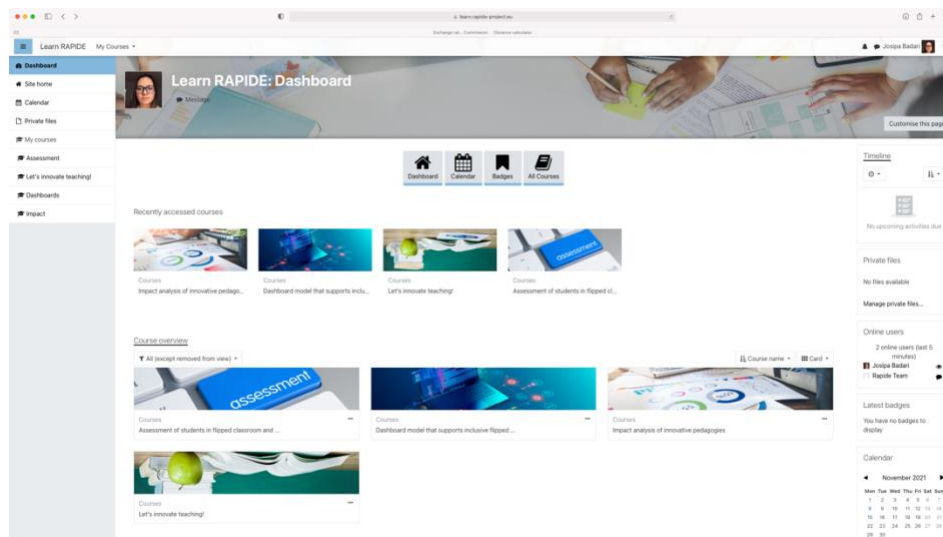


Figure 11 Print Screen of the RAPIDE online course home page

8.2 3RD CHAPTER - LET’S INNOVATE SUPPORT

The chapter was developed by the Faculty of Organization and Informatics with support of other project partners as a result of the extensive literature review and in line with the project goal to enable education to the higher education teachers.

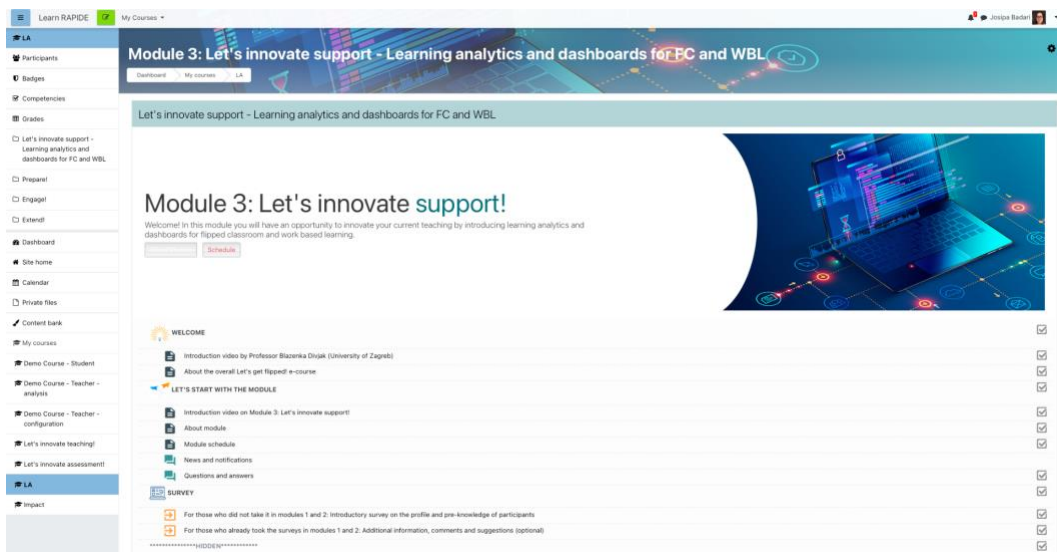
It introduces learning analytics, which offers important insights into learning processes by analyzing and reporting digital data about students' learning, collected primarily in learning management systems. Insights provided by learning analytics can help teachers better understand their students' learning, recognize their weaknesses, and according to that, design their teaching and provide appropriate feedback. They can also support students in informed decision-making and self-regulated learning. What students and teachers usually interact with in terms of learning analytics are visualizations presented in dashboards. Therefore, this chapter puts a special focus on exploring and discussing the specific needs of both students and teachers. It also draws attention to data interpretation and ethical use of data, essential in making use of learning analytics.

Learning Outcomes:

- Analyze aspects in which learning analytics can be used in order to support students in learning and their teachers in facilitating students' learning in an online environment.
- Analyze learning analytics models and dashboards that support students in the flipped classroom and work-based learning in an online environment, taking into account study and subject field and student background and needs.
- Interpret learning analytics data taking into account ethical aspects of learning analytics.
- Relate learning analytics to the social impact and informed decision-making in higher education.

As within previous chapters, chapter 3 takes about 25 hours to complete (equivalent to 1 ECTS) depending on the experience and expertise of participants.

After the LTT3 event the chapter was further developed as Module 3 of the RAPIDE MOOC to be piloted with 90 registered participants in September, 2022. The module was organised according to the principles of flipped classroom and the final feedback was gathered from participants to enable module creators further work on improvements. The Module 3 and the piloting process is described in more details in the document - RAPIDE e-course Let's get flipped.



The screenshot displays the RAPIDE online course interface. The main heading is "Module 3: Let's innovate support - Learning analytics and dashboards for FC and WBL". Below this, there is a "WELCOME" section with a message from Professor Blaženka Drujak. The course content is organized into sections: "LET'S START WITH THE MODULE" and "SURVEY". The "LET'S START WITH THE MODULE" section includes items like "Introduction video by Professor Blaženka Drujak (University of Zagreb)", "About the overall 'Let's get flipped' e-course", "Introduction video on Module 3: Let's innovate support!", "About module", "Module schedule", "News and notifications", and "Questions and answers". The "SURVEY" section includes "For those who did not take it in modules 1 and 2: Introductory survey on the profile and pre-knowledge of participants" and "For those who already took the surveys in modules 1 and 2: Additional information, comments and suggestions (optional)". A navigation menu on the left lists various course elements like "Participants", "Badges", "Competencies", "Grades", "Dashboard", "Site home", "Calendar", "Private files", "Content bank", "My courses", "Demo Course - Student", "Demo Course - Teacher - analysis", "Demo Course - Teacher - configuration", "Let's innovate teaching!", "Let's innovate assessment!", "LA", and "Impact".

Figure 12 Print Screen of the RAPIDE online course

9. ANALYSIS OF DATA OBTAINED IN LMS DURING PILOTING AND DISPLAYED ON DASHBOARDS

The analysis of data obtained in the LMS was conducted and explained in two research papers, as follows:

- Students' perspectives on LA dashboards and the features considered useful by them were analyzed based on a student survey. The research included, inter alia, a factor analysis, leading to a proposal for a dashboard model for students. For more details, see section 3. The paper has been accepted for presentation at the Learning Analytics and Knowledge conference 2023. and for publication in the accompanying proceedings (Q1).

Divjak, B., Svetec, B., Horvat, D. (2023) Learning analytics dashboards: What do students actually ask for? LAK 2023, March 13–17, 2023, Arlington, TX, USA

Abstract: Learning analytics (LA) has been opening new opportunities to support learning in higher education (HE). LA dashboards are an important tool in providing students with insights into their learning progress, and predictions, leading to reflection and adaptation of learning plans and habits. Based on a human-centered approach, we present a perspective of students, as essential stakeholders, on LA dashboards. We describe a longitudinal study, based on survey methodology. The study included two iterations of a survey, conducted with second-year ICT students in 2017 (N = 222) and 2022 (N = 196). The study provided insights into the LA dashboard features the students find the most useful to support their learning.

The students highly appreciated features related to short-term planning and organization of learning, while they were cautious about comparison and competition with other students, finding such features possibly demotivating. We compared the 2017 and 2022 results to establish possible changes in the students' perspectives with the COVID-19 pandemic. The students' awareness of the benefits of LA has increased, which may be related to the strong focus on online learning during the pandemic. Finally, a factor analysis yielded a dashboard model with five underlying factors: comparison, planning, predictions, extracurricular, and teachers.

- Assessment validity and LA, researched based on LMS assessment data, are discussed in a research paper published in the British Journal of Educational Technology:

Divjak, B., Svetec, B., Horvat, D., & Kadoić, N. (2022). Assessment validity and learning analytics as prerequisites for ensuring student-centred learning design. *British Journal of Educational Technology*, 00, 1– 22. <https://doi.org/10.1111/bjet.13290> (Q1)

Abstract: To ensure the validity of an assessment programme, it is essential to align it with the intended learning outcomes (LO). We present a model for ensuring assessment validity which supports this constructive alignment and uses learning analytics (LA). The model is based on LA

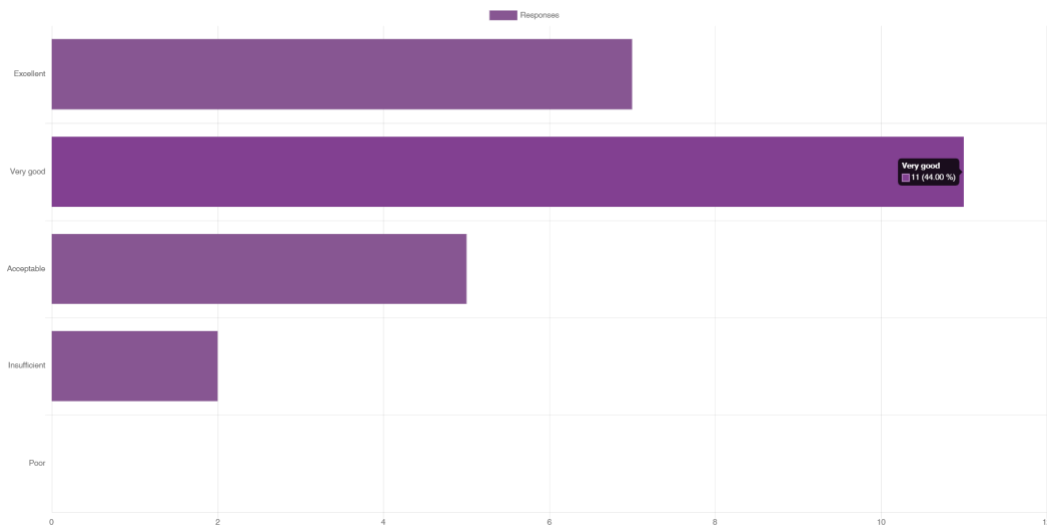
that include a comparison between ideal LO weights (expressing the prioritization of LOs), actual assessment weights (maximum assessment points per LO), and student assessment results (actually obtained assessment points per LO), as well as clustering and trace data analysis. These analytics are part of a continuous improvement cycle, including strategic planning and learning design (LD) supported by LO prioritization, and monitoring and evaluation supported by LA. To illustrate and test the model, we conducted a study on the example of a graduate-level higher education course in applied mathematics, by analysing student assessment results and activity in a learning management system. The study showed that the analyses provided valuable insights with practical implications for the development of sound LD, tailored educational interventions, databases of assessment tasks, recommendation systems, and self-regulated learning. Future research should investigate the possibilities for automation of such LA, to enable full exploitation of their potential and use in everyday teaching and learning.

10. REVISION OF LA MODELS AND GUIDELINES FOR ETHICAL USE OF DATA ACCORDING TO FEEDBACK FROM TRAINING PARTICIPANTS AND DATA OBTAINED IN LMS AND DISPLAYED AT DASHBOARDS

Within the RAPIDE e-course, participants were presented with the LA dashboard models (section 5), as well as the guidelines for the ethical use of data (section 7) and tips and tricks for data interpretation (section 6). Live sessions provided an opportunity to present and discuss the models and guidelines/tips and tricks. The e-course participants had no major suggestions, but their minor comments and proposals were introduced to the said materials.

As part of the e-course evaluation, the participants also provided some related feedback, with an excerpt presented here:

How do you evaluate your knowledge related to data interpretation and ethical use of data?



11. LTT 3 EVENT

On April 27 -29, 2022 the RAPIDE consortium participated in the consortium meeting and LTT3 activity - Let's innovate support.

The meeting was conducted as a hybrid event and hosted by the Goethe University at the impressive campus Westend in Frankfurt. Partners discussed project plan for the next 6 months, preparation of LD for the workshops, presented literature review and introduction to student survey conducted at partners institutions, presented overview of strategic goals of partner institutions, presentation of best practices related to LA dashboards with functionalities for FC and algorithm for peer-assessment, focus group with teachers and instructional designers was held based on the questions for further improvements, gallery of best practice examples of evaluation and impact analysis of FC and WBL scenarios was presented. Furthermore, systematic classification of the showcases in the context of strategic goals of the institutions was conducted. Partners planned further activities and events: multiplier events and workshops.

The aim of the LTT3 event was to provide teachers with hands-on training on supporting students in an online environment by use of learning analytics and to get feedback from teachers/participants on content, design and transferability of IO3 and on training performance.

Learning outcomes of LTT3 activity included: understanding the concept of supporting students in an online environment, analyzing aspects in which learning analytics can be used in order to support students in learning and their teachers in facilitate students' learning in online environment, analyzing different academic study fields and align it with appropriate dashboard models, implementing dashboard models that supports students in FC and WBL related activities in online environment considering study and subject field and student background and needs and implement demonstration tool (dashboard app for open LMS).

The LTT event gathered 20 participants from partner institutions.

12. QUALITY FEEDBACK

The quality feedback of the performed activity LTT3 was performed immediately after the end of the activity via google forms and reported to the project Quality Manager. The form consisted of 7 short questions which covered: Quality, content and duration of the training, Training methods, Acquired skills and knowledge, and Overall satisfaction with the training.

The final report is available to all project partners in the shared GDrive folder. The quality of the 3rd chapter Let's innovate teaching was performed during LTT3 activity via questionnaire administered on GDrive. All LTT3 participants provided their feedback. The report is available to all project partners on GDrive.

13. INCLUSIVENESS

This result is created to support higher education teachers to improve their skills and transcultural experience which will enable them to be more competent in further delivering the education and assessment, as well as the support within a diverse student population.

In its Communication on achieving a European Education Area (EEA) (4) by 2025, the Commission outlines two key initiatives. These aim to address pressing educational challenges related to underachievement and early leaving from education and training within the EU. As one indicator of the need for education improvement, the level of underachievement, in the EU as a whole, has increased in science and reading, while remaining stable in mathematics. It is generally recognised that underachievement and early leaving are symptoms of more deeply rooted challenges in education.

These relate to a need for education providers to have access to approaches and competences enabling them to embrace student diversity; to offer secure and inspiring learning environments; and to motivate all learners regardless of their socioeconomic background, ethnic origin or disabilities.

(<https://education.ec.europa.eu/et/news/inclusive-education-in-europe-learning-from-erasmus>)

This result, therefore, is in line with the conclusions of the OECD Teaching and Learning International Survey (TALIS), particularly this that teachers and trainers need continuous opportunities for professional development. (https://read.oecd-ilibrary.org/education/talis-2018-results-volume-i_1d0bc92a-en#page7)

According to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions the higher education and VET systems need to adapt to strengthen their key role in supporting lifelong learning and reaching out to a more diverse student body. The need for more flexible and inclusive learning paths has increased as the student population is becoming more diverse and the learning needs more dynamic.

(<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0625&from=EN>)

Inclusive learning analytics

As stated in (Chen W. 2020¹) learning analytics has potential to address the gap between an increasingly diverse student population and a “one-size-fits-all” approach in education contributing to inclusive education and enhancing learning experiences for students with disabilities.

Regarding the learning analytics, comprehensive it may be, data is only useful to those who can access it. The potential of (learning) data for those who are disadvantaged is enormous. Students would have the wherewithal to monitor their own progress against their individual objectives and the possibility of summoning timely targeted interventions that will deal directly with the barriers they are experiencing – as they happen. Teachers should be trained how to actively use this data to differentiate responses, enable more personalized learning and improve inclusive teaching practice.²

Therefore, the following questions need to be considered by teachers and instructional designers when developing dashboards:

- Is the data presented in a format that is accessible?
- Does everyone know how to access it?
- Do all students and teachers, even those using assistive technology or with sensory impairments have the same quality of experience.
- Equally important, does everyone contribute to the data?
- Are all disadvantaged students and teachers properly represented? Are they enabled to participate in suggesting appropriate data – data that will identify their individual progress and needs and promote their best interests accurately?

Further, the partners took into the consideration the following principles and statements described by [Jisc](#):

- The collected data must be used for the benefit of all students and teachers including those with disabilities and disadvantages.
- Providing equality of access via student and teacher dashboards and ensuring that the right data is collected and used effectively and intelligently to support everyone’s needs.
- All data is open to misinterpretation and misuse. Being clear about the purpose is key. Wherever data contributes to assessment the implications for each student needs to be considered.

Finally, according to the principle that learning analytics should be for the benefit of students. It’s important for ethical and legal reasons to ensure that students with special needs are able to benefit equally from the technologies, and are not put at a disadvantage by the collection and use of their data. The following eight ways in which institutions developing dashboards for their students and teachers can attempt to ensure this was considered³:

- learning analytics is **not** assessment
- labeling of individuals and reinforcing of prejudice and stereotypes should be avoided
- disabled students’ confidentiality shall be maintained
- the inference of disabilities from the analytics shall be handled appropriately
- analytics shall not unfairly single out disabled students/teachers

¹ Chen W.: Learning Analytics for Inclusive Higher Education. So, H. J. et al. (Eds.) (2020). Proceedings of the 28th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

² <https://accessibility.jiscinvolve.org/wp/2017/01/09/an-inclusive-approach-to-learner-analytics/>

³ <https://analytics.jiscinvolve.org/wp/2016/12/14/accessibility-considerations-for-learning-analytics/>

- analytics shall be used to identify modules where there appear to be accessibility issues
- teacher/student-facing analytics shall be accessible
- interventions shall be worded appropriately.

Regarding the learning analytics design, i.e. visualization and dashboard design the partners took into consideration accessibility principles and guidelines such as Web Content Accessibility Guidelines (W3C, 2021)⁴.

All these principles of inclusive learning analytics are in line with the basic principles of inclusive education such as: diversity enriches and strengthens all communities, society equally values, respects, and appreciates the diverse learning styles and achievements of all students and all participants are empowered to realize their potential, taking into account individual needs and requirements.

14. APPENDIX(ES)

APPENDIX 1. FUNCTIONAL SPECIFICATIONS AND DEVELOPMENT OF THE DASHBOARD:

APPENDIX 2 - TIPS AND TRICKS

APPENDIX 3. GUIDELINES ON ETHICAL USE OF DATA

⁴ W3C 2021: <https://www.w3.org/Press/Releases-2021.html>